



CONCEPT PAPER ON NATURAL RESOURCE ACCOUNTING IN INDIA
an initiative of
GOVERNMENT ACCOUNTING STANDARDS ADVISORY BOARD



**NEW DELHI,
 JULY 2020**



Hon'ble Shri Babul Supriyo, Minister of State for Environment, Forest and Climate Change digitally launching the Concept Paper on Natural Resource Accounting in India - an initiative of GASAB



Ms Anita Pattanayak, Deputy CAG & Chairperson, GASAB delivering key note address



Hon'ble Shri Babul Supriyo, MoS, Environment, Forest & Climate Change in his inaugural speech



Ms Anita Pattanayak presenting a copy of the Concept Paper to Hon'ble Shri Babul Supriyo, MoS



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Table of contents

| Particulars | Reference to para | Page(s) |
|---|-------------------|------------|
| Abbreviations | | vii - viii |
| Bibliography | | ix |
| Foreword and Messages | | xi - xix |
| Preface | | xxi |
| Making of this Paper | | xxiii-xxiv |
| Officers associated with making of this Paper | | xxv |
| Acknowledgements | | xxvii |
| Comments on the Paper | | xxix |
| Executive Summary | | xxxi-xxxiv |
| Chapter I : NRA - Introductory | | |
| Introduction | 1.1 | 1 |
| Types of natural resources | 1.2 | 2 |
| What is calling the attention - why place value on nature | 1.3 | 3 |
| What is NRA | 1.4 | 4 |
| Aim of NRA | 1.5 | 5 |
| Guiding values of NRA | 1.6 | 5 |
| Need for NRA | 1.7 | 6 |
| Chapter II : Sustainable Development Goals - Role of NRA | | |
| Introductory | 2.1 | 11 |
| India Index Baseline Report by NITI Aayog | 2.2 | 12 |
| Preparedness of India on sustainable development goals | 2.3 | 15 |
| Chapter III : Climate change vis-à-vis NRA | | |
| Definitions | 3.1 | 17 |
| Climate Change - the threat | 3.2 | 17 |
| Climate Change - UN's intervention | 3.3 | 18 |
| Climate Change - global phenomenon | 3.4 | 19 |
| Climate Change - major contributors | 3.5 | 20 |
| Climate Change - India's role | 3.6 | 21 |

| Particulars | Reference to para | Page(s) |
|---|--------------------------|----------------|
| Role of NRA in combating Climate Change | 3.7 | 22 |
| Chapter IV : Development of environmental accounting | | |
| The initiative and major milestones on environmental accounting | 4.1 | 25 |
| System of National Accounts | 4.2 | 26 |
| The Brundtland Commission - 1987 | 4.3 | 27 |
| Earth Summit at Rio De Janeiro - 1992 | 4.4 | 28 |
| SEEA - CF, SEEA, EEA and SEEA, AE | 4.5 | 29 |
| Interrelation between SNA 2008 and SEEA (CF) | 4.6 | 30 |
| Implementations of SEEA (CF) | 4.7 | 31 |
| Accounting principles as defined in SEEA - CF | 4.8 | 31 |
| Summing up | 4.9 | 32 |
| Chapter V : Valuation of resources | | |
| Valuation - a brief overview | 5.1 | 33 |
| Valuation suggested by SEEA -CF | 5.2 | 33 |
| Other valuation methodologies | 5.3 | 34 |
| Summing up | 5.4 | 36 |
| Chapter VI : Initiatives in other countries | | |
| Initiatives in other countries | 6.1 | 37 |
| Other Studies | 6.2 | 39 |
| Chapter VII : NRA in India - Progress so far | | |
| Introductory | 7.1 | 41 |
| NRA in India - Role of CSO (MoSPI) | 7.2 | 41 |
| Report on Green National Accounts in India - A Framework | 7.3 | 42 |
| Present status of NRA in India - EnviStats 2018 | 7.4 | 44 |
| EnviStats 2019 | 7.5 | 45 |
| National Capital Accounting and Valuation of Ecosystem Services Project | 7.6 | 46 |
| Summing Up | 7.7 | 47 |
| Chapter VIII : NRA - Initiative by INTOSAI and SAI, India | | |
| Introductory | 8.1 - 8.2 | 49 |
| INTOSAI - WGEA initiative 1998 | 8.3 | 49 |
| INTOSAI - WGEA initiative 2010 | 8.4 | 51 |
| WGEA work-plan for 2020-22 on common sustainable future | 8.5 | 51 |

| Particulars | Reference to para | Page(s) |
|---|--------------------------|----------------|
| Initiatives by SAI, India on Environmental Audit and Sustainable Development in India | 8.6 | 52 |
| Role of SAI, India on NRA | 8.7 | 53 |
| iCED to consolidate Asset Accounts | 8.8 | 53 |
| Chapter IX : Natural Resources - listing, governance and imposition of revenues in India | | |
| What are natural resources | 9.1 | 55 |
| Natural resources listed by SEEA - CF | 9.2 | 55 |
| Listing of natural resources in India | 9.3 | 56 |
| Constitutional mandate governing resources | 9.4 | 56 |
| Major legislations, strategies governing natural resources | 9.5 | 57 |
| Mandate for imposition of taxes on resources and preparation of Accounts | 9.6 | 59 |
| Summing up | 9.7 | 62 |
| Chapter X : NRA - Way Forward | | |
| Way Forward - Introductory | 10.1 | 65 |
| Implementation stages prescribed by SEEA - CF | 10.2 | 66 |
| Implementation strategy - the road ahead | 10.3 | 66 |
| Availability of information for the Asset Accounts | 10.4 | 71 |
| NRA Cell in States to facilitate preparation of Asset Accounts | 10.5 | 71 |
| Summing up | 10.6 | 71 |
| Chapter XI : Preparation of Asset Accounts - Mineral and Energy Resources | | |
| Mineral and energy resources - basic postulates | 11.1 | 73 |
| Mineral and energy resources - in India | 11.2 | 73 |
| Preparation of Asset Accounts | 11.3 | 76 |
| Systemic approach for continuity in data collection | 11.4 | 88 |
| Summing up | 11.5 | 89 |
| Chapter XII : Preparation of Asset Accounts - Water Resources | | |
| Water is life - <i>Jal hi Jeevan Hai</i> | 12.1 | 91 |
| The water cycle | 12.2 | 91 |
| Water resources in India vis-à-vis climate change | 12.3 | 92 |
| National Water Mission and National Water Policy | 12.4 | 93 |
| Types of water resources - inland and ground water | 12.5 | 93 |

| Particulars | Reference to para | Page(s) |
|---|--------------------------|----------------|
| Need for water accounting - difficult times lurking ahead | 12.6 | 95 |
| Usage of surface water vis-à-vis ground water | 12.7 | 96 |
| Water scarcity and security in India | 12.8 | 98 |
| Management of Water Resources in India | 12.9 | 98 |
| Understanding water scarcity indexes | 12.10 | 98 |
| Absence of database on water dependability among users in India | 12.11 | 99 |
| Preparation of Asset Accounts - Water Resources | 12.12 | 100 |
| Source of data for Asset Accounts | 12.13 | 103 |
| Summing up | 12.14 | 103 |
| Chapter XIII : Preparation of Asset Accounts - Forestry and Wildlife Resources | | |
| Forests - the balancer | 13.1 | 105 |
| Legal Framework for management of forests | 13.2 | 106 |
| Scientific management of forests - working plans | 13.3 | 106 |
| Community participation in management of forests | 13.4 | 106 |
| International participation | 13.5 | 107 |
| Constitution of CAMPA Fund | 13.6 | 107 |
| Status of Forests in India - 2019 | 13.7 | 107 |
| Wildlife sanctuaries and national parks | 13.8 | 109 |
| India's forests vis-à-vis forestry resources in the World | 13.9 | 109 |
| Management of forest resources | 13.10 | 110 |
| Management of wildlife in India | 13.11 | 112 |
| Need for forest asset accounts | 13.12 | 112 |
| Preparation of Asset Accounts - Forestry and Wildlife | 13.13 | 113 |
| Source of data for the Asset Accounts | 13.14 | 115 |
| Summing up | 13.15 | 116 |
| Chapter XIV : Preparation of Asset Accounts - Land Resources | | |
| Land - the lithosphere | 14.1 | 117 |
| Land resources | 14.2 | 117 |
| Factors mounting pressure on land resources | 14.3 | 117 |
| Some statistics of land resources | 14.4 | 119 |
| Management of land resources | 14.5 | 120 |
| Preparation of Asset Accounts of land resources | 14.6 | 120 |
| Periodicity of data generation - a challenge | 14.7 | 122 |

| Particulars | Reference to para | Page(s) |
|---|--------------------------|----------------|
| Source of data for Asset Accounts | 14.8 | 122 |
| Summing up | 14.9 | 123 |
| Chapter XV : NRA - Issues and Challenges | | |
| Introductory | 15.1 | 125 |
| Issues and challenges part of Way Forward | 15.2 | 125 |
| Other probable hindrances | 15.3 | 127 |
| Chapter XVI : NRA - Participation of Private Sector | | |
| Introduction | 16.1 | 129 |
| Format for asset accounts for private enterprises | 16.2 | 130 |
| Format for disclosure of discharge of effluents, treatment facilities | 16.3 | 131 |
| Format for water accounts | 16.4 | 131 |
| Centralised data maintenance and online data entry | 16.5 | 132 |
| Chapter XVII : Disclosure on receipts and expenditure related to NRA | | |
| Disclosures to Accounts - Role of GASAB | 17.1 | 133 |
| Disclosure on natural resource related activities | 17.2 | 133 |
| Preparing the disclosures | 17.3 | 134 |
| Summing up | 17.4 | 135 |
| Annexures | | 137- 141 |

Abbreviations

| | |
|-----------|---|
| CAG | Comptroller and Auditor General of India |
| CGA | Controller General of Accounts |
| CSO | Central Statistics Office (India) |
| CGWB | Central Ground Water Board |
| CWC | Central Water Commission |
| DPSIR | Driving force - Pressure - State - Impact - Response |
| ECOSOC | Economic and Social Council |
| EU | European Union |
| FC | Finance Commission |
| FDES | Framework for development of Environment Statistics |
| FSI | Forest Survey of India |
| GASAB | Government Accounting Standards Advisory Board |
| GDP | Gross Domestic Product |
| GNI | Gross National Index |
| IPCC | Inter-Governmental Panel on Climate Change |
| INTOSAI | International Organisation of Supreme Audit Institutions |
| MoEFCC | Ministry of Environment, Forest and Climate Change, Government of India |
| MoSPI | Ministry of Statistics and Programme Implementation, Government of India |
| NASA | National Aeronautics and Space Administration |
| NAPCC | National Action Plan on Climate Change |
| NGT | National Green Tribunal |
| NNP | Net National Product |
| NITI | National Institution for Transforming India |
| NRA | Natural Resource Accounting |
| NRSC | National Remote Sensing Centre |
| NSO | National Statistical Office |
| SAI | Supreme Audit Institution |
| SDG | Sustainable Development Goals |
| SEEA | System of Environmental and Economic Accounting |
| SEEA - AE | System of Environmental and Economic Accounting - Applications and Extensions |
| SEEA - CF | System of Environmental and Economic Accounting - Central Framework |
| SEEA - E | System of Environmental-Economic Accounting for Energy |
| SNA | System of National Accounts |
| TEEB | The Economics of Ecosystems and Biodiversity |

| | |
|--------|--|
| UNSTAT | United Nations Statistical Division |
| UNCEEA | UN Committee of Experts on Environmental-Economic Accounting |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNSC | United Nations Statistical Commission |
| WGEA | Working Group on Environmental Auditing of INTOSAI |
| WTO | World Trade Organisation |

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Note : Though due care has been taken to ensure inclusion of all the websites and papers consulted in the above table, any miss is sincerely apologised and contributions of all organisations and authors towards the subject is gratefully acknowledged.

- Foreword -



Over the years, there has been increasing awareness about environmental issues across the globe and growing concern about the depletion and degradation of the natural resources. Many nations like Australia, Canada, China, France, Germany have attained various levels of achievement as far as environmental accounting is concerned. In India, environmental accounting is still in nascent stage with a number of studies conducted in the past and in recent times. Notable among them is the Report on Green National Accounts in India - A Framework devised by a Group constituted by the Ministry of Statistics and Programme Implementation, Government of India and chaired by Professor Sir Partha Dasgupta. Also, the MoSPI has painstakingly consolidated the data on physical stock and quality of major natural resources in their publications titled EnviStats 2018 and 2019.

However, despite these positive developments, a system of collation of a periodic database in the shape of an Asset Account on available natural resources linked with inter-related factors like revenues and costs involved in exploitation of such resources, their sustainability for the future generations is still to be achieved. Such a database would be extremely helpful in monitoring the sustainability of resources, effective decision making and ensuring good governance besides attaining other pressing obligations like the sustainable development goals - ensuring future for all and climate change.

It is with this idea and the mandate of the Government Accounting Standards Advisory Board (GASAB) in suggesting an accounting framework for enhancing the quality of decision making and public accountability in mind, GASAB under my guidance conceived the idea of preparing a Concept Paper on the subject, about two years back.

It gives me immense pleasure to state that the GASAB Secretariat has come up with the Concept Paper on Natural Resource Accounting in India in such a short time. The Paper, while complementing the good efforts of the United Nations in implementing NRA across the world, *inter-alia*, envisions implementation of NRA in phased manner, first in the States, and then at the national level and encompasses various issues like preparation of Asset Accounts, bringing the Government as well as the private sector under the ambit of NRA, mapping the issues and challenges, floating the idea of a disclosure statement on receipts and expenditure related to exploitation of natural resources. The way forward is carefully crafted in alignment with the requirements of System of Environmental and Economic Accounting - Central Framework and with these ambitious targets laid over a time frame of about 10 years, India would be able to achieve half of the four stage implementation plan of NRA envisaged by SEEA - CF and find place among the select countries reaching this far, till date.

I would like to appreciate the team under the guidance of Shri K K Srivastava, Additional Deputy CAG (GASAB), Shri Ashok Sinha and Ms Asha Rani Rungta, Principal Directors and others in the Secretariat such as Shri Sudipta N Biswas, Sr. Admn Officer who have put wholehearted efforts in making this Paper, a reality. I would also like to thank the Vice Chancellor of Delhi University, Director General of the Economic and Resources Institute (TERI), MoSPI, and other members of the GASAB Board for their unstinting support for making this Paper, a success. I would also like to compliment the Director General of Audit, Environment and Scientific Departments and also the Director General, International Center for Environment Audit & Sustainable Development for quickly peer reviewing the Paper before its finalisation.

I dedicate this Concept Paper on Natural Resource Accounting in India to the welfare of the future generations of this country - *Jai Hind*.

17 July 2020

NEW DELHI


(Anita Pattanayak)
Deputy CAG & Chairperson, GASAB

- Message -



प्रवीण श्रीवास्तव
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The sustainable development dialogue has brought to the fore the direct and indirect impact of human activity on the environment and there is now a consensus that continuing economic growth and human welfare are integrally dependent on the benefits obtained from the environment. The critical trade-offs between managing ecosystems and environmental resources for future sustainable economic and social development need to be understood for effective policy interventions. The UN System of Environmental Economic Accounting (SEEA) provides a sound framework for understanding the inter-relatedness and impact of the key actors in ecosystem accounting. Environmental accounting or Natural Resource Accounting (NRA) helps frame policy responses as well as to enable their evaluation.

The Ministry of Statistics and Programme Implementation has taken several initiatives for environmental accounting while collaborating with key stakeholders from different domains within the UN SEEA framework and brought out a few environmental accounts. The Ministry is making efforts to ensure that that the frameworks adopted in India are at par with the international standards. India has also become a member of the UN Committee of Experts on Environmental Accounting. Recognising that assessing the wide panorama of environmental aspects is challenging, it is important that there is better coordination amongst agencies and synergies evolved in the administrative data systems so that they can cater to the requirements as envisaged in the SEEA framework.

The Concept Paper on Natural Resource Accounting in India from the GASAB Secretariat is a step towards garnering this coordination and assisting the Government of India in developing environmental accounts by identifying the goals and the challenges, and recommending strategies to facilitate regular production of accounts of the natural resources.

This document puts on record the short-term goals and directions to the States to devise procedures for compilation and regular updation of accounts for land, water, minerals and forests, as also the revenues and expenditure related to these resources. The Report lays the foundation for improving the periodicity and robustness of natural resource accounts in the coming years. The suggestion of having an overarching agency under the CAG to monitor collection of information and preparation of Asset Accounts in the States will go a long way in accelerating the implementation process.

A specific recommendation of the report is to compile information from the Finance Accounts to understand the revenues from exploitation of natural resources while keeping a tab of the total stock of natural resources. By integrating these two areas, the implications for sustainability of different patterns of production and consumption can be examined for the future generation, and there is a sound basis for framing alternative action plans and policies for course corrections.

We appreciate the role played by GASAB in emphasizing that environmental accounting is fundamental to good environmental governance and a meaningful shift towards holistic sustainability.

(Pravin Srivastava)

- Message -

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Ajay Mathur Ph.D.
Director-General

Economic growth over decades has largely been an outcome of our continued reliance on natural resources. The current paradigm of resource-led economic development sees a coupling between the availability of natural resources and economic growth. Growth is clearly the major engine to create livelihood options; its reliance on increased resource use has however led to many negative externalities. Deforestation leading to land degradation and loss of natural carbon sinks, or overexploitation of exhaustible mining resources leading to ambient air pollution are two common examples of the impacts due to the overuse of natural resources. These two examples also bring out the challenges of irreversible long term consequences in the continuing use of forestry or mining resources as a means of fostering economic growth.

Addressing this challenges requires us to assess the stocks and flows of natural resources because, as is often said, 'what cannot be measured cannot be managed'. In addressing the larger goal of sustainable consumption and production, as outlined under UNSDG (UN Sustainable Development Goal) 12, countries are increasingly using resources and environment accounts to understand the extent of resource degradation, and to design innovative policies that can reverse growing resource depletion. There is also growing acknowledgment of the potential resource security challenges in India and the consequent need for the identification of appropriate measures that will decouple economic growth and resource exploitation so that we are able to achieve the economic growth and job creation necessary to move our fellow citizens out of poverty, but without a commensurate increase in resource flows. The solution lies in the sustainability science that can help us achieve circular economy, based on the 6R principles that need to be embedded in our development paradigm.

I compliment the GASAB (Government Accounting Standards Advisory Board) Secretariat, in developing the concept paper 'On Natural Resource Accounting in India'. The document is extremely relevant and well timed in providing fresh perspectives towards finding instruments that can enable the decoupling between resource availability and economic growth, and in strengthening India's commitment of the UNSDGs. The diversity of resources and their usage across sectors and regions and value chains will warrant greater engagement across various stakeholders and further strengthen co-operation not only for data sharing but greater exchange of practices that can facilitate a transition to resource efficiency in India.


(Ajay Mathur)



- Message -

The Government Accounting Standards Advisory Board (GASAB) has been established in August 2002 by the Comptroller & Auditor General of India with the support of the Government of India. GASAB is a representative body of the Central and State Governments with the responsibility of formulating, proposing and improving standards of government accounting and financial reporting (www.gasab.gov.in). The Board, *inter-alia*, includes representatives of heads of all accounting services, JS Budget, Government of India, four State Governments in rotation, heads of the Institute of Chartered Accountants of India, Institute of Cost Accountants of India among others and headed by Deputy CAG as the Chairperson. In addition to its endeavour on formulating Government Accounting Standards, GASAB had also been working on natural resource accounting for nearly two years.

This Concept Paper is a result of GASAB's efforts towards helping the causes of environmental accounting in India, climate change, and sustainable development goals and *inter-alia* proposes specific formats for Asset Accounts in respect of four major natural resources, namely, Mineral & Energy Resources, Water Resources, Forestry & Wildlife Resources and Land Resources. The formats of Asset Accounts has been designed in keeping with the prescriptions of System of Environmental and Economic Accounting - Central Framework which allows flexibility to embed country specific needs. Undoubtedly, this is a major step towards implementation of NRA in the country and the formats of Asset Accounts proposed through this Paper are novel in their own ways and some of these formats had been tested through pilots/samples prepared and found to be feasible and implementable.

The Paper proposes to commence with preparation of Asset Accounts on Mineral and Energy Resources in the States in the first instance and gradually move on to the national level by 2022-23. No doubt, preparation of Asset Accounts for all the resources planned to be implemented till 2024-25 may face some challenges like system of data generation and collection which will eventually be subsumed and settle down with the passage of time. Preparation of the Asset Accounts would definitely help the entities and the country at large to capture and consolidate information/data on resources which will further add value and help the cause of monitoring the sustainability of resources, effective decision making and ensuring good governance.

Here, I would like to recognise the huge effort put in by the team consisting of Shri Ashok Sinha, Principal Director and Shri Sudipta Narayan Biswas, Senior Administrative Officer in not only preparing this Concept Paper within a very short time but also conceiving and designing the way forward for implementation of NRA in India in alignment with the prescriptions of SEEA - CF; and also designing specific formats for Asset Accounts and highlighting other related issues. I would also like to compliment the members of the internal working group, the Accountants General in the States for providing timely inputs while framing this Paper.

I sincerely hope that the Concept Paper will be well received by the stakeholders in the Government and private sector and taken forward for implementation. Also, I am sure that the Paper would be a stimulant for various interest groups among the academia in India and also abroad.

17 July 2020

NEW DELHI



(K K Srivastava)

Additional Deputy CAG, GASAB



- Message -

The information on the availability, usage, replenishment/ depletion of natural resources is the need of the hour. The pollution and other environmental issues are depleting and degrading the natural resources at an alarming rate. Several Statutes and regulations have been passed by the Government of India to administer these resources on sustainable basis but as compared to several other countries around the world, India is still at nascent stage requiring urgent public indulgence. The Institute of Chartered Accountants of India on its part has established Sustainability Reporting Standards Board for formulation of standards, doing research and to work closely with various stakeholders including GASAB in this direction.

Natural Resource Accounting (NRA), an accounting framework to compile data relating to natural resources, is a way to prepare India to achieve Sustainable Development Goals (SDG) 2030. NRA would help in taking decisions not only about further usage of natural resources but also for ascertaining sustainability of these resources for future generation. NRA can also play important role in assessing environmental aspects of the projects being undertaken, be it by the Government, private or through public-private partnership models.

This paper prepared by GASAB covers in detail what are natural resources, what is NRA, valuation of resources, progress so far in India with regard to NRA, role of NRA in SDG and the initiatives in other countries, issues and challenges in NRA, participation of private sector in NRA, way forward for implementation of NRA in India, etc. It also provides detailed guidance about preparation of asset accounts in respect of various natural resources such as mineral, energy, water, forestry, wildlife, land along with disclosure on receipts and expenditure related to NRA.

This paper prepared keeping in mind the Indian scenario, proposes to initiate the preparation of Asset Accounts in the States that can gradually be expanded to the national level in a phased manner. This paper also mentions that to facilitate NRA, each State may constitute an NRA Cell with representatives from the administrative departments in the State Governments, Statistical Department, Accountants General (Audit and A&E).

I congratulate the Government Accounting Standards Advisory Board (GASAB) and all other contributory agencies for their efforts in bringing out the Concept Paper on the novel concept of Natural Resource Accounting in India.

I hope that this Concept Paper would prove immensely beneficial to various stakeholders.

New Delhi

July 23, 2020

(CA. Atul Kumar Gupta)
President, ICAI

PREFACE

Environmental and natural resources make an important contribution to long-term economic performance and can be considered economic assets, even when they do not enter the market transactions directly. As natural resources are crucial for manufacturing as well as having inbuilt value for existence of inter-generations, the idea of natural capital has the prospective to bring together economic and environmental welfare by integrating the significance of natural capital in decision making process.

The need for natural accounting took its first step at the UN Conference on Human Environment in 1970 when the relationship between economic development and environmental degradation was discussed. The Brundtland Commission articulated the idea of close association between the environment and economic activities for the first time in 1987 which was followed up by environmental accounting and the Earth Summit at Rio de Janeiro in 1992. In line with these developments, the UN released the international standards for the compilation of national accounts in 1993 which was revised in 2009. Simultaneously, the UN also adopted the System of Environmental and Economic Accounting - Central Framework in 2012.

Many countries are using their environmental accounts to track pollution; the use of natural resources, such as water, forests, and mineral deposits; and environmental protection expenditures. The accounts are also used in policy analysis and resource management decision making. In India, the CSO under the MoSPI has been spearheading the work and since the year 2000, more than 150 studies have been conducted. India is also a partner in the Natural Capital Accounting and Valuation of Ecosystem Services' project launched by the United Nations which, at present, is proposed in five countries including India. Meanwhile, CSO has issued supplement on Environment Accounts in September 2018 wherein the physical stock of four natural resources across India have been enumerated. Subsequently, CSO has also brought out the EnviStats 2019 based on the quality characteristics namely soil nutrient index and water quality accounts.

This concept paper intends to present a broad outline about the concept of NRA vis-à-vis its interrelation with sustainable development goals and climate change (Chapter I, II and III), development of environmental accounting (Chapter IV), Valuation of resources (Chapter V), progress made by various countries and in India (Chapter VI and VII), Role of SAI, India (Chapter VIII), natural resources available in India - their listing, governance and imposition of revenues thereon (Chapter IX). The paper proposes a three pronged way forward - short, mid and long term goals *inter-alia* encompassing the issues and challenges which are at Chapters X to XV. This paper also proposes to bring the private sector under the process of NRA (Chapter XVI). The last Chapter XVII discusses about the receipts and expenditure related to NRA and bringing them under single umbrella as a disclosure statement.

MAKING OF THIS PAPER

Natural Resource Accounting is being dealt upon in GASAB for quite some time but it gained momentum in recent years. An internal working group (IWG) was formed in 2018 with members from CAG, MoEFCC, MoSPI etc. A list showing members of the IWG is at **Annexure - A**. The IWG met twice to discuss the issues and challenges of implementing NRA in India and probable ways forward. Besides, two workshops on NRA have been conducted at the CAG's International Centre for Environment Audit and Sustainable Development at Jaipur during the years 2019 and 2020 where eminent speakers across ministries, research scholars, non-government organisations etc working in the field spoke on various subjects related to NRA. Also, there were a number of workshops on NRA at the knowledge center of GASAB (CAG's Regional Training Institute) at Allahabad where the Group Officers and staff members of CAG from the field Offices attended.

This Concept Paper was prepared in the GASAB Secretariat in CAG's Office by a core team consisting of Shri Ashok Sinha, Principal Director and Shri Sudipta Narayan Biswas, Senior Administrative Officer. This included research works on available information/data on the subject from diverse sources some of which are detailed in bibliography, conceiving and chalking out the proposed way forward divided into three term strategies along with the formats of the Asset Accounts and inclusion of private entities under the ambit of NRA, identifying the probable issues and challenges to be handled while implementation of NRA in India besides designing the overall layout of the Paper. Shri K K Srivastava, Additional Deputy CAG, GASAB monitored and supervised the work and Ms Anita Pattanayak, Deputy CAG & Chairperson, GASAB provided overall vision and guidance for the project. The first draft of the paper was prepared between August and December 2019 and released in January 2020.

The first draft paper was shared with the members of senior management in CAG, all the Accountants General (both Audit and Accounts & Entitlements) across the country, members of the IWG and also the members of the Board of GASAB. The draft Paper was preliminarily discussed in the 35th GASAB Board meeting held on 3 February 2020 and was subsequently put up to the CAG for appraisal on 6 February 2020.

In order to involve the academia with this Paper, a team led by Additional Deputy CAG (GASAB) met with the Vice Chancellor (VC) of Delhi University (January 2020) at the instance of Chairperson, GASAB for seeking assistance on various environmental related initiatives of GASAB and also to peer review the concept paper. The VC, DU has nominated three subject experts from the Department of Environmental Studies. The subject specialists from DU agreed to the proposal of this Paper to start with the Asset Accounts on Mineral & Energy Resources. Another meeting was held between a team led by Additional Deputy CAG (GASAB) and representatives of The Energy and Resources Institute (TERI) in February 2020 on preparation of Concept Paper on NRA with the request to review the Paper. During the meeting, the experts of TERI largely agreed with the outline of the Paper.

Responses have been received from MoSPI (member of internal working group), Chief General Manager, Reserve Bank of India (member of GASAB Board) and a number of field Offices of CAG which have been appropriately incorporated in the Paper.

As the draft paper envisaged implementation of NRA in phases and proposed for taking up the Asset Accounts in respect of mineral and energy resources in the first phase, pilot studies on the above are underway in three States namely Andhra Pradesh, Uttar Pradesh and Rajasthan.

The second draft of this Paper was finalised in June 2020 and shared with the Secretaries to the Government of India in the MoSPI, MoEFCC, Ministry of Mines; *Jal Shakti* and Land Resources; all the State Governments in the Finance Department, members of the Board of GASAB; technical advisors of GASAB, all Accountants General across the country for their information with the request to share their comments/suggestions, if any, for improving the Paper. Comments/suggestions received till 20 July 2020 had been incorporated in the Paper.

In order to ensure an independent evaluation of this Paper, Offices of the Director General, International Center for Environment Audit & Sustainable Development at Jaipur and Director General of Audit, Environment & Scientific Departments Audit at New Delhi have peer reviewed the Paper in July 2020. Their comments/suggestions have been taken into consideration while finalising the Paper.

The contribution of these Offices in quickly reviewing the Paper as also the comments/suggestions of other entities, academia are gratefully acknowledged.

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- Ministry of Environment, Forest & Climate Change, Statistics Division for their valuable inputs and suggestions on various issues included in the Paper
- Member of GASAB Board and technical advisor from Reserve Bank of India for their comments/suggestions on the second draft of Concept Paper
- Vice Chancellor, Delhi University for nominating specialists from the Department of Environmental Studies, Delhi University to assist the environment related endeavours of GASAB and also helping in this Paper
- Director General of The Energy and Resources Institute (TERI) for nominating experts in the field to discuss various issues related to natural resource accounting and also making of this Paper within a very short time
- Directors General of International Center for Environmental Audit & Sustainable Development, Jaipur and Environment & Scientific Departments Audit, New Delhi for independently reviewing the Paper and providing with inputs for improving the Paper
- Senior Management in the CAG for constant encouragement in this highly ambitious project of GASAB
- The members of the Internal Working Group for continuous discussions on the probable issues and challenges towards implementing natural resource accounting in India
- Accountants General in various States under the CAG for valuable inputs in different stages of making of this Paper
- Internal resources in GASAB Secretariat for their active support and in reviewing the document

Without the support and contribution of the aforesaid Ministries/entities within and outside CAG's establishment, the academia in the Delhi University and TERI, finalising the Paper within a definite timeframe would not have been possible.

Comments on the Paper

The following comments were received on the Paper, till date of printing:

- I am very sure that GASAB will do gazab with this noble endeavour. All the very best to the entire team. This will help us in assessing the humongous volume of natural resources in the country and I am sure all Ministries will come forward in its implementation -

Hon'ble Shri Babul Supriyo,
Minister of State for Environment, Forest and Climate Change
(During digital launch of the Concept Paper on 28 July 2020)

- We Congratulate the team that worked on the Concept Paper for the comprehensive coverage of the topic -

Member of Board, GASAB and
Technical Advisor, Reserve Bank of India,

- MoSPI appreciates that the short, medium and long term goals given in the Concept Paper are well aligned with the Report on Green National Accounting in India prepared by Professor Sir Partha Dasgupta. MoSPI also appreciates the objective of bringing the State Governments on board to collectively collaborate and contribute to the compilation of natural resource accounts of the country -

Ministry of Statistics & Programme Implementation,
Social Statistics Division

- I congratulate the GASAB for bringing out this concept paper on the novel concept of Natural Resource Accounting (NRA) in India which is a great step to prepare India to achieve Sustainable Development Goals (SDG), 2030. I also appreciate the GASAB to skilfully craft the long, medium & short term goals to implement NRA in India from the State level to then gradually move to the National level.

ICAI, being a partner in Nation Building and with a strong tradition of service to the public interest and to the Indian economy, would suggest that the Members of the ICAI can also contribute in NRA by providing assistance to the Government of India in identification and compilation of quantitative data and measuring the value of natural resources as per the valuation methods prescribed in the concept paper -

CA. Atul Kumar Gupta
President, ICAI

- The Concept paper is a noteworthy step towards linking the financial flows from natural resources to the depletion in physical stocks and usage. It identifies the many benefits that would accrue from Natural Resource Accounting like, (a) Resource management (b) Monitoring of sustainable development goals (c) Combating Climate Change and (d) being an aid to Environment Impact Assessment. It has also brought the focus on Agenda 21 and stated that an important step is the establishment of better measurement of the crucial role of the environment as a source of natural capital and as a sink for by products generated during the production of man- made capital and other human activities.

In the Concept Paper, there have been painstaking efforts to formulate formats for Asset Accounts for Mineral & Energy, Water, Forestry and Land Sectors. The timelines set in this Paper are fairly ambitious and would have to be aligned with the ground reality of data flows in the various sectors and sub-sectors -

Ministry of Environment, Forest & Climate Change,
Statistics Division



EXECUTIVE SUMMARY

Taking its initial steps in the 1970s, sustainability of natural resources and its accounting in the overall framework of national accounts has been gaining importance, decades after decades. While some countries have gone ahead with implementing resource accounting in some ways or the other, the United Nations has been working on the subject and came out with successive frameworks on NRA, the latest being the System of Environmental and Economic Accounting - Central Framework in 2012 which is the latest internationally accepted framework for natural resource accounting across the world.

The concept of NRA has been gaining momentum in India as well with number of studies carried out under the aegis of the Ministry of Statistics and Programme Implementation. However, despite the efforts at different levels, it is undenyng that at present, a consolidated database on availability and physical extraction/use of natural resources, revenue generated therefrom, expenditure incurred on extraction and mitigation of environmental degradation and sustainability of resources is not available in the States as well at the national level. Such a database will be immensely helpful for having a broad idea of the available resources, revenues expected therefrom, costs involved and their sustainability for the future generations.

Keeping the above in view and the mandate of the Government Accounting Standards Advisory Board in suggesting accounting framework for enhancing the quality of decision making and public accountability in mind, this Concept Paper is a result of GASAB's efforts towards helping the causes of environmental accounting in India, climate change, and sustainable development goals and *inter-alia* proposes a detailed way forward segregating the implementation strategy into short, medium and long term goals with suggestive formats for preparation of Asset Accounts in respect of four major natural resources namely mineral & energy resources, water resources, land resources and forestry & wildlife resources. The formats of Asset Accounts have been designed in keeping with the prescriptions of SEEA - CF which allows flexibility to embed country specific needs, *e.g.*, the Asset Accounts on Mineral & Energy Resources incorporate information on illegal mining while the Asset Accounts of Water Resources require information to be provided separately for surface water and ground water, taxed and untaxed water supplies etc. Similarly, the Asset Account on Forestry and Wildlife Resources is designed to capture illegal felling of trees and also to include the data on wildlife resources including encroachment and poaching cases. The Asset Account on Land Resources requires the

entities to provide information on acquisition and further allotment of land by Government for industrial and other purposes.

These additionalities proposed in the Asset Accounts would definitely help the entities and the country at large to capture and consolidated information/data on resources which will further add value and help the cause of monitoring the sustainability of resources, effective decision making and ensuring good governance.

The Paper also maps tentative issues and challenges that may come up during the course of implementation process. Another important issue flagged in this Paper is recognising the role of private players and bringing them under the overall framework of NRA by proposing specific reporting requirements so that the entire spectrum of resource extraction and utilisation and management of residuals/effluents can be covered under one umbrella. The Paper proposes to initiate the preparation of Asset Accounts in the States and then gradually expanded to the national level. Upon preparation of Asset Accounts in the States and in the Union, these Asset Accounts can also form part of the Finance Accounts of the States and Union, in the long run, after necessary approvals.

The short, medium and long term goals as envisaged in this Paper are as mentioned below:

Short term goals

| Highlights | Years covered | Challenges to address |
|--|--------------------|--|
| <ul style="list-style-type: none"> • Preparation of Asset Accounts on mineral and energy resources in States • Initiation and preparation of disclosure statement on revenues and expenditure related to NRA | 2019-20 to 2021-22 | <ul style="list-style-type: none"> • Mandating the reporting requirements by private sector as to use of resources, water and release of effluents/ residuals • Identifying the authority to manage and monitor online information from private sector |

(Para 10.3.1.1)

NRA to initially commence from States with preparation of Asset Accounts in respect of Mineral & Energy Resources from the year 2019-20. The Paper proposes specific formats for Asset Accounts.

(Chapter XI and tables 9 and 10)

Private Sector to be included in overall framework of NRA. Reporting requirements and formats for reporting the usage of resources and management of effluents/residuals is proposed.

(Chapter XVI and tables 27 & 28)

This Paper proposes for a separate disclosure statement for capturing the receipts collected from as well as expenditure incurred on exploitation of natural resources and related activities. Indicative formats for the disclosure statement is suggested in this Paper.

(Chapter XVI and tables 27 & 28)

Mid term goals

| Highlights | Years covered | Challenges to address |
|--|--------------------|--|
| <ul style="list-style-type: none"> Preparation of National Asset Accounts on mineral and energy resources Preparation of Asset Accounts in respect of other three resources namely water, land and forest resources Preparation of supply and use tables in physical and monetary terms showing flow of natural resource inputs, products and residuals | 2022-23 to 2024-25 | <p>Periodicity of the Asset Accounts of Water, Land and Forest resources to be decided</p> <p>Mapping the periodicity of data management with the requirement of Asset Accounts</p> <p>Decision on the agency which would prepare the Asset Accounts in respect of the resources at national level</p> |

(Para 10.3.1.2)

During the mid-term goal period, the Paper proposes to expand the Asset Accounts of Mineral & Energy Resources to national level by including the natural resources not under direct control of the States, like the resources in ocean beds which is administered directly by the Union Government.

The mid-term goals also include proposal for preparation of Asset Accounts in respect of other three resources namely the Water, land and forestry and wildlife resources. Specific formats for preparation of these Asset Accounts are also proposed in this Paper. As regards the Water Accounts, while the Paper proposes for preparation of Asset Accounts on Water Resources during the mid-term goals (2022-23 onwards), yet, it also suggests that the States may start preparation of Asset Accounts on experimental basis with immediate effect.

(Chapters XII, XIII & XIV, tables 16, 20-22, and 25-26)

Long term goals

| Highlights | Years covered | Challenges to address |
|---|-----------------|-----------------------|
| <ul style="list-style-type: none"> Preparation of the economic accounts highlighting depletion adjusted economic aggregates; and Preparation of functional accounts recording transactions and other information about economic activities undertaken for environmental purposes. | 2025-26 onwards | Nil |

Subsequent to rolling out of short and mid-term goals which would help India to achieve the first two of the four stage implementation of NRA as prescribed by the SEEA - CF, work on the third and fourth stages would need to begin. These are planned post 2024-25.

(Para 10.3.1.3)

As NRA is being taken up for implementation in India, there is bound to be operational constraints and difficulties in filling up the Asset Accounts. Foreseeing these, the SEEA - CF has envisaged flexibility in preparation of the Asset Accounts which may evolve with the passage of time. The entities may also feel free to modify the fields of the suggested formats in view of practicalities keeping the overall framework and idea of the tables intact. This Paper proposes setting up NRA Cell in the States with representatives from the administrative departments of State Governments, Statistical Department, Accountants General (Audit and A&E) for facilitating preparation of Asset Accounts.

(Para 10.5)

Achievement of the short and mid-term goals by 2024-25 would not only help the entities with a consolidated database on availability, usage and sustainability of resources vis-a-vis revenues generated and the costs involved, but also will be a major breakthrough towards attaining first two out of four stage implementation of NRA as envisioned in the SEEA - CF.

Undoubtedly, NRA would also help in attaining other pressing commitments like the sustainable development goals and targets for reduction in green house gases to mitigate the devastation caused by climate change. The efforts may then be taken forward with the aim of achieving the remaining two stages by 2030 - the indicative target of achievement of Sustainable Development Goals set by the United Nations.



CHAPTER - I

NATURAL RESOURCE ACCOUNTING - INTRODUCTORY

1.1 Introduction

Ecosystem Services - nature's gift to mankind : Human well-being depends upon healthy ecosystems. They provide the mankind with oxygen to breathe, clean water, food, natural medicinal substances, and raw materials for industrial goods; their many services include storing greenhouse gases and providing inspiration for technical solutions. They also provide a range of cultural services, which considerably enhance our quality of life – a walk through the forest, the beauty of flora and fauna, opportunities for recreation and enjoyment, and so on.

However, loss of biodiversity along with the depletion of natural resources and the resulting degradation of ecosystems are becoming ever more apparent. When ecosystem services and the benefits they provide are lost, it is difficult and often highly costly to society to offset this loss. Yet as numerous examples from around the world have shown, it is worthwhile – not least economically – to protect nature and ensure the sustainable use of biological diversity.

The concept of Natural Resource refers to all types of environmental assets existing in the environment and incorporates the broad set of services provided by ecosystems assets. Natural resource is essential for economic growth, employment, and, ultimately, prosperity of a country. 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 - 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.

There is now widespread international support for the concept and practice of Natural Resource Accounting (NRA). One of the key international developments has been the System of National Accounts (SNA) which is an accounting framework for measuring the economic activities of production, consumption and

accumulation of wealth in an economy and provides for analyzing and evaluating the performance of an economy during a period of time. Further, major development has been adoption of integrated System of Environmental and Economic Accounting (SEEA) which describes the interrelationship between the economy and the environment. Unlike the conventional accounting system, this system provides for computing the depletion of natural resources and environmental degradation.

India has a long history of research on environmental aspects including ecosystem services. Although, various regional studies have been carried out in areas of forest, wetlands, coastal marine etc., a full-fledged national account could not be compiled. Environmental accounts and NRA is still in developing stage. There is a need to construct a full-fledged and robust environmental accounting and NRA methodology to ensure that natural capital, resource depletion and environment effects are accounted for. This concept paper attempts to bring out the various challenges and possible way forward to accounting of natural and environment resources in India.

1.2 Types of natural resources

Natural resources are components that exist in the world without the input of humans. Natural resources can be divided into:

On the **basis of origin**:

Biotic- These resources are obtained from the biosphere - living and organic material such as forests and animals. Fossil fuels such as coal and petroleum are also biotic resources.

Abiotic – Abiotic resources are those that come from non-living, inorganic material e.g. land, fresh water, air and heavy metals including ores such as gold, iron, copper, silver, etc.

On the basis of their stage of development, natural resources may be classified as:

Potential resources - Potential resources are those that exist in a region and may be used in the future. For example, petroleum occurs with sedimentary rocks in various regions, but until the time it is actually drilled out and put into use, it remains a potential resource.

Actual resources - Actual resources are those that have been surveyed, their quantity and quality have been determined and are being used in present times.

Reserve resources - The part of an actual resource which can be developed profitably in the future is called a reserve resource.

Stock resources - Stock resources are those that have been surveyed but cannot be used due to lack of technology. For example: oxygen.

Further, natural resources can also be categorized as either renewable or non-renewable resources:

Renewable resources - These are resources that can be replenished naturally. Resources are classified as renewable if its rate of replenishment/recovery exceeds that of the rate of consumption. Resources such as forest, solar energy, air, sea water etc are not only renewable resources but can continue to replenish themselves through ecological systems and support the mankind if actions detrimental to these could be minimised through concerted environmental action plans. Though they are continuously available, yet these resources are susceptible to depletion by over-use *e.g* air pollution.

Non-renewable resources – A natural resource is considered non-renewable when it exists in a fixed quantity, or when it cannot be replenished/regenerated on a scale comparative to its consumption, *e.g* fossil fuels, minerals, rocks etc. The economy of any country is greatly dependent upon these non-renewable natural resources. Therefore, special emphasis is needed to prevent over exploitation of these resources and preserving them for sustenance of the future generations.

The primary distinction between non-renewable and renewable resources is that in management of non-renewable resources, the fundamental question is at what rate the resource is depleted while in case of managing renewable resources, the objective is about the balance between the rate of use of these resources and the rate of their regeneration.

1.3 What is calling the attention - why place value on nature

Nature is inherently valuable, which should be reason enough to preserve it. Additionally, nature's many and varied ecosystem services have a significant economic value. Often this value is absent from private and public sector decision making. In most cases this lack of consideration is unintentional, as decision makers are not aware of these free benefits from nature.

"Earth provides enough to satisfy every man's needs, but not every man's greed"

Mahatma Gandhi

An economic perspective can generate more transparency. The aim of economic valuation is not to put a price tag on plants and animals but rather to uncover the

hidden value of biological diversity and ecosystem services – the value of "natural capital" – for society. By adopting an economic perspective, we can identify management options to better integrate the value of nature into private and public sector decision making and to promote a more sustainable use of natural resources.

Over the years, there has been increasing awareness about environmental issues across the globe and growing concern about the depletion and degradation of the natural resources.

Though India as a country is blessed with rich natural resources, but from research on the usage of natural resources, it has been found that the resources are depleting every day. For example:

- Forest and arable land is being depleted due to urbanization, overpopulation and overconsumption.
- Water resources are being contaminated and are drying up due to industrialization, urbanization and overuse.
- Wild life resources are being lost due to illegal poaching, hunting and industrialization.
- Residual emissions in excess of the assimilative capacity of the ecosystem raise the likelihood of natural and environmental resource degradation.
- Rapid depletion of exhaustible resources, over-exploitation of renewable resources and residual emissions in excess of assimilative capacity generally indicate that the economy has become too large relative to the ecosystem.

Therefore, it's high time that there should be proper accounting and effective management of natural resources.

1.4 What is NRA

Natural resource accounting is the compilation of data relating to natural resources within an accounting framework. NRA is an accounting system that deals with stocks and stock changes of natural assets, comprising biota (produced or wild), subsoil assets (proved reserves), water and land with their aquatic and terrestrial ecosystems. Natural resources accounts may involve both physical units and monetary values. The resources in question may include both those which contribute to marketable forms of production as well as non-commercial or environmental resources such as air, water and biological life. Natural resource accounts are regarded as a means of creating linkages between the environment and the economy. The terms 'NRA', 'green accounting' and 'environmental



accounting' are used interchangeably. One of the particularly thorny problems relating to NRA is the valuation of resources in monetary terms. The way in which natural resources are priced is often the result of decisions based on subjective criteria.

1.5 Aim of NRA

The aim of NRA is to provide information on the state of natural resources and the changes affecting them. As such, it is an important link in the chain of sustainable development. The term 'sustainable development' is taken to mean a form of development which is capable of meeting the needs of the present generation without jeopardizing the ability of future generations to meet their own needs.

"Let us pledge to collectively work towards conserving precious environment resources. Let us live in harmony and keep our beloved earth clean and green."

*Shri Narendra Modi,
Prime Minister of India*

Environmental accounting or NRA aims to provide a framework for organizing information on the status, use, and value of natural resources and environmental assets as well as expenditures on environmental protection and resource management. Natural resource accounts differ from other data as they are organized in terms of stocks and flows.

NRA also combines national income and product accounting concepts with analysis of natural resource and environmental issues. The development of resource accounting is generally perceived as having gone along two different paths; these are characterised as "physical" accounts and "monetary" accounts.

In essence, an environmental account must be:

- Purposeful and consequential for the account-user who depends on the reported information;
- Able to measure change in a defined account subject through time;
- Organised to enable comparisons and crosschecks in an internally consistent manner; and
- Comparable with other relevant accounts so it can provide the basis for more detailed or aggregated analyses.

1.6 Guiding Values of NRA

Environmental account ought to have the fundamental characteristics of relevance, credibility, and legitimacy for the accounts to be effective and play different roles in the development and value of the account. First, the account must have relevance to the users and align to their needs. Credibility would mean that while adequately

representing the subject, the account would effectively render the desired information. Even if the environmental accounts are well-founded, relevant, and credible, legitimacy is also another important value to reckon while establishing NRA. Legitimacy is the degree of acceptance of an account by the account users. Legitimacy reflects the perception that the production of information and technology has been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct, and fair in its treatment of opposing views and interests (Cash et al. 2003). These values guide and influence the environmental accounting principles and every aspect of the accounting process.

1.7 Need for NRA

It is long recognized that the conventional system of accounts to measure NNP has treated the environmental resources and their role in the economy inconsistently. Conventional accounting under the SNA captures data only of the measurable economic activity. Under the SNA, NNP increases when natural resource stocks are depleted and the quality of environment is reduced by pollution. Thus, the correct approach to NRA is to also account for the depletion of natural resources and the fall in the environmental quality in estimating the NNP.

The need for NRA can be broadly classified in the following categories:

- (i) Resource management;
- (ii) Policy planning;
- (iii) Identification and accounting the natural resources within the economy;
- (iv) Monitoring sustainable development goals;
- (v) Combating climate change: and
- (vi) Aid to Environment Impact Assessments.

These are discussed in the succeeding paragraphs:

1.7.1 Aid to resource management and policy planning

Currently, many policymakers lack information needed to understand the potential environmental impacts of their decisions, and the economic implications of changes to their environment and natural resources. In contrast, a wealth of economic information is usually available about production and income, which policymakers use to understand the state of the economy, monitor trends, and make projections that inform policy debates. Similarly, environmental accounts have the potential to provide key information that policymakers can use to understand the state of the environment, how it is changing over time, and the consequences of various policy options.

It can support policy for integrated environmental and economic analyses at the sectoral and macro-economic levels. For example, in recent times two major auction of natural resources like coal blocks and electro-magnetic spectrum were made by the Government of India. Though a broad outline of available stock was used as a base, availability of detailed physical stock and flows on a year-to-year basis would have further helped the Government in effective decision making keeping an eye on the sustainability of these resources.

Creation of NRA will also help in ascertaining the total stock of each of the resources vis-à-vis their periodic usage which would help in decision making regarding their further usages and also to opt for alternative action plan.

The XIV Finance Commission has for the first time used the criterion of forest cover on the grounds that while the forest cover maintained by States provide ecological benefits it also imposes opportunity costs that need to be compensated. The XIV FC assigned 7.5 per cent weightage to forest cover in the devolution formula for sharing the taxes. The XV FC Report released in November 2019 also continued to provide weightage based on forest cover and increased the weightage to 10 per cent for forest and ecology. While the FCs ascertained the increase/decrease in forest cover in the States through the ISFR issued by the FSI, biennially, environmental accounting can also be used to assess the forest cover in such cases in future.

"No part of natural resource can be dissipated as a matter of largess, charity, donation or endowment, for private exploitation. Each bit of natural resource expended must bring back a reciprocal consideration. The consideration may be in the nature of earning revenue or may be to 'best sub-serve the common good'. It may be the amalgam of the two."

*Supreme Court of India
{2012 (9) SCR (pg 345)}*

1.7.2 Accounting for the resources within the economy - establishing an interrelation between the environment and the economy

It is an accepted fact that standard accounting procedures like tracking the growth in economy fail to account for the environmental costs of the growth, the depletion of the Natural Capital/Resources or its deterioration. For example, if a country uses its natural capital by cutting down forests for farmland/industries, enhances its extraction of mineral ores to feed industry, excessively cultivates its farmland by use of fertilizers and pesticides, overdraws its groundwater resources etc., the traditionally measured economic activity will show a growth and GDP (and aggregate for the economic activity in an economy) will expand. The issue, however, is whether this computation is holistic and the growth attained sustainable over a long run. And as a consequence of exclusion of NRA the fundamental concept of matching revenues/incomes with all expenses (including

natural resources consumed) is not met. The principle of accrual where all expenses or outgo whether paid for or not are accounted for to determine real income is also flouted, thereby affecting the principle of full disclosure and conservatism also in the process.

Therefore, Environmental Accounting or NRA is seen as means of demonstrating linkages between the environment and the economy for promoting sustained productivity of the economy. And present day understanding of the intimate interplay between the manmade environment and the various components of the natural environment has resulted in appreciation for the need for preparation of accounts: NRA, Environmental accounts, and the EEA.

1.7.3 Management of Sustainable Development Goals

The 70th session of the United Nations General Assembly adopted (25 February 2016) the resolution titled 'Transforming our World: the 2030 Agenda for Sustainable Development' consisting of 17 SDGs and 169 associated targets. One of the most important overall challenges the society is facing today is how to maintain and improve the well-being of all citizens, both now and into the future. It is undenyng that information on the flow of availability, usage, replenishment (in case of renewable resources) of the natural resources in the form of an environmental account would have been a definite advantage for policy decisions and towards ascertaining the sustainability of the resources in the long run, thus safeguarding the resources and securing the future. SDGs have been discussed in greater details in Chapter II.

1.7.4 Combating Climate Change

Since climate change is linked to economic growth, governments must be able to connect economic data to environmental data to develop policies that allow for economic growth while keeping an eye on climate change and supporting sustainability.



Regredation of earth over time

Environmental accounts can play a key role in helping governments make well-founded decisions regarding climate change. In fact, asset and flow accounts have been recognised by the global statistical community as a useful framework for monitoring, measuring and analysing climate change. Climate change has been discussed in Chapter III.

1.7.5 Aid to Environmental Impact Assessments

Environmental Impact Assessment (EIA) is an important management tool for ensuring optimal use of natural resources for sustainable development. Initiating

with the impact assessment of river valley projects in 1978-79, the scope has subsequently been broadened to other developmental sectors such as industries, thermal power projects, mining schemes etc. Natural resources are finite and can only be optimised through internalisation of environmental considerations within the process of the development. Often, availability of natural resources becomes a limiting resource in a given region thereby restricting the scope of developmental portfolios. Asset Accounts of resources, state-wise, along with the whole framework of NRA which would calculate the overall gains in the economy while accounting for the natural resources used in the developmental process can play a defining role assessing the environmental impacts of the projects being undertaken, be it by the Government, private or through private-public partnership models.



CHAPTER - II

Sustainable Development Goals - Role of NRA

2.1 The 70th session of the United Nations General Assembly adopted (September 2015) the resolution titled 'Transforming our World: the 2030 Agenda for Sustainable Development' consisting of 17 SDGs and 169 associated targets to help organise and streamline development actions for greater achievement of human wellbeing, while leaving no one behind – by 2030. The details of the SDGs and associated targets are shown in **Annexure - B**. In this Assembly, Government of India affirmed its commitment to the 2030 Agenda and SDGs. SDGs are expected to set up the development agenda and policies to eradicate poverty, protect the planet, foster peace and promoting prosperity for all. The Agenda allows each Government to set its own national targets based on national circumstances and decide how global targets would be incorporated into national planning processes, policies and strategies. To assist this process, the United Nations Development Group created a Reference Guide for mainstreaming the 2030 Agenda and SDGs.

NITI Aayog, Government of India has been entrusted with the responsibility for coordination and overseeing the implementation of the 2030 Agenda in India. The MoSPI has been entrusted with the task of preparing monitoring indicators for SDG targets.

NITI Aayog has involved the States and UTs in the preparedness exercise by associating them with the formulation of the Vision and Strategy documents and advising them to undertake mapping of Goals and Targets with various departments, while building their institutional capacities for implementing, monitoring and evaluation of the SDGs.

As per the UN Resident Coordinator in India (December 2018), the success of Agenda 2030 globally will depend, in a decisive way, on the progress India makes on the SDGs in the next decade. It is not just the size of India's population or the scale of its interventions that makes it so critical to the SDGs, but its unique

We must work closely together to make this year a year of global action, one that will be remembered as the dawn of a new era of sustainable development.

(Secretary General, UN)

convergence of extraordinary economic growth, commitment to sustainability, and social and technological innovations.

2.2 India Index Baseline Report by NITI Aayog

A perusal of the SDGs would indicate that though a number of SDGs out of total 17 are linked to natural resources, but five of them (6, 7, 11, 14 and 15) relate directly to the sustainability of natural resources. In December 2018, the NITI Aayog brought out a report on status of achievement of SDG titled 'SDG India Index Baseline Report, 2018'. The Report outlines the status of achievement of these goals. The Report reveals that based on the status of achievement of the States in a parameter of composite SDGs (13 out of 17 SDGs¹), the States can be divided into four groups, namely achiever (100 per cent), front runner (65 - 99 per cent), performer (50 - 64 per cent) and aspirant (0 - 49 per cent). The map² at **figure 1** depicts the status.

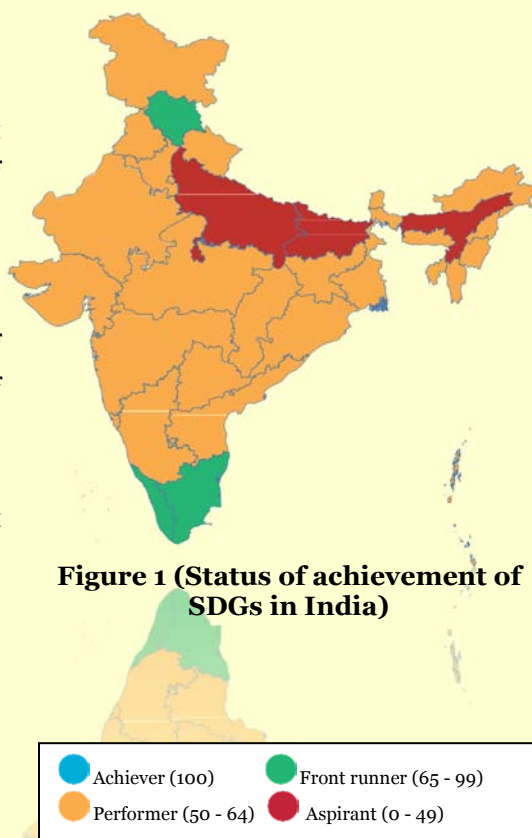
Analysis of the information provided in the Report on goals 6, 7, 11, 14 and 15 (related to sub-goals on sustainability of natural resources) reveals the following:

SDG - 6

Safe and Adequate Drinking Water in rural areas:

While the national target is to provide safe and adequate drinking water to all, currently only 71.8 per cent of the rural population in India has access to safe and adequate drinking water. Goa, Gujarat and Madhya Pradesh are close to achieving universal coverage in rural areas. Uttar Pradesh follows with a coverage of about 98 per cent.

Annual Ground Water Withdrawal: About 62 per cent of the net available groundwater in India is withdrawn. The national upper limit is 70 per cent so that the ground water is replenished at a normal rate. Audit of ground water management and



¹ SDGs 12, 13, 14 and 17 are not covered by the India Index Report.

² Source : India Index Baseline Report 2018.

regulation by CAG revealed that ground water withdrawal was higher than the national upper limit of 70 *per cent* in eight States namely Chandigarh, Delhi, Haryana, Himachal Pradesh, Puducherry, Punjab, Rajasthan and Tamil Nadu and the States need to improve this ratio which have far surpassed the maximum limit.

SDG - 7

Clean cooking fuel : Accordingly to the National Family Health Survey - 4, 2015-16, 43.8 *per cent* of the Indian households use clean cooking fuels. There is a significant divide between rural and urban households, with only 24 *per cent* of rural households using clean cooking fuels compared to 81 *per cent* urban households. Goa at 84.1 *per cent* and Delhi at 97.7 *per cent* are the best performing among States and UTs respectively.

Renewable energy : Renewable energy sources are 17.51 *per cent* of the total installed electricity generating capacity of India. Among the installed electricity sources of utilities, renewable energy grew at the highest rate during 2006-07 and 2015-16. Wind power has the highest share among all renewable power sources (March 2016). Renewable sources constitute 100 *per cent* of total installed generating capacity of electricity in three States and four UTs.

SDG - 11

Door to door waste collection: Proper and established waste management is an important criterion for sustainable cities. Five States and four UTs have achieved the target of 100 *percent* door to-door waste collection. On an average, across India, 73.58 *per cent* of the wards are collecting 100 *per cent* of the waste from door to door.

Waste processed: The installed capacity of waste treatment in the country is not at par with the amount of waste generated. Only 24.8 *per cent* of the total waste generated gets treated. The best performer among the States is Chhattisgarh with 74 *per cent* of its waste getting processed. Among the UTs, Delhi leads with processing 55 *per cent* of its waste.

SDG - 14

Life under water: To harness India's 7,500 km long coastline, 14,500 km of potentially navigable waterways and strategic location on key international maritime trade routes, the Government of India is laying emphasis on promoting blue economy through ambitious projects like the Sagarmala, which aim to promote port-led development and sustainable development of coastal communities through skill development and livelihood generation activities, fisheries development, coastal tourism etc.

SDG - 15

Forest cover: The total forest cover of India is 7,08,273 sq km, which is 21.54 per cent of the geographic area of the country. The national target is to have at least 33 per cent of the area covered under forest. In terms of forest cover with respect to total geographical area, Mizoram leads among the States with 86.27 per cent of its area covered with forest and Lakshadweep among the UTs with 90.33 per cent of the area covered with forest. In term of total area of forest cover, Madhya Pradesh has the largest forest cover spanning across an area of 77.414 sq km.

Change in Water Bodies: The increase in water bodies within forest areas of the country clearly brings out the positive effects of forests in augmenting water resources. Highest increase in the extent of water bodies within forest areas has been observed in Manipur (81.25 per cent) followed by Mizoram (72 per cent), Tamil Nadu (62 per cent) and Nagaland (59 per cent).

Change in Forest area: Between 2015 and 2017, the forest cover increased nationally by 6.778 sq km (0.21 per cent) due to an increase in plantation and conservation activities and improvement in data interpretation. Among the States, major decline in forest cover was observed in Nagaland followed by Mizoram and Meghalaya. Among the UTs, Puducherry has seen the highest decline in area under forest cover.

Population of wild elephants : Since elephants have high dietary requirements, their population can be supported only by forests that are under optimal conditions. So, the status of elephants is the best indicator of the status of forests. The population of wild elephants in India is estimated to have risen by 20 per cent over the five year period between 2012 and 2017. Nagaland has witnessed a 110.38 per cent increase.

The above Report was followed up with another index in December 2019 which *inter-alia* reports that India's composite score has improved from 57 in 2018 to 60 in 2019 thereby showing noticeable progress. The maximum gains been made in goals 6, 7 and 9. All three aspirant States (Assam, Bihar and Uttar Pradesh) have graduated to the performer category. Five States (Andhra Pradesh, Goa, Karnataka, Telengana and Sikkim) have moved up from performer to front runner category. Kerala achieved the first rank in the composite SDG index followed by Himachal Pradesh. Andhra Pradesh, Tamil Nadu and Telengana ranked at the third position. It was also mentioned that the SDG index 2019 is more robust than the first edition on account of wider coverage of goals, targets, and indicators as it spans 16 out of 17 SDGs with a qualitative assessment of Goal 17. This marks an improvement over the 2018 index which covered 13 goals. Additionally, the SDG 2019 has a new

section on profiles of all 37 States and UTs which will help in analysing the performances of States on all goals in a lucid manner.

2.3 Preparedness of India on SDGs

In view of the importance of SDGs and their periodic monitoring of attainment of targets and goals, the CAG has carried out an audit of 'Preparedness of India on SDGs' (Report No. 8 of 2019) which is available on public domain. A snapshot of main audit findings are mentioned in the following **table 1**. The detailed Report and recommendations are at cag.gov.in/content/report-no8-2019-preparedness-implementation-sustainable-development-goals-union-government.

Table 1 (Audit findings of CAG's Audit Report on preparedness on SDGs)

| Area | Audit findings (in brief) |
|---|--|
| Adapting the 2030 Agenda | Though several initiatives have been taken by the <i>NITI Aayog</i> as the nodal institution for coordinating the 2030 Agenda, a roadmap with defined milestones aligned with SDG targets to be achieved in the year 2020, 2025 and 2030 is yet to be prepared. Existing mechanisms for co-ordination amongst the Ministries and agencies, and different levels of Government would need strengthening. |
| Resource mobilisation for the 2030 Agenda | No comprehensive exercise for assessing and identifying financial resources required for implementing SDGs had been undertaken either by the Ministry of Finance at the Centre or by the selected States. No steps had also been initiated at the Central level for integrating SDGs in national budgeting and most of the selected States were only at the preliminary stage of orienting their budgets with SDGs. |
| Monitoring and Reporting | To enable monitoring and review, MoSPI was entrusted with the task of developing a national indicator framework which was published only in November 2018. As a result, tasks key to the institution of a proper monitoring and reporting framework, such as preparation of baseline data was completed only in March 2019. Milestones were yet to be aligned with timeline for targets achievement. In the seven selected States, action on developing indicators and identification of data sources had not achieved required level of progress. The creation of a robust mechanism for monitoring, evaluating and reporting progress on implementation of SDGs therefore, remains an area requiring immediate and focussed action. |

In addition to these measures suggested for effectively attaining the SDGs 2030, it is undenyng that information on the availability, usage, replenishment (in case of renewable resources) of natural resources in the form of Asset Account as part of environmental accounting would be a definite advantage for informed policy decisions and also for ascertaining the sustainability of these resources for future generations.



CHAPTER - III CLIMATE CHANGE VIS-À-VIS NRA

3.1 Climate Change - as defined in the Oxford Dictionary - climate change is a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

NASA defines climate change as a change in the usual weather found in a place. This could be a change in how much rain a place usually gets in a year. Or it could be a change in a place's usual temperature for a month or season. Climate change is also a change in Earth's climate. This could be a change in Earth's usual temperature or it could be a change in where rain and snow usually fall on Earth. Weather can change in just a few hours but climate takes hundreds or even millions of years to change.

The UNFCC's definition of climate change is a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.

3.2 Climate Change - the threat

Climate change is a natural process, but it is the recent rapid change that is evident is what causes concern to environmentalists all over the world. The United Nations Development Programme (UNDP) is deeply concerned, for instance, that the increased exposure to draughts, floods and storms is already limiting opportunities and reinforcing inequality in the world. Current projections point to a global increase in temperature of 2° Fahrenheit to 11.5° Fahrenheit (1.1° Celsius to 6.4° Celsius) by 2100, which will result in additional sea level rise that will gradually inundate coastal areas and increase beach erosion and flooding from coastal storms, changes in precipitation patterns, increased risk of floods and draughts, threat to biodiversity, and a number of potential challenges to public health. The

above increase in global temperature cannot be addressed easily. The major target, however, should be the drastic reduction of emissions of carbon dioxide and other greenhouse gases by re-orienting the way nations power their economy. This demands shifting away from a century's legacy of unrestricted fossil fuel use and its associated emissions in pursuit of more efficient and renewable sources of energy. According to IPCC (Summary for Policymakers) changes in lifestyle and behavior patterns could contribute to climate change mitigation across all sectors; management practices also can have a positive role.

Climate represents the average weather which exists over a period of time, and may be referred to in terms of local, regional or global geographical confines. Climate change occurs when the climate deviates from the average weather over a long period of time. According to IPCC, global warming, the cause of climate change in most cases, is evidenced by the following:

- Increase in average air and ocean temperature.
- Increase in average global sea level.
- Widespread melting of ice and snow.
- Changes in weather, wind pattern, precipitation, frequency of weather events (floods, storms, tsunami etc.)

The average temperature of the earth has increased by 0.74°C since the late 1800s. It is further expected to rise, according to the UNFCCC, by the year 2100, unless prompt rectificatory actions to mitigate the global warming are adopted. UNFCCC points out that even if the minimum predicted increase takes place, it will be larger than any previous century-long trend in the last 10,000 years. According to the National Aero Space Agency (NASA), USA, *'because of rapid warming trends over the last thirty years, the earth is now reaching and passing through the warmest levels seen in the last 12,000 years'*.

The principal reason for the mounting global warming is none other than the feverish trend of industrialization; burning of ever-greater quantities of fossil fuel, the cutting of forests and the practice of certain farming methods. It is assessed that the average sea level has risen by 10 to 20 cm during the 20th century. An additional rise of anything between 18 to 59 cm is expected by 2100. If the higher end of the scale is reached, the sea could overflow the heavily populated coastline of such countries as Bangladesh, cause the disappearance of some nations entirely (such as Maldives), foul freshwater supplies for billions of people and spur mass migrations.

3.3 Climate Change - UN's intervention

The Rio de Janeiro Conference on Environment and Development held in 1992 had Agenda 21 as a plan of action which set out the direction and commitment in areas

such as poverty reduction, education, water, waste, air, biodiversity, forests and energy. The subsequent World Summit on Sustainable Development (WSSD) held in Johannesburg evaluated the progress achieved towards the above common cause. Several countries have integrated their WSSD commitments into national action plan and sustainable development strategies. According to India's National Environment Policy, 2006, *'the key environment challenges that face the country relate to the nexus of environmental degradation with poverty in its many dimensions, and economic growth'*. The policy affirms that the proximate drivers for environmental degradation are population growth, inappropriate technology and consumption choices, and poverty, leading to changes in relations between people and ecosystems, and development activities such as intensive agriculture, polluting industry, and unplanned urbanization. Further, the Policy assumes that these factors give rise to environmental degradation only through causal linkages, in particular, institutional failures. Environmental degradation moreover impacts soil fertility, quantity and quality of water, air quality, forests, wildlife, and fisheries, all affecting the population, especially the rural poor. The impact on human health is tenacious, with 20 per cent of the burden of diseases in India attributable to environmental degradation.

The Kyoto Protocol which is linked to the UNFCCC was the first binding agreement covering 37 industrialized countries and the European Commission, aimed at emission reduction targets. The Protocol targets GHG reduction of five per cent against 1990 levels over the five-year period of 2008-2012. Detailed rules for the implementation of the protocol were adopted in the Marrakech accord in 2001, providing for national measures supplemented with market mechanism.

3.4 Climate Change - global phenomenon

The WMO describes the build-up of greenhouse gases in the atmosphere during the 20th century as resulting from the growing use of energy and expansion of the global economy. According to the WMO, the build-up of greenhouse gases in the atmosphere alters the



Figure 2 (Evidences of climate change)

radiative balance of the atmosphere. The net effect is to warm the Earth's surface and the lower atmosphere because greenhouse gases absorb some of the Earth's outgoing heat radiation and reradiate it back towards the surface. A comprehensive assessment of the science was undertaken in 2007 by the IPCC on the causes,

impacts and possible response strategies to climate change. The conclusions are supported by a wide range of the world's leading scientific institutions including the US's NOAA. During 2010, there has been widespread debate about climate science particularly as a result of errors which emerged in the last (2007) IPCC report. None of the errors alter the fundamental conclusions of the IPCC's report, namely that climate change is the result of human activity, that the phenomenon will have devastating effects if left unchecked and that cost of action on climate change are significantly lower than the costs of inaction. Following a review by the Inter Academy Council, the IPCC has announced that it will strengthen a number of its processes and procedures. During 2010, several regions of the world experienced what the WMO terms severe weather related events. These included flash floods and widespread flooding in large parts of Asia and parts of Central Europe. Other regions were also affected: by heat-wave and drought in the Russian Federation, by mudslides in China and severe droughts in sub-Saharan Africa. The WMO stated that while a longer time range is required to establish whether an individual event is attributable to climate change, the sequence of current events matches IPCC projections of more frequent and more intense extreme weather events due to global warming. The findings of the latest report of IPCC, the Fifth Assessment Report titled 'The Climate Change 2014, Synthesis Report' can be summarised into four distinct groups which are termed as summary for policy makers (SPM), namely - (i) observed changes and their causes, (ii) future climate changes, risks and impacts, (iii) future pathways for adaptation, mitigation and sustainable development and (iv) adaptation and mitigation. Based on the above findings, the Report proposed the following approaches for managing the risks of climate change through adaptation. These are at **Annexure - C**.

3.5 Climate Change - major contributors

As per the data available as of January 2019, while the US is way ahead of China under the CO₂ per capita measurement, China is the world's biggest emitter overall. It overtook the US in terms of total emissions back in 2006 and now emits more than the US and EU combined. Rapid economic growth and a large population have been driving up China's emissions. This chart shows the scale of its contribution to global warming. Canada has neither the large population nor the high total greenhouse emissions of China and the US, but when its CO₂ emissions are measured per person it only

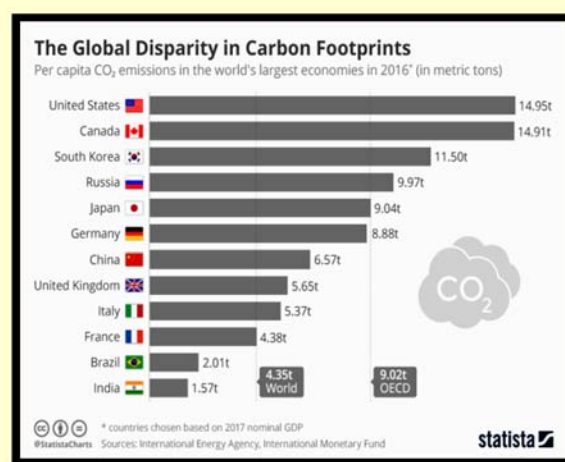


Figure 3 (Global carbon emission data)

narrowly misses out on the top spot. This is because it's a vast country with a small population and abundant natural resources that are spread across its wilderness, which means it has proportionally high emissions from transport, industry and energy. Third on the list behind the US and Canada is South Korea which still relies heavily on coal for electricity and has a more energy-intensive economy than most other G20 countries.

Its a collective endeavour, its a collective accountability and it may not be too late.

*(Christine Lagarde)
Managing Director, IMF*

At the UN's COP24 summit in Poland nearly 200 countries reached a consensus on implementing the 2015 Paris Climate Agreement. But global action on climate change can't come soon enough – the recent uptick in the world's emissions is a stark reminder of the struggle that lies ahead. In a recent article, Emily Farnworth, Head of Climate Change at the World Economic Forum, outlined five ways to shift to a carbon neutral world, from protecting nature to putting a price on carbon as mentioned below.

- Investing in nature-based solutions
- Pricing carbon
- Utilizing the full potential of 4IR technologies
- Transitioning to a circular economy
- Accelerating low carbon energy for all.

3.6 Climate Change - India's role

India being a developing nation is not bound by the Kyoto Protocol to reduce the green house gas emissions, which in any case is far below the global average. Nevertheless, India has adopted several policies, strategies and programmes aimed at arresting environmental degradation. For instance, the Government of India's Vision Statement on Environment and Health refers to the development strategy adopted by the Rio Declaration to reiterate that human beings are at the centre of concerns for sustainable development and that they are entitled to a healthy and productive life, in harmony with nature. Quoting from the World Summit on Sustainable Development held at Johannesburg on 26th September, 2002, the vision statement reaffirms that *inter alia*, health concerns arising from air pollution should be addressed by integrating them with strategies, policies, and programmes for poverty eradication, strengthen regional and national programmes including through public private partnerships with technical and financial assistance to developing countries, support the phasing out of lead in gasoline, and strengthen and support efforts for the reduction of emissions through the use of cleaner fuels and modern pollution techniques.

In line with the resolution at the UNFCCC and recognising that climate change is a global challenge, the Government of India constituted the NAPCC in 2009 with the emphasis to engage actively in multilateral negotiations in the UNFCCC, in a positive, constructive and forward-looking manner. The objective of NAPCC is to establish an effective, co-operative and equitable global approach based on the principle of common but differentiated responsibilities and respective capabilities, enshrined in the UNFCCC³. Accordingly, it was determined that India's per capita greenhouse gas emissions will at no point exceed that of developed countries even as India pursues its development objectives.

As per the data published by the World Economic Forum in January 2019, though most of the world's largest economies have high CO₂ emissions per capita – 10 of the top 12 are above the global average of 4.35 metric tons, Brazil and India are the only major economies with below average CO₂ emissions per capita. Moreover, China, Brazil and India are the only nations that are outside the “very high” category of the United Nations Development Programme's Human Development Index. Despite having high total emissions, Brazil's and India's CO₂ emissions per capita are comparatively low due to their large populations and relatively low GDP per capita.

As a step toward achieving the overarching objectives of the NAP, the NAPCC devised eight multi-pronged, long term and integrated national strategies, viz national solar mission, national mission for enhanced energy efficiency, national mission on sustainable habitat, national water mission, national mission for sustaining the Himalayan ecosystem, national mission for a Green India, national mission for sustainable agriculture and national mission on strategic knowledge for climate change.

The INCCA, Government of India has also brought out a Report on 'Climate Change in India - A 4 X 4 Assessment, A Sectoral and Regional Analysis for 2030s' in November 2010. The Report, *inter-alia*, envisaged a five-pronged action plan to address data gaps, ensuring systematic observations, accessing multiple regional climate models with higher resolutions, capacity building and making a pan-Indian regional assessment for informed policy making at all levels.

No challenge poses a greater threat to future generations than Climate Change.

*(Barrack Obama)
Former President, USA*

³ Source : National Action Plan on Climate Change (website of MOEF & Climate Change)

3.7 Role of NRA in combating Climate Change

Given the complex nature of climate change, the cost to prevent and adapt to its effects, and the controversy surrounding the issue, policy decisions in this area will need to be based on sound data. It is also imperative that the focus should be on mitigating the phenomenon by reducing green house gas emissions and by enhancing carbon sinks. This has to be seen in distinction with adaptation to global warming which involves taking action to minimize the effects of such warming and is intended to reduce the vulnerability of natural and human systems to actual or expected climate change effects. As the climate change is linked to economic growth, governments must be able to connect economic data to environmental data to develop policies that allow for economic growth while supporting sustainability. Environmental accounts can play a key role in helping governments make well-founded decisions regarding climate change. In fact, asset and flow accounts have been recognised by the global statistical community as a useful framework for monitoring, measuring and analysing climate change.



CHAPTER - IV DEVELOPMENT OF ENVIRONMENTAL ACCOUNTING

4.1 The initiative and major milestones on environmental accounting

The UN has promoted the integration of environmental factors in national accounts ever since the early 1980s. In conjunction with various other organisations, the UN has launched a number of initiatives, all of which are aimed at providing a complement to conventional systems of national accounts by enabling countries to measure depletion of natural resources and the degree of environmental degradation. Major milestones on implementation of NRA were as mentioned in the **table 2** below.

Table - 2 Showing major milestones of Environmental Accounting

| Year | Major milestones |
|-----------|---|
| 1970s | The first environmental accounts were constructed by Norway |
| 1983-1987 | World Commission on Environment and Development, also known as the Brundtland Commission set up |
| 1992 | The UN Earth Summit held in Rio de Janeiro |
| 2003 | SEEA-1993 released |
| 2005 | UNCEEA established ⁴ |
| | Oslo Group on Energy Statistics established ⁵ |
| 2010 | TEEB - a global initiative focused on making nature's value visible presented four reports in the COP 10 consisting of 10 countries in Nagoya, Japan. |

⁴ With the objective to: (a) mainstream environmental-economic accounting and related statistics; (b) elevate the SEEA to an international statistical standard; and (c) advance countries' implementation of the SEEA.

⁵ To contribute to the development of improved methods and international standards for national official energy statistics, and, in particular, to review and contribute to the updating of the UN's handbooks and manuals on energy statistics. The Oslo Group is contributing to the development of the SEEA-E.

| Year | Major milestones |
|-------------|--|
| 2012 | The SEEA - (CF) adopted by UN Gaborone declaration of 10 African countries on multi-year process of sustainable development in Africa issued |
| 2013 | The SEEA (EEA) adopted by the UN |
| 2015 | 21st yearly session of the COP to the 1992 UN Framework Convention on Climate Change and 11th session of the meeting of parties to the 1997 Kyoto Protocol held in Paris. The conference negotiated the Paris Agreement, a global agreement on the reduction of climate change |
| 2017 | 'Natural Capital Accounting and Valuation of Ecosystem Services' - project launched by the UN with pilot projects in five countries - Brazil, China, India, Mexico and South Africa rolled out |

4.2 System of National Accounts

Guidelines for the compilation of conventional accounts in the form of SNA have been in existence since 1968, and these have been observed by individual countries. The SNA underwent five revisions till the latest version of 2008 came out which updated the SNA of 1993.

SNA is the internationally agreed standard set of recommendations on how to compile measures of economic activity in accordance with strict accounting conventions based on economic principles. The framework of the SNA provides accounts that are (a) comprehensive, (b) consistent and (c) integrated. Most of the countries including India, comply with the SNA in the compilation of our National accounts which serve as the basis of drawing up numerous macro-economic indicators that inform policy making.

Though the accounting framework of the SNA allows economic data to be compiled and presented in a format that is designed for purposes of economic analysis, decision taking and policy making; yet, it did not provide for taking into account the environmental inputs, degradation and depletion of environment and natural resources which are residues of economic growth.

In their conventional form, national accounts were intended to record economic transactions which had actually been observed and which could be expressed in monetary terms. This approach had the drawback that it failed to identify either the scale of environmental damage or the extent of resource depletion caused by these transactions. This also meant that the utilisation of the environment and natural resources had an exclusively beneficial effect on economic indicators such as the GNI and the NNP. This difference in the treatment of natural resources and

other tangible assets reinforces the false dichotomy between the economy and the environment that leads policy-makers to ignore or destroy the latter in the name of economic development. Natural capital can be exploited by man, but cannot be created by man and given the limited substitutability between man-made capital and natural capital, it is necessary to maintain some amount of the natural capital stock constant in order to maintain the real income constant at the current level over time.

4.3 The Brundtland Commission - 1987

In order to formulate 'a global agenda for change', the UN had set up the World Commission on Environment and Development, known as the Brundtland Commission, in 1983 with the following objectives:

- To propose long-term environmental strategies for achieving sustainable development by the year 2000 and beyond;
- To recommend ways as to how the concern for the environment can be translated into greater co-operation among developing countries and between countries at different stages of economical and social development and lead to the achievement of common and mutually supportive objectives that take account of the interrelationships between people, resources, environment, and development;
- To consider ways and means by which the international community can deal more effectively with environment concerns; and
- To help define shared perceptions of long-term environmental issues and the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long term agenda for action during the coming decades, and aspirational goals for the world community.

The challenge before the Commission was to find sustainable development paths ought to provide the impetus - indeed the imperative - for a renewed search for multilateral solutions and a restructured international economic system of co-operation. These challenges cut across the divides of national sovereignty, of limited strategies for economic gain, and of separated disciplines of science. Amidst these challenges the Commission examined whether nations were misusing their natural and environmental resources and issued a report entitled *Our Common Future* in 1987. The Commission noted that while the "environment" is where the mankind live; "development" stood for what it does in attempting to improve the mankind within that abode. The two are inseparable. Further, many of the development paths of the industrialised nations are clearly unsustainable. And

the development decisions of these countries, because of their great economic and political power, will have a profound effect upon the ability of all peoples to sustain human progress for generations to come.

The report popularized the concept of sustainable development as an alternative to unfettered economic growth and defined “sustainable development” as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

4.4 Earth Summit at Rio De Janeiro - 1992

Another major step towards attaining sustainable development was the Earth Summit at Rio de Janeiro in 1992 with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people. This Summit was a follow up of the declaration of the UN on human environment adopted at Stockholm in 1972. The Earth Summit in 1992 was attended by 172 countries working towards international agreements which respect the interest of all and protect and integrity of the global environmental and developmental system and recognising the integral and interdependent nature of the Earth - Our home.

In agenda 21, – a plan of action agreed upon by the 172 governments in attendance – the integration of environmental and development concerns and greater attention to them will lead to the fulfillment of basic needs, improved standards for all, better protected and better managed ecosystems and a safer and more prosperous future. Toward that end, Agenda 21 recommended, among other steps, that - *a first step towards the integration of sustainability into economic management is the establishment of better measurement of the crucial role of the environment as a source of natural capital and as a sink for by-products generated during the production of man-made capital and other human activities. As sustainable development encompassing social, economic and environmental dimensions, it is also important that national accounting procedures are not restricted to measuring the production of goods and services that are conventionally remunerated - A program to develop national systems of integrated environmental and economic accounting in all countries is proposed.*

The recommendation was based on the Conference’s finding that better measurement of the environment’s crucial role as both a source of natural capital and as a sink - or repository - for by-products generated during human activities is an important first step towards the integration of sustainability into economic management. More recently, the outcome document of the UN Conference on Sustainable Development held also in Rio in 2012 reconfirmed that need for environmental accounting in decision making processes.

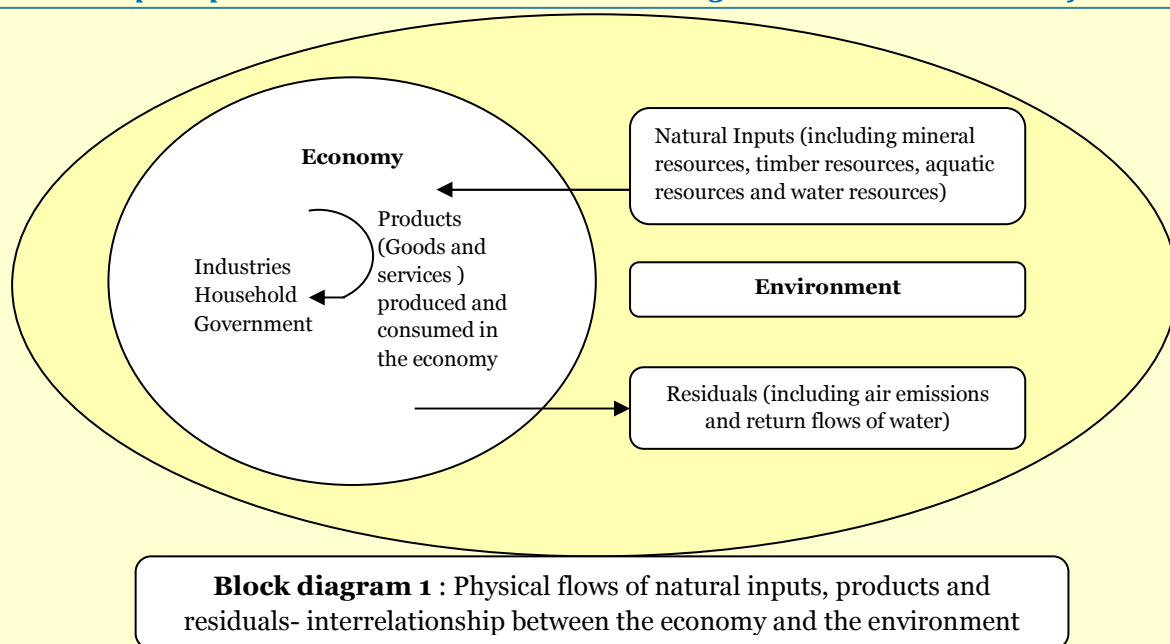
In response to the policy demands from the World Commission on Environment and Development or the Brundtland Commission and subsequently the Agenda 21, the 1993 Handbook of National Accounting : Integrated Environmental and Economic Accounting (SEEA 1993) was developed. Further development of the statistical framework based on practical experience in implementing the SEEA 1993, was published in the Handbook of National Accounting: Integrated EEA 2003 (SEEA 2003). This satellite system is designed to reflect the use that is made of natural resources and the damage that is caused to the environment. The satellite accounts are intended to complement the four main accounts of the conventional SNA. The SEEA was tested in Mexico and Papua New Guinea. The main elements of the SEEA and the case studies were published during a UNSTAT - World Bank Symposium.

4.5 SEEA - CF - SEEA, EEA and SEEA, AE

At its 43rd session, the UNSC adopted (2012) the SEEA - CF as the initial international statistical standard for environmental economic accounting, to be implemented in a flexible and modular approach.

SEEA (CF) is the first international statistical standard for environmental economic accounting consisting of a comprehensive set of tables and accounts, which guides the compilation of consistent and comparable statistics and indicators for policymaking, analysis and research. It is a multipurpose conceptual framework for understanding the interactions between the economy and the environment, and for describing stocks and changes in stocks of environmental assets. It puts statistics on the environment and its relationship to the economy at the core of official statistics. This version of the SEEA is an outcome of much path-breaking work on extending and refining concepts for the measurement of the interaction between the economy and the environment. As an accounting system, it enables the organisation of information into tables and accounts in an integrated and conceptually coherent manner. This information can be used to create coherent indicators to be used to informed decision making and to generate accounts and aggregates for a wide range of purposes. Regular compilation of environmental-economic accounts in countries as part of a programme of official statistics will foster international statistical comparability, provide policy-relevant information at national, regional and international levels, improve the quality of the resulting statistics and ensure a better understanding of the measurement concepts.

The following block diagram discusses the inter-relation between the economy and the environment.

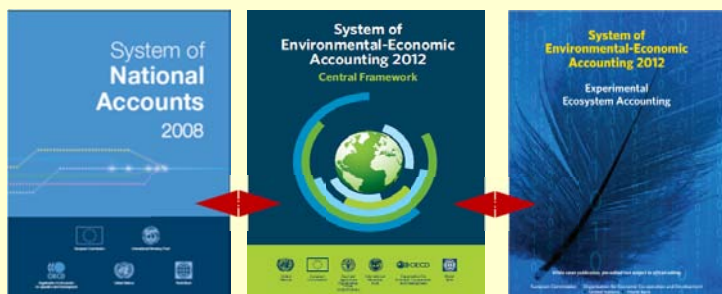


The SEEA provides information related to a broad spectrum of environmental and economic issues including, in particular, the assessment of trends in the use and availability of natural resources, the extent of emissions and discharges to the environment resulting from economic activity, and the amount of economic activity undertaken for environmental purposes.

The SEEA (CF) is complemented by two other publications namely, SEEA Experimental Ecosystem Accounting (SEEA, EEA) and SEEA Applications and Extensions (SEEA, AE). While SEEA (EEA) is not a statistical standard, it provides a consistent and coherent synthesis of current knowledge regarding an accounting approach to the measurement of ecosystems within a model that complements the SEEA (CF). The SEEA (AE) presents various monitoring and analytical approaches which could be adopted using SEEA data sets and describes ways in which the SEEA can be used to inform policy analysis and like SEEA (EEA) it is also not a statistical standard.

4.6 Interrelation between SNA 2008 and SEEA (CF)

As discussed above, the SNA is a measurement framework to embody the pre-eminent approach to the measurement of economic activity, economic wealth and the general structure of the economy. The SEEA (CF) applies the accounting concepts, structures, rules and principles of the SNA to



environmental information. Consequently, the SEEA (CF) allows for the integration of environmental information (often measured in physical terms) with economic information (often measured in monetary terms) in a single framework. The power of the SEEA (CF) comes from its capacity to present information in both physical and monetary terms coherently. Because it uses the same accounting conventions, the SEEA (CF) is, in general, consistent with the SNA.

4.7 Implementation of SEEA (CF)

The SEEA (CF) is a system conceived as an integrated, internally consistent series of accounts. At the same time, its design is such that it can be implemented equally well in part or as a whole. Depending upon the specific environmental issues faced, a country may choose to implement only a selection of the accounts included in the SEEA (CF). The SEEA (CF) provides that even if a country desires eventually to implement the full system, *it may decide to focus its initial efforts on those accounts that are most relevant to current issues.*

4.8 Accounting principles as defined in SEEA - CF

The SEEA (CF) is a multipurpose conceptual framework for describing the interaction between the economy and the environment, and the stocks and changes in stocks of environmental assets. Utilizing a systems approach to organizing environmental and economic information, it covers, as completely as possible, the stocks and flows that are relevant to the analysis of environmental and economic issues.

The SEEA (CF) covers measurement in three main areas: (a) the physical flows of materials and energy within the economy and between the economy and the environment; (b) the stocks of environmental assets and changes in these stocks; and (c) economic activity and transactions related to the environment.

The information on various stocks and flows of the economy and the environment are organized and integrated in a series of tables and accounts as follows:

- (a) *supply and use tables in physical and monetary terms showing flows of natural inputs, products and residuals;*
- (b) *asset accounts for individual environmental assets in physical and monetary terms showing the stock of environmental assets at the beginning and the end of each accounting period and the changes in the stock;*
- (c) *a sequence of economic accounts highlighting depletion-adjusted economic aggregates; and*
- (d) *functional accounts recording transactions and other information about economic activities undertaken for environmental purposes.*

4.9 Summing up

Thus, the Chapter discusses about the development of environmental accounting under the auspices of the UN, progress made towards implementation of environmental accounting, system of national accounts, inter-relation between the SNA and the environmental accounting etc. Challenge so far has been to implement the aforesaid theories in Indian context where these prescriptions are at the initial stage by making necessary maneuvering in the implementation guidelines envisaged by the SEEA (CF) to fit the needs and requirements in Indian parlance. This paper aims to link the international guidelines, works done so far in India, expected difficulties and to provide a broad spectrum as to how best NRA could be implemented in India keeping intact the outline of SEEA (CF). These are discussed in some of the succeeding Chapters of this paper.



CHAPTER - V VALUATION OF RESOURCES

5.1 Preparation of Asset Accounts in respect of the natural resources as envisaged in the SEEA (CF) has been discussed in the preceding chapter. One of the key elements of preparation of the Asset Accounts is attribution of valuation to the resources for them to be of use by the policy makers as discussed in this Chapter.

Valuation can simply be defined as an attempt to put monetary values to environmental goods and services or natural resources. However, for attributing valuation to the resources, the core question is the methodologies of valuation of resources.

5.2 Valuation suggested by SEEA - CF

The SEEA (CF) prescribes three methodologies to value the resources. One - the market price, second is the basic, producers' and purchaser's price and third - the net present value for environmental assets.

5.2.1 Market Price : Market prices for transactions are defined as amounts of money that willing buyers pay to acquire something from willing sellers. The exchanges should be made between independent parties on the basis of commercial considerations only, sometimes called "at arm's length". A market price should be distinguished from a general market price which gives an indication of the "average" price for exchanges of a type of good, service or asset.

5.2.2 Basic, producer's and purchaser's price : The basic price measures the amount retained by the producer and is therefore the price most relevant for the producer's decision-making. The producers' price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser. The producers' price excludes any transport charges invoiced separately by the producer. Unlike the basic price, the producers' price includes any taxes on products other than a deductible VAT, and excludes any product subsidies. The purchasers' price is the amount paid by the purchaser, excluding any VAT or similar tax deductible by the

purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchasers' price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place. This is the price most relevant for the purchaser.

5.2.3 Net present value : For many environmental assets, there are no relevant market transactions or set of acquisition prices that would permit the use of the previous two approaches. Thus, although prices can be found to value the output from extraction or harvest of an environmental asset, no values for the asset itself, *in situ*, are available.

In this situation, the discounted value of future returns approach, commonly referred to as the net present value (NPV) approach, uses projections of the future rate of extraction of the asset, together with projections of its price, to generate a time series of expected returns. Typically, these projections are based on the history of returns earned from the use of the environmental asset. Assuming that returns earned in the current period are worth more to the extractor than returns earned in the future, the stream of expected returns is discounted to reflect the value that a buyer would be prepared to pay for the asset in the current period.

Best example is NPV collected by the MoEFCC on diversion of forest land for developmental projects. By classifying the forested land into various categories, the Ministry has prescribed various amounts to be paid by the entities acquiring forested land.

5.3 Other valuation methodologies

Besides the above definitions by SEEA (CF), there are other pricing methodologies coined by other authors, reports which are briefly discussed below:

5.3.1 In the paper on 'A New Environmental Accounting Frame Work Using Externality Data and Input-Output Tools for Policy Analysis', Mr. M N Murty discussed three different valuation types: (a) market valuation according to the concept of the non-financial asset accounts in the conventional system of national accounts, (b) maintenance valuation, which estimates the cost necessary to sustain at least the present level of natural assets, and (c) Nonmarket valuation using hypothetical behavioral methods: contingent valuation methods and the observed behavioral methods such as hedonic prices, travel cost and household production functions for estimating the value of consumptive services of the natural environment.

5.3.2 Hedonic Pricing Method : The method is based on the assumption that people value the characteristics of a good, or the services it provides, rather than the good itself. Thus, prices will reflect the value of a set of environmental characteristics that people consider important when purchasing the good.

5.3.3 Travel cost method : The travel cost model or recreation demand modeling approach, is a revealed preference method that fundamentally depends on observing actual behavior (trips taken over some period) rather than on answers to hypothetical questions. The method involves using travel costs as a proxy for the price of visiting outdoor recreational sites (fishing, hunting, boating, and forest visit).

5.3.4 Production function approaches : The production-function method also known as change-in-productivity approach, seeks to exploit the relationship between environmental attributes and the output level of an economic activity. The underlying assumption is that, when an environmental attribute enters a firm's production function, environmental changes' economic impacts may be measured by looking at the effect on production, and by valuing such effect at market (or shadow adjusted) output prices.

5.3.5 Contingent valuation methods : The most obvious way to measure nonmarket values is through directly questioning individuals on their willingness-to-pay for a good or service called the contingent valuation method. It is a survey or questionnaire-based approach to the valuation of non-market goods and services.

As evident from the recitals above, much of the valuation methodologies pertains to period prior to release of SEEA (CF), i.e. 2012 which confirms consolidation of all major notions of the authors working on environmental accounting till date, it is apparent that the pricing methodologies prescribed by the SEEA (CF) could be most relevant techniques to be applied while valuation of the resources.

5.3.6 Shadow pricing of resources : As envisaged in the Report on Green National Accounts in India, to estimate the valuation of the resources, one needs ideally to impute a social value to every capital asset, multiply each asset's stock (measured in terms of either quantity and quality) by its social value, and add across all the assets. The social value of an asset is called its shadow price which is a link between a society's well being and its capital.

5.3.7 Estimation of rent method : In Canada, natural asset stocks are valued at their estimated market value which is worked out on the difference between the annual cost of extraction of the resource and the revenue generated from the sale of such resource. The different is referred to as 'rent'. Costs of extraction include

both operating costs, such as wages and supplies, and capital costs, such as expenditure on exploration, infrastructure and equipment. Data for these costs, and for the value of production, are obtained from annual surveys of the resource producing industries. The total value or wealth associated with the stock is calculated as the present value of all future annual rent that the stock is expected to yield.

5.3.8 Royalty method : A lessee is a person who is granted mineral concessions. The lessee is required to pay a certain amount in respect of the mineral extracted in proportion to the quantity extracted. Such payment is called royalty. The term originated from the fact that for centuries gold and silver mines in Great Britain were the property of the Crown. Such “royal” metals could be mined only if a payment (“royalty”) were made to the Crown. The royalties in respect of mining leases is specified in Section 9 of the Mines and Minerals (Development and Regulation) Act, 1957. In a nut shell, it can be stated that royalty is a charge by the owner of a mineral in consideration of the exploitation of mineral resources by the lessee.

For example, the Union and the State Governments levy royalty on different types of natural resources which are reviewed at periodic intervals to keep them as close as possible with the market prices of such minerals. Prior payment of royalty is mandatory before issuance of permits for exploration of minerals as has been discussed in Chapter IX.

5.4 Summing up

The principles for valuation of the natural resources in India will have to take into consideration the availability of information with various stakeholders while maintaining the overall framework of the SEEA (CF). As described by SEEA (CF), since it is commonly the case that governments have a high level of ownership or influence over the extraction of environmental assets, the NPV method or Government revenue/royalty method could be the best option to value the resources, along-with the market value.



CHAPTER - VI INITIATIVES IN OTHER COUNTRIES

6.1 Many industrialised countries, including Australia, Canada and France and an increasing number of developing countries, including Namibia and the Philippines have developed some components of environmental accounting and continue to refine their accounts. Some major instances are mentioned below:

Australia

Australia has developed SEEA-based stock and flow accounts for energy and emissions, fisheries, minerals, and water. Australia has also determined a monetary value for land, mineral, and forest stock accounts and has included them in its balance sheets to create a measure of total wealth. Australian Bureau of Statistics and the National Water Commission have produced water accounts that track the supply and use of water in the Australian economy to better understand how to make the most of Australia's limited water resources. Besides, a number of environmental accounts are currently being produced in Australia, for example, greenhouse gas emissions, waste accounts, water and land accounts. While there are inherent complexities in using an accounting approach to track environmental value, methods continue to be developed by the Australian Government and being implemented.

Canada

Canada has, since 1990s, produced annual environment accounts and has used them in many ways, including developing environment - economy indicators such as urban-rural land use change and annual stock estimates for timber, energy and mineral resources. Natural resource asset accounts in Canada measure quantities of natural resource assets, i.e. oil, natural gas, minerals, and timber and the annual changes in these assets due to natural processes and human activity. These accounts, which are recorded using both physical and monetary units, form the basis of the estimates of Canada's natural resource wealth that are integrated into the Canadian national balance sheet accounts.

China

China has made efforts to calculate an environmentally adjusted macroeconomic aggregate, or 'Green GDP' by subtracting the cost of environmental damage from its

GDP. China also calculated a GDP that was adjusted for estimated pollution abatement costs. One of the authors of SEEA 2003 regards the Chinese effort as a major contribution to the international community because it integrates Marxist economics, Chinese philosophy and market economic principles to establish a value theory and pricing method for natural resources.

Columbia

Columbia began its environmental economic accounting efforts in 1992 and since then, the country has developed physical and monetary asset accounts for oil, gas, and coal. In Columbia, the environmental accounts exist for government, manufacturing, recycling, agriculture, transportation and mining sectors.

France

France, starting in 1980s, has developed some natural resource asset accounts, physical flow accounts and environmental protection and resource management expenditure accounts. In 1998, France was one of the pilot countries implementing the Integrated Environmental and Accounting for Forests -a set of 20 main tables created by the Eurostat Task Force on Forest Accounting that covered monetary and physical balance sheets for land and standing timber, economic accounts for forestry, monetary and physical supply - use tables, material balances and tables describing non-market environmental functions of forests - and the country now regularly publishes forest asset accounts as well as subsoil asset accounts. In the future, France would like to use water valuation to help resource managers make allocation decisions based on both the market and non-market uses for water.

Initially France embarked on an ambitious agenda to produce accounts for every asset that was received from previous generations and should be passed on to future generations - including both natural and cultural resources. In the 1990s, it became clear that this plan was too ambitious, and the government decided to develop a smaller number of accounts.

Germany

Germany is a leader in the development of material and energy flow accounts, which are the most developed of all its accounts. Germany compiled economy-wide materials to provide an indicator of the economy's direct material input - or all materials, i.e. domestic extraction plus imports which are of economic value and are used in production and consumption activities. Also, besides production of year-wise data on extraction, use, exports and recycling of renewable and non-renewable resources, Germany has also mapped the natural resources consumption for public as well as private sectors.

Mexico

The UN, the World Bank and the Mexican Government collaborated in a pilot study to implement aspects of the draft SESA in 1990 and 1991 and test their feasibility. The pilot study also examined resource use and environmental protection expenditures made by various sectors, which facilitate policy analysis more readily than the adjusted aggregates. Since the pilot study, Mexico has published asset accounts for the years 1985 - 2004, called the System of Economic and Ecological Accounts, Mexico and the accounts cover minerals, energy, soil, water and land.

Mexico plans to expand its accounts for forest and water (using SESA) as well as its material flow accounts.

Norway

The work on the natural resource accounting system in Norway was initiated in 1978 with selection of resources which are economically and politically important. Different types of accounts developed included material accounts, material resource accounts, environmental accounts. Since the 1980s, Norway publishes an annual report containing updates on an aggregated level of most operative natural resource accounts together with results from analyses of special issues.

The Netherlands

The Netherlands has developed a National Accounting Matrix including Environmental Accounts which is a matrix that adds environmental physical flow accounts to the flow accounts of the SNA. Since that time, statistics Netherlands has developed consistent time series for oil, natural gas, and six types of environmental degradation (such as the greenhouse effect and acidification) based on emission flows. In addition, the EU officially adopted this framework and is helping finance other EU countries that want to develop their own systems.

6.2 Other studies

As NRA is an evolving and dynamic subject, many studies/research have been carried out under the aegis of different organisations, both Government and non-Government, Universities etc in addition to the efforts of the Governments in different countries as enumerated above. Some of the studies have been referred while framing this document as mentioned in bibliography. Though these studies have come up with unique methodologies for environmental accounting, yet, all these documents unequivocally highlighted the importance of calculating the natural resources of a country and then to amalgamate them into the national accounts with the goal of ensuring sustainable development and thereby stabilising sustainability of income in future.



CHAPTER - VII

NRA IN INDIA - PROGRESS SO FAR

7.1 The idea or rather philosophy of the deep interconnection between man and the surrounding nature has been a part of the Indian culture since millennia. The worship of rivers, trees, the sun, moon, some of the animals are reflective of the innate sensibility towards the symbiotic relationship between man's wellbeing and prosperity and the elements of the natural environment. Over a period of time, however, this sensibility was lost and concern for the natural environment was relegated to the backburner. But with the passage of time and undeterred exploitation of natural resources, the world including India has understood the criticality of the need for sustainability of natural resources. The Indian government has made a firm commitment to environmental protection as part of its development agenda, with a focus on the interconnections between poverty and environmental degradation, that may be informed by ecosystem accounts.

Importance of environment and the need for healthy environment has gained momentum in India since 1970 when laws for the protection of the environment were brought in and enacted. The then Prime Minister of India strongly presented her case for a healthy environment at the UN conference on the human environment in Stockholm in 1972.

7.2 NRA in India - Role of CSO, MoSPI

In respect of official statistics on environment in India, CSO under the MoSPI is the nodal agency and their activities are broadly classified in three categories, namely, environmental statistics, environment accounts and International co-ordination. MoSPI, in India is mandated with preparation of National Accounts as well as publication of annual estimates.

India has been compiling environmental statistics since 1997 when the Central Statistics Office (CSO) released the first issue of the Compendium of Environment Statistics, based on the United Nations Framework for Development of Environment Statistics (FDES) 1984. Since its inception in 1997, 16 issues of the publication have been released, presenting data relating to the environment of the country.

The first initiative on NRA in India was taken in 1990s when a technical working group on NRA was constituted. As per the recommendations of the group, a pilot project on NRA was initiated in Goa in 1999-2000.

Major works in the shape of eight studies commissioned by the CSO in this field are tabulated in table 3 below:

Table - 3 Showing major reports of CSO on environmental accounting

| Sl. No | Name of the Report | Carried out by |
|--------|---|---|
| 1. | NRA on Air and Water Pollution in Andhra Pradesh and Himachal Pradesh | Institute of Economic Growth, Delhi |
| 2. | NRA of Land and Forest for Madhya Pradesh and Himachal Pradesh | Indian Institute of Forest Management, Bhopal |
| 3. | Environmental Accounting of Land and Forest of Meghalaya | North East Hill University, Shillong |
| 4. | NRA of Solid Waste, Air Pollution, Water Pollution, Forests in Goa | Integrated Research and Action for Development, Delhi |
| 5. | Environmental Accounting of Land and Water in Tamil Nadu | Madras School of Economics, Chennai |
| 6. | NRA for Air and Water Sectors in West Bengal | Jadavpur University, Kolkata |
| 7. | Accounting for unsustainable mineral extraction in Madhya Pradesh and West Bengal | The Energy and Resources Institute, Delhi |
| 8. | NRA of Land and Forestry (excluding mining) in Karnataka | Centre for Multi-Disciplinary Development Research, Karnataka |

However, all the above studies were carried out prior to SEEA being adopted internationally and thus, the formats of asset accounts in this paper has been developed in alignment with those proposed in the SEEA (CF) which is the latest version of resource accounting prescribed by the UN and followed worldwide.

7.3 Report on Green National Accounts in India - A Framework

Another major step towards implementation of NRA in India was constitution of an expert group on 4 August 2011 by the MoSPI under the directions of then Prime Minister of India. The demand for *green national accounts* has arisen because of a growing recognition that contemporary national accounts are an unsatisfactory

basis for economic evaluation. The qualifier "green" signals for special concern for the absence of information on society's use of the natural environment.

Professor Sir Partha Dasgupta, Frank Ramsey Professor Emeritus of Economics, University of Cambridge, and Professorial Research Fellow, Sustainable Consumption Institute was the Chairman of the Group. The Group was formed with the mandate to develop a framework for 'Green National Accounts in India' and preparing a roadmap for its implementation. Other eminent members of the expert group *inter-alia* included Secretary & Chief Statistician of India, former Chief Economic Advisors, Chairman of India Development Foundation, Chairman of National Statistical Commission, Program Director of South Asian Network for Development and Environmental Economics etc. The Group consulted with Indian Center of Agricultural Research, Forest Survey of India, Central Pollution Control Board, Indian Bureau of Mines, Ministry of Earth Sciences, Geology Survey of India, Botanical and Zoological Survey of India during finalisation of the Report.

The group submitted its Report in March 2013 on 'Green National Accounts in India - framework'. The Report *inter-alia* suggested ways in which the SEEA can more readily serve the purposes of economic evaluation. And while focusing little on the income side, the report focuses on the parallel systems of production and expenditure accounts. The Report also discusses about the present arrangement in preparing India's SNA and transitional requirements for upgrading to contemporary national accounts. As against the system of economic evaluation on the basis of Gross Domestic Product (GDP), the report proposes to evaluate the comprehensive notion of wealth or the social value of an economy's stock of capital assets, comprising (i) reproducible capital (commonly known as manufactured capital : roads, ports, cables, buildings, machinery, equipment, and so forth), (ii) human capital (population size and composition, education, health), and (iii) natural capital (ecosystems, land, sub-soil resources, and so on). This way the Report shows in particular the changes in the circumstances of an economy should be judged on the basis of their effect on the economy's wealth per capita, adjusted for the distribution of wealth. The Report hinges on measuring growth in wealth per capita as the term economic growth should not mean, the Report suggests, growth in per capita GDP, and by inclusive economic growth, it should mean inclusive growth in wealth.

The Report also suggested working out the Net Domestic Product as GDP minus the depreciation of capital assets which should include wear and tear of buildings and equipments, loss of human capital, and physical depletion of natural capital. Also, as the report is on greening the national accounts, much attention is given to discuss ways to measure the value of environmental resources by offering a unified view of conservation and pollution. And pollutants are best described as reverse side of natural capital like acid rains damage forests, industrial seepage and discharge reduce water quality in streams and underground reservoirs, killing fisheries and damaging human health, sulfur emissions corrode buildings and structures and harm human health, and so on. The Report interprets the damages

to each of the assets like forests, fisheries, human health and buildings as a depreciation of that asset. The Report also put forth the idea of shadow prices as the sum of its market price and the externalities that are associated with its use.

In view of the above discussions, the report recommended six short, medium and long term goals for greening the National Accounts of the country as mentioned below :

1. Initial focus on preparation of physical supply use tables in respect of land, forest and timber and minerals which is possible in a short time period.
2. A medium-term plan for preparation of (a) monetary supply use tables for land, forest and timber and minerals, and (b) physical supply use tables for soil, water, carbon and energy.
3. A medium term plan for estimating NDP by adjusting the depletion of natural capital that have been identified by the steps at 1 and 2 above.
4. Initiate exploratory research on valuation and development of a more complete set of national accounts.
5. A long-term plan for (a) environmental accounts in respect of aquatic resources, air and biodiversity and (b) institutionalising mechanism for periodic collection of data/periodic studies and surveys.
6. The Planning Commission (now NITI Aayog) could fruitfully put in place a mechanism for estimating shadow prices and their natural ranges.

The report was discussed in an international workshop in Delhi in April 2013. The outcome of the workshop was discussed in the National Statistical Commission for drawing Action Plan for Environmental Accounting in India.

Present status of NRA in India - Release of EnviStats by MoSPI

7.4 EnviStats India - 2018 (Supplement on Environment Accounts)

In line with the implementation plan recommended by the Expert Group led by Professor Sir Partha Dasgupta, CSO released the publication titled 'EnviStats India-2018 - Supplement on Environment Accounts' in March 2018. The supplement provides the time-series data, in physical terms, on the stock position of four natural resources in India, namely land, forest, mineral and water across the States in India. This development is in line with the recommendations of the expert group under Professor Sir Partha Dasgupta for developing a framework for 'Green National Accounts in India' and preparing a roadmap for its implementation. It is also mandated in the document that CSO will continue to add further details subsequently keeping in view the formats prescribed in the SEEA-CF.

In order to make gradual progression towards the compilation of accounts, the EnviStats initiates the presentation of aggregate environment accounts for India with the asset accounts in physical terms of above mentioned four natural resources which are broadly mentioned below:

Minerals

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. The compilation do not cover minor minerals like stone, boulders, sand etc which are economically important to the States.

Water

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.

Land

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

The chapter contains the asset account of forests and other wooded land compiled using the biennial publication of the Forest Survey of India, namely the "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.

7.5 EnviStats India - 2019 (Volumes I and II)

EnviStats India - 2019 Volume I has six Chapters, each of which focuses on one of the six fundamental components of Framework for the Development of Environment Statistics (FDES) 2013 as follows:

FDES Component 1 : Environmental conditions and quality

FDES Component 2 : Environment resources and their uses

FDES Component 3 : Residuals

FDES Component 4 : Extreme events and disasters

FDES Component 5 : Human Settlements and Environment health

FDES Component 6 : Environment protection, management and regulation.

In this edition of EnviStats 2019 (Vol I), environmental statistics, updated information of more disaggregated levels have been provided for the indicators. The compilation also provides correspondence between the environmentally related SDGs, targets and global indicators and the Basic Set of Environment Statistics (BSES) of FDES 2013.

EnviStats - 2019 Volume II envisages to add condition layers to the physical accounts based on the quality characteristics namely, soil nutrient index and water quality accounts in respect of surface, ground and sea water. In addition, to help understand the contribution of ecosystem services to the economy, values of two ecosystem services have been compiled for all the States of the country - cropland ecosystem services and nature based tourism.

7.6 Natural Capital Accounting and Valuation of Ecosystem Services Project

India is taking part in an innovative multi-year project to advance the theory and practice of ecosystem accounting. It joins four other countries - Brazil, China, Mexico, and South Africa - as part of the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project, funded by European Union, and implemented by the United Nations Statistics Division, in collaboration with UN Environment TEEB office and the secretariat of the Convention on Biological Diversity (CBD).

The role of MoSPI is to evolve a model by coordinating with all the stakeholders through a consultative process which can help in “NCAVES” by building upon the various datasets generated through surveys, studies, remote sensing as also through the administrative mechanisms.

The project’s main objective in the partner countries is to mainstream natural capital accounting and valuation of ecosystem services in data-driven decision and policymaking and is expected to influence policy-makers at the national, regional and local level. Project activities in India include the development of pilot ecosystem accounts. This will include experiments at different scales with different types of accounts:

- At the national level, several ecosystem services will be modelled in physical and monetary terms, including nature-based recreation and crops provisioning service. Also, the feasibility of compiling a biodiversity accounts will be examined.

- At the national level soil accounts (an important element of ecosystem condition) will be developed applying the S-World model.
- In the State of Karnataka, a whole suite of ecosystem accounts will be developed in physical and monetary terms. These accounts will also be applied in scenario analysis.

The State of Karnataka has been identified in a landscape assessment due to:

1. Good data availability and presence of existing studies;
2. Strong technical capacity within local research institutes on spatially explicit mapping and the valuation of a range of ecosystem services at the local scale; and
3. Policy interest in using an accounting approach for informing a range of policies.

The initial policy areas which the ecosystem accounts could inform included watershed management programmes and agro-forestry schemes. The key ecosystem services at Karnataka-State level to initially focus on in the piloting of ecosystem accounts identified include: food provisioning; materials / timber provisioning; fresh water; carbon sequestration; local climate and air quality; pollination; soil fertility; and tourism.

The experiences learned through the piloting will provide important inputs into the development of guidelines and standardisation of methods through the revision process of the SEEA - EEA. In parallel to the piloting, India will also contribute to other work streams of the project such as the testing of indicators that are derived through the accounts, and the work stream on alignment with sustainability reporting in the private sector. A national communication and outreach strategy to raise awareness and value addition of NCAVES in India will also be implemented. More details about further developments/progress of the study are awaited.

7.7 Summing up

The core idea of NRA is based on continuity of reporting at pre-defined frequencies, otherwise, the data will fail to serve the objective of monitoring the natural resources with an eye towards sustainable future. Further, flexibility in designing the accounts based on the specific environmental issues faced by a Government has been envisaged in SEEA (CF). Besides, India is yet to commence any form of annual environmental accounting of its resources. Thus, any progress towards preparation of NRA would hinge upon the idea of continuous generation of reports, at prescribed intervals preferably annually at least in respect of non-renewable resources to start with which are of prime importance at the moment. The way forward as in Chapter X has attempted to push this idea forward as to how the physical stock taking of the natural resources gradually from non-renewable

resources to renewable resources, at periodic intervals, including their tentative valuation based on royalty/net present value and average market rates, could be made possible. In keeping with the prescription of SEEA (CF) which allows flexibility in designing the environmental accounts as per the need of the respective country, implementation has been planned in a phased manner in respect of non-renewable resources to start with and thereafter rolled out to cover the renewable resources.



CHAPTER - VIII

NRA - INITIATIVE BY INTOSAI AND SAI, INDIA

8.1 The INTOSAI, founded in 1953, is an autonomous, independent and non-political organisation with special consultative status with the ECOSOC of the UN. It operates as an umbrella organisation for the external government audit community. For more than 50 years it has provided an institutionalised framework for SAIs to promote development and transfer of knowledge, improve government auditing worldwide and enhance professional capacities, standing and influence of member SAIs in their respective countries. In keeping with INTOSAI's motto, '*Experientia mutua omnibus prodest*', the exchange of experience among INTOSAI members and the findings and insights which result, are a guarantee that government auditing continuously progresses with new developments. At present, INTOSAI has 194 Full Members including SAI India, 5 Associate Members and 1 Affiliate Member.

8.2 WGEA, is a group constituted by the INTOSAI - aims to encourage the use of audit mandates and audit methods in the field of environmental protection and sustainable development by both members of the Working Group and non-member SAIs. The WGEA and its members share a commitment to use the power of public sector audit to leave a positive legacy for future generations, by improving the quality of the environment, the management of natural resources, and the health and prosperity of peoples around the world. In order to carry out its mission, the WGEA performs the following:

Assists SAIs in acquiring a better understanding of the specific issues involved in environmental auditing;

Facilitates exchange of information and experience among SAIs; and

Publishes guidelines and other informative material for their use.

8.3 INTOSAI (WGEA) initiative - 1998

The Netherlands Court of Audit, then Chairman of the WGEA, presented its first working group document on NRA at its fourth meeting in Tallinn (Estonia) in 1997. The WGEA discussed and accepted the document. The paper consisted of two parts - Part I - presented possibilities for SAIs to play a role in NRA;

Part II - contained a preliminary study on NRA, dealing with subjects like definition of NRA, problems in the practice of NRA, the state of the art of international organisations dealing with NRA as well as the activities which are world-wide performed at the national level.

The paper put forth an inventory of options available to SAIs which were as follows:

- Audit institutions can discuss the possibilities of NRA and can make their knowledge on this subject available to their Governments;
- Audit institutions can make contact with other related professional organisations to exchange information on NRA;
- Where the Government has drawn up a plan of approach for NRA, audit institutions can monitor progress;
- In countries where NRA accounts are already compiled, audit institutions can conduct audits of their reliability;
- In countries where NRA already exist, audit institutions could find out whether these are actually used in the decision-making process;
- At the micro-economic level, audit institutions could identify those government agencies and firms which compile environmental accounts or which have a policy for encouraging such accounts to be compiled and used;
- Audit institutions could conduct NRA themselves.

As of May 1998, the WGEA, INTOSAI reported that the Columbian SAI has carried out a study into the state of natural resources in the country and attempted in doing so to place a figure on the monetary value of a particular river basin. Secondly, the Canadian SAI was involved in a case of study of sustainable forestry management which the UN has commissioned. The case study is essentially a model which sets out a methodology as to how commercial principles can be applied to sustainable concepts and how commercial practices should be modified in order to determine the costs and benefits, sacrifices and implications of a move towards sustainability.

The paper reported that till 1998, 14 countries⁶ were having Government sponsored action on NRA while nine countries⁷ had studies performed under UN, World Bank while in Zimbabwe an independent researcher was carrying out the study.

⁶ Australia, Canada, Denmark, Germany, Estonia, Finland, France, India, Japan, The Netherlands, Norway, Thailand, The USA and Sweden.

⁷ Costa Rica (WRI), Ghana (UN), Indonesia (WRI/UN), Mexico (World Bank), Papua New Guinea (World Bank), South Korea (UN), The Philippines (WRI), Tanzania (World Bank) and Hungary (World Bank).

8.4 INTOSAI (WGEA) initiative - 2010

The report of 1998 was updated by the WGEA through its report of 2010 titled 'Environmental Accounting - current status and options for SAIs'. Based on the deliberations, the following inventory of options had been reported.

8.4.1 In countries that are not currently developing NRA, SAIs could take the following actions:

- Determine the value of environmental accounts for their Government by identifying the costs and benefits of developing environmental accounting within the country, and /or
- Assist the Governments in the development of environmental accounts, by
 - ✓ Identifying challenges to applying environmental accounting in their country;
 - ✓ Recommending strategies to overcoming challenges;
 - ✓ Identifying goals for developing environmental accounts;
 - ✓ Identifying agencies and organisations that compile information useful for NRA, and/or
 - ✓ Identifying best practices in NRA.

8.4.2 In respect of countries that have developed some environmental accounts, SAIs could take the following actions:

- Audit the reliability of environmental accounts or methodologies used to develop them;
- Use environmental accounts in program audit to assess the effectiveness of environmental policies and programs and/or whether or not government programs are complying with national laws;
- Use environmental accounts to determine the Government's compliance with reporting requirements from international conventions, and/or
- Assess the extent to which program managers are using environmental accounts in decision making and identify opportunities for managers to enhance their use of the accounts.

8.5 WGEA work-plan for 2020-22 on common sustainable future

The WGEA aims at continuing their endeavour towards environmental auditing and sustainable development. In order to ensure this, the WGEA added to its future plan for the years 2020-22, the vision of environmental auditing for a common sustainable future by contributing to the follow up and review of SDGs from public finance perspective.

8.6 Initiatives by SAI, India on Environmental Audit and Sustainable Development in India

The SAI, India or the CAG has been aware of the need and the relevance of Environmental Audit in the context of the increasing concerns about global warming and climate change, and has already brought out several incisive and informative reports on the economy, efficiency and effectiveness of the environmental programmes and activities initiated by the Central and State Governments. The Environmental Audits carried out by the CAG in the past embrace a variety of issues such as biological diversity including forests and forest management, pollution control and regulations relating to air, water etc., waste management and coastal zone management.

In order to develop high quality products in training and research to enrich environment audit through an inter-disciplinary approach enabled by valuable partnerships, an International Centre for Environment Audit and Sustainable Development (iCED) was set up by the CAG of India in 2011. The vision of this center is to be a global centre of excellence for improving accountability and governance in the area of environment and sustainable development. The iCED has issued training Manual with a view to reinforcing the percept and the practice of Environmental Audit in India in the context of the expanding horizon of this highly technical and specialized area and the large number of environment-related issues to be covered in audit. The ICED and the CAG has also issued Environment and Climate Change - Auditing Guidelines in 2010. Notwithstanding the above, SAI, India has been carrying out environmental audit for about two decades, now.

Some of the major environmental audit carried out by the SAI, India are mentioned in the table 4 below while a comprehensive list is available in the websites of WGEA and the iCED.

Table 4 showing major environmental audits carried out by SAI, India

| Performance Audit Reports for the Union Government (laid in the Parliament of India) | Performance Audit Reports for States (laid in the Legislative Assemblies of Provincial Government) |
|---|--|
| • Ganga Rejuvenation | • Kaziranga National Park |
| • Environment management in Indian Railways | • Natural Disaster in Uttarakhand |
| • Total Sanitation Campaign - <i>Nirmal Bharat Abhiyan</i> | • Forests, ecology, environment & wildlife in Nagaland |
| • Environment clearance and post clearance monitoring | • Solid Waste Management |
| • Renewable energy sector in India | • Wildlife and forest management in Meghalaya |
| • Compensatory afforestation in India (CAMPA) | • National Parks and Wildlife sanctuaries in Karnataka |
| <i>A comprehensive list of PAs on environmental audit in India can be seen at https://www.environmental-auditing.org/audit/</i> | |

8.7 Role of SAI, India on NRA

SAI, India's role in environmental auditing for over two decades including training to international participants at its international centre at Jaipur since 2011 has been brought in the preceding paragraph. This evidences that CAG has been actively involved in pursuing the environmental concerns of the country and assisting it by carrying out performance audits and suggesting recommendations to overcome the difficulties and upgrade the performance of the entities with reference to standards prescribed by international and national authorities.

In view of the WGEA report of 2010, the CAG can assist the Government of India in developing environmental accounts (NRA) by identifying the goals with reference to best practices around the world along with the imminent challenges, recommending strategies to overcome them and identifying agencies and organisations for compilation of information for implementation of NRA. Thus, GASAB being an inter-institutional body of the Government of India constituted by the CAG can play a pioneering role in implementation of NRA in the country while recommending the possible ways out for mitigating the challenges foreseen in the future.

8.8 iCED to consolidate Asset Accounts of four major natural resources

The International Center for Environment Audit and Sustainable Development, Jaipur being the nodal agency in CAG for training needs in respect of the environmental auditing and sustainable development, may act as the nodal agency, in co-ordination with GASAB Secretariat, for all activities relating to NRA in the country. This may *inter-alia* include research activities on NRA, conducting workshops on various topics related to NRA in line with processes enshrined in this Paper, collect information from the States and prepare central database of four major natural resources to aid not only in environmental auditing across the country but to help the overall cause of NRA in the country.

In order to operationalise the above, iCED may prepare Standard Operating Procedures (SOP) in consultation with GASAB Secretariat, to include detailed operational guidelines with reference to the way forward laid down in this Concept Paper. Ideally, iCED may collect data from the States on biennial basis and create a central database for use in training and research activities conducted at iCED. Also, to ensure coherence of State Asset Accounts with the national database, iCED may reconcile these with national sources as and when available. To facilitate this, iCED may commence with creation of an NRA Cell and opt to take the help of the State AsG, both Audit and A&E Offices in gathering data from the State Governments.



CHAPTER - IX NATURAL RESOURCES- LISTING, GOVERNANCE AND IMPOSITION OF REVENUES IN INDIA

9.1 What are natural resources

As per definition given by SEEA, UN : Environmental assets are the naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.

WTO defines natural resources as stocks of materials that exist in the natural environment that are both scarce and economically useful in production or consumption, either in their raw state or after a minimal amount of processing.

9.2 Natural resources listed by SEEA - CF

The classification of environmental assets as listed in the SEEA (CF) is given in the following table:

Table - 5 showing classification of environmental assets

| | |
|-----|--|
| 1. | Mineral and energy resources |
| 1.1 | Oil resources |
| 1.2 | Natural gas resources |
| 1.3 | Coal and peat resources |
| 1.4 | Non-metallic mineral resources (excluding coal and peat resources) |
| 1.5 | Metallic mineral resources |
| 2. | Land |
| 3. | Soil resources |
| 4. | Timber resources |
| 4.1 | Cultivated timber resources |
| 4.2 | Natural timber resources |
| 5. | Aquatic resources |
| 5.1 | Cultivated aquatic resources |

- 5.2 Natural aquatic resources
- 6. Other biological resources (excluding timber resources and aquatic resources)
- 7. Water resources
 - 7.1 Surface water resources
 - 7.2 Ground water resources
 - 7.3 Soil water resources

As may be seen from the table above, SEEA (CF) lists and classifies the environmental assets into seven distinct categories. Of these, the Report of Professor Sir Partha Dasgupta has suggested to take up four classes of assets, namely mineral and energy resources, land resources, timber resources and water resources as the immediate requirements for implementing NRA in India. Accordingly, the MoSPI has also prepared the EnviStats based on these four broad items. In light of the above, this paper has also been framed considering coverage on those four major resources. The remaining three elements of environment assets may be covered in future, after management of NRA on the already identified four assets goes full swing.

9.3 Listing of natural resources in India

As against the listing and classification of natural resources by the SEEA (CF), the EnviStats 2018 released by the MoSPI has listed the natural resources available throughout the country - State-wise. The listing of natural resources includes details of all major mineral and energy resources, available water sources, classification of land and forest resources available across the country. Besides listing the resources, the EnviStats had also enumerated the stock of resources available at different given period of time as collected from various agencies responsible for governing these resources. The Indian Bureau of Mines (IBM) have been periodically preparing the stock report of metallic, non-metallic and fuel minerals State - wise. These stock reports are prepared in a time gap of five years and uploaded in their website for wide dissemination of information. Last such report was prepared in 2015. The stock of mineral and energy resources enumerated in the EnviStats 2018 has been sourced from these data sets consolidated by the IBM. Thus, the initial step of NRA *i.e.* listing of natural resources, mainly the mineral and energy resources, State-wise has long been achieved in India by the IBM and MoSPI and has undoubtedly added a major step towards implementing NRA in the country.

9.4 Constitutional mandate governing resources

In the federal structure of India, the State Governments are the owner of minerals located within the boundaries of the concerned States. In accordance with article 297 of the Constitution, the Central Government is the owner of the minerals

underlying the ocean within the territorial waters or the exclusive economic zone in India. Entries in the Union list, State list and Concurrent list of the Seventh schedule under article 246 of the Constitution of India *inter-alia* bestows exclusive powers to the Central Government (list I), the State Governments (list II) and joint powers to Central and State Governments (list III) over management of the natural resources as follows:

Table - 6 showing Union, State and Concurrent lists involving natural resources

| List I (Union) | List II (State) | List III (Concurrent) |
|--|--|--|
| <ul style="list-style-type: none"> • Regulation and development of oilfields and mineral oil resources, petroleum and petroleum products • Regulation of mines and mineral development to the extent to which such regulation and development • Regulation and development of inter-state rivers and river valleys • Fishing and fisheries beyond territorial waters | <ul style="list-style-type: none"> • Water i.e. water supplies, irrigation and canals, drainage and embankments, water storage • Land i.e. rights in or over land, land tenures, collection of rents, transfer and alienation of agricultural land • Fisheries subject to List I • Regulation of mines and mineral development subject to provisions of List I • Assessment and collection of land revenue, taxes on lands and buildings • Taxes on mineral rights subject to such limitations Parliament may impose | <ul style="list-style-type: none"> • Transfer of property other than agricultural land, registration of deeds and documents • Forests • Protection of wild animals • Stamp duties other than due duties or fees collected by judicial stamps not including rates of stamp duty |

9.5 Major Legislations, strategies governing natural resources

Control and monitoring of natural resources in India are governed by a number of legislations, strategies as enumerated below. Being the principal owner of the resources, the Government India had enacted a number of Acts, Rules and regulations to administer the resources and also undertook strategies for management of the resources on sustainable basis. These statutes provide the broad laws and Rules there under for administration and monitoring of resources at the Central as well as State level. As mentioned in the paragraph on Constitutional mandate governing resources, States have powers to make Rules under the Central legislations in respect of the resources under the State list as well as those listed under the Concurrent List.

9.5.1 Environmental legislations/strategies

MoEFCC is the nodal agency responsible for all matters relating to environmental protection and climate change and is responsible for the planning, promotion,

coordination, and implementation of national policies and programmes on environment and forests. The following major legislations are in place :

- The Forest (Conservation) Act, 1980
- The Water (Prevention and Control of Pollution) Act, 1974 and The Water (Prevention and Control of Pollution) Cess Act, 1977
- The Environment (Protection) Act, 1986
- The Air (Pollution and Control of Pollution) Act, 1981
- The Wildlife (Protection) Act, 1972
- The Biological diversity Act, 2002
- Central and State Pollution Control Boards
- National Conservation Strategy and Policy Statement on Environment and Development (1992);
- National Environment Policy (2006);
- National Action Plan for Climate Change (2009);
- Vision Statement on Environment and Human Health.

9.5.2 Legislations governing mining and energy resources

Ministry of Mines is responsible for survey and exploration of all minerals, other than natural gas, petroleum and atomic minerals, for mining and metallurgy of non-ferrous metals like aluminium, copper, zinc, lead, gold, nickel etc and for administration of the Mines and Minerals (Regulation and Development) Act in respect of all mines and minerals other than coal, natural gas and petroleum which are governed by other Ministries namely Ministry of Petroleum and Natural Gas and Ministry of Coal. Acts and Rules governing the resources under mineral and energy resources are mentioned below:

- Mines and Minerals (Development and Regulation) Act, 1957
- Off-shore Areas Mineral (Development and Regulation) Act, 2002
- Cess and Other Taxes on Mineral (Validation) Act, 1992
- The Coal Bearing Areas (Acquisition and Development) Act, 1957
- The Coal Mines (Conservation and Development) Act, 1974
- The Coal Mines Act, 2015
- Mineral Concession Rules, 1960
- Mineral Conservation and Development Rules, 1988
- Petroleum and Natural Gas Rules, 1959

9.5.3 Legislations governing land resources

Department of Land Resources, Government of India is responsible to ensure sustainable improvement in productivity and livelihood/income potential of land, in particular rain fed cultivated areas and culturable wasteland. It is also the

mandate of the Department to develop an appropriate integrated land information management system, which will *inter-alia* improve real-time information on land, optimise use of land resources and assist in policy and planning. The following legislations govern land resource management in the country.

- The Land Acquisition Act, 1894
- The Registration Act, 1908
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 and Rules made there under
- National Rehabilitation and Resettlement Policy, 2007
- Land Acquisition (Company) Rules, 1963

9.5.4 Legislations governing water resources

The Ministry of *Jal Shakti*, Department of Water Resources, River Development and Ganga Rejuvenation is mandated to oversee optimal sustainable development, maintenance of quality and efficient use of water resources to match with the growing demands on this precious natural resources of the country. Act, Rules and policies governing water resources are enumerated below.

- The National Water Policy
- The Comprehensive Mission Document for National Water Mission
- Hydro-meteorological data dissemination Policy
- The inter-state water disputes Act
- River Boards Act
- Central Ground Water Board notification.

9.6 Mandate for imposition of taxes on resources and preparation of Accounts

9.6.1 Articles 109-111 of the Constitution *inter-alia* provides for procedures relating to imposition of levies such as taxes, duties, fees etc by the Union Government while articles 196 - 200 *inter-alia* prescribes the procedure relating to levies imposed by the State Governments.

Article 149 and 150 of the Constitution provides the duties and powers of CAG in relation to the accounts of the Union and of the States and of any other authority or body as prescribed by or under any law made by the Parliament and that the accounts of the Union and the States shall be kept in such a form as the President may, on the advice of the CAG, prescribe. In exercise of the provisions of this Article, the CAG's (DPC) Act, 1971 has been enacted by the Parliament. The CGA compiles the Finance Accounts of the Union while the Accountants General in the States compile the State Finance Accounts. These are certified/countersigned by the CAG and placed in the Central and State Legislature respectively.

Own receipts of the Union and States are divided into tax receipts and non-tax receipts which are reported through the Finance Accounts. The major heads of receipts involving exploitation/impact on natural resources are depicted through the table below:

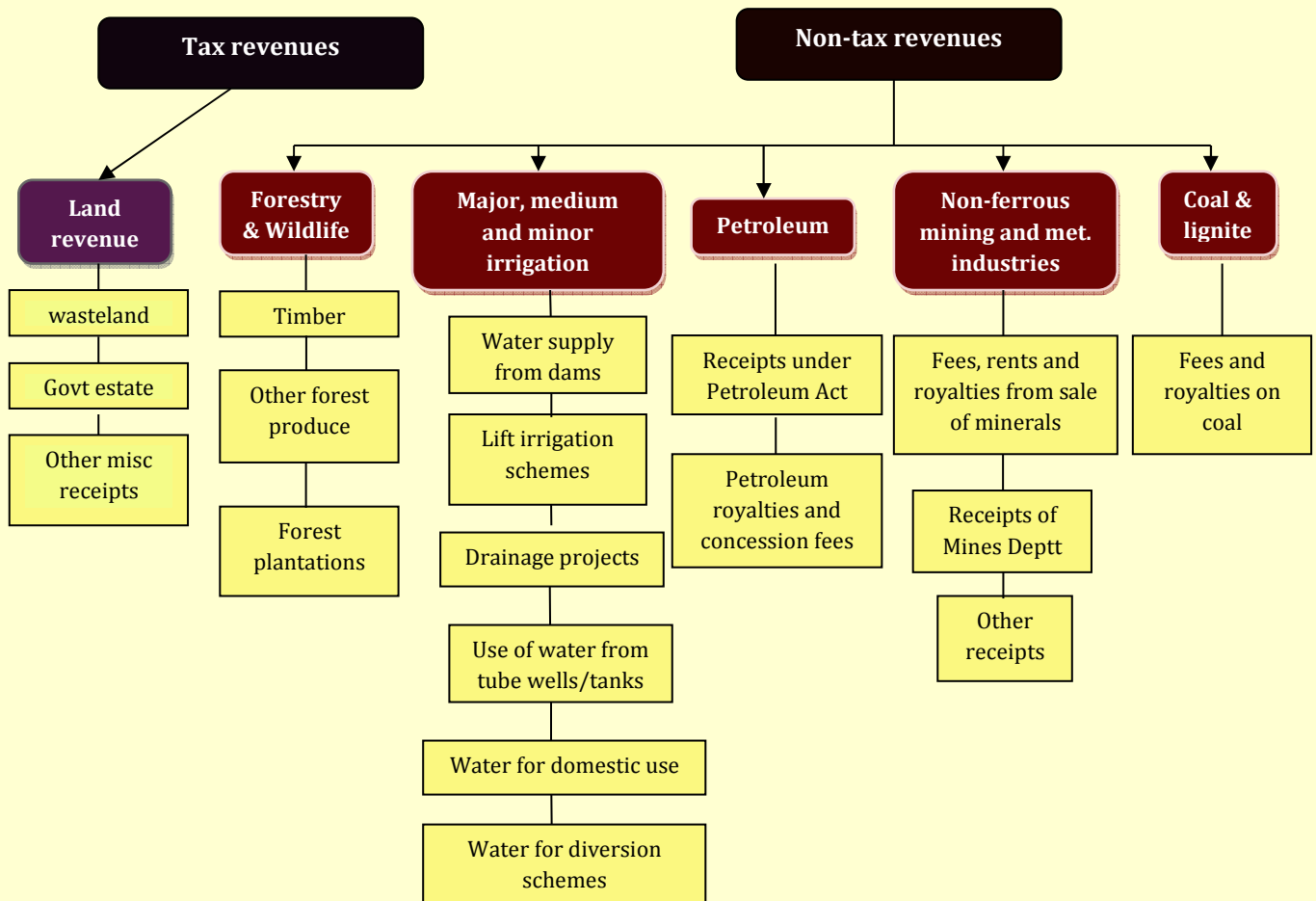
Table - 7 showing tax and non-tax receipts accrued from exploitation of natural resources

| Tax receipts | Non-tax receipts |
|--|---|
| <ul style="list-style-type: none"> • Land revenue | <ul style="list-style-type: none"> • Forestry and wildlife • Major, medium and minor irrigation • Petroleum • Non-ferrous mining and metallurgical industries • Coal and lignite |

9.6.2 Resources covered by the heads of Finance Accounts

Revenues from sale proceeds of different types of resources covered by each of the heads of tax and non-tax revenues of the Union and the States as depicted in table 7 are shown through the block diagram below.

Block Diagram - 2 Showing minor heads of revenue under major heads of revenue contributed by exploitation of natural resources



The block diagram above would indicate that while the Governments receive revenue from sale of various land uses like wasteland, Government estates etc which entails change in land use, the other receipts under the non-tax heads mainly consists of exploitation of resources from timber, other forest produce to water resources to crude oil/natural gas and mines and minerals including coal.

Besides the above, revenues are also collected by the Central Government under Compensatory Afforestation Management and Planning Authority (CAMPA) wherein compensation in the shape of net present value towards deforestation of the forest areas is collected from the agencies requiring land for industrial or other purposes. These funds are kept in a separate public account and not in the Consolidated Fund. These funds are again routed to the originating States for regeneration of natural forests. As on 29 August 2019, CAMPA funds aggregated ₹ 47,436 crore was distributed to 27 States/Union Territories by the Union Government.

9.6.3 Status of depiction of revenues in the Finance Accounts

Revenues of the Union Government are depicted in Statements 1 and 8 of the Union Finance Accounts. Statement 1 provides information on summary of receipts consisting of tax revenues; non-tax revenues; interest receipts, dividends and profits; grants-in-aid and contributions etc. Statement 8 provides information on the above major heads by minor heads of accounts.

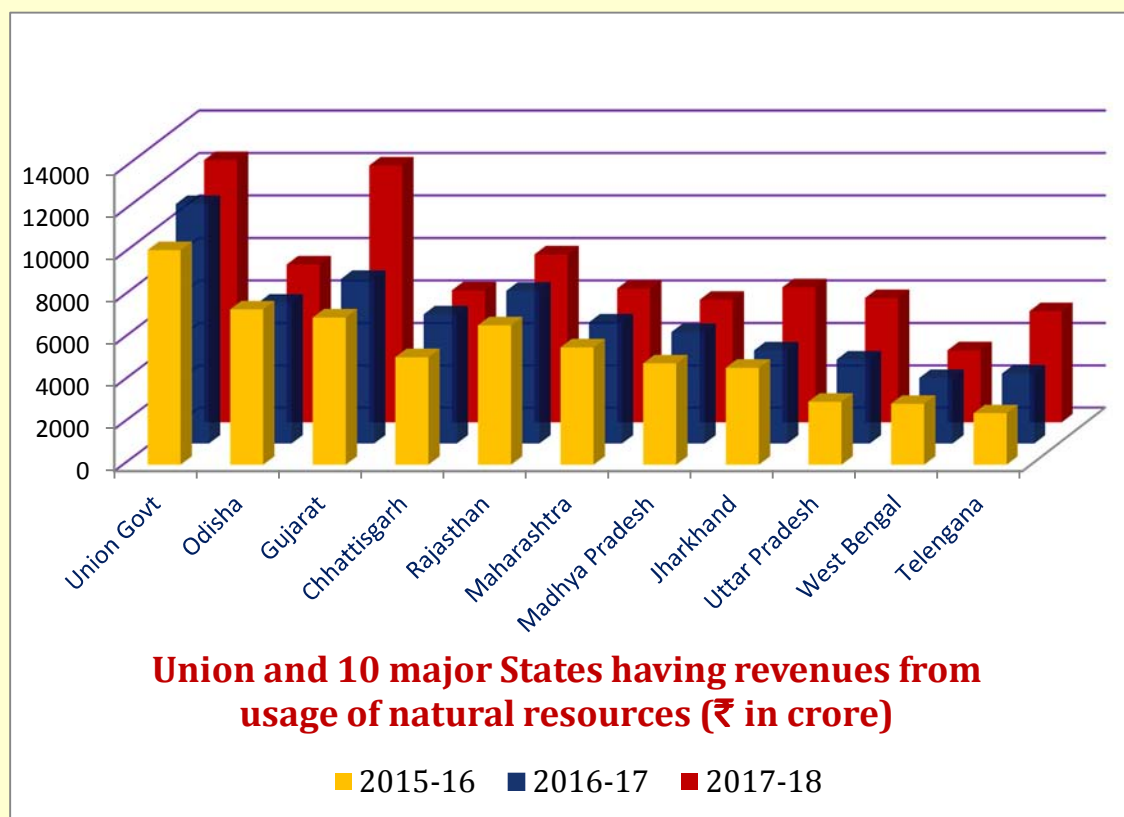
Revenues of the State Governments are depicted in Statements 2, 3 and 14 of the State Finance Accounts. Statement 2 of Finance Accounts of the States provide information on statement of overall receipts which includes tax revenues, non-tax revenues, interest receipts, share of Union taxes and duties and grants-in-aid. Statement 3 provides detailed statement of receipts containing own tax revenues, share of net proceeds of taxes, non-tax revenues, grants consisting of non-plan grants, plan scheme grants, grants from Finance Commission etc. – Statement 14 provides further information on receipts by minor heads of revenues under each of the major heads included in statement 3.

9.6.4 Revenues from sale and exploitation of resources

Laws regulating imposition of taxes on exploitation of resources and methodologies of reporting revenues of the States and Union from tax and non-tax revenues have been discussed in this Chapter. Major heads under tax and non-tax revenues including the details of resources covered under each of these heads had also been discussed. An analysis of the revenue earnings from exploitation of

natural resources and appearing in the Finance Accounts under seven heads⁸ of 10 major States⁹ and the Union during 2015-16 to 2017-18 are shown in the chart below.

Chart 1 showing revenues derived from exploitation of natural resources by Union and selective State Governments



Source : Finance Accounts of Union and the concerned States.

Thus, it is seen from the graph above that the revenue receipts from utilisation of natural resources registered an increasing trend over three years in almost all the States and the Union Government except Odisha where receipts in 2016-17 registered a decreasing trend over 2015-16.

9.7 Summing up

Thus, broad listing and classification of resources by SEEA (CF), major resources to be taken up for implementation of NRA in India as suggested by the Green National Accounts in India - A Framework seconded by listing of those four major natural resources in India by MoSPI through their EnviStats 2018 has been discussed in

⁸ (i) Coal and lignite, (ii) Forestry and Wildlife, (iii) Land revenue, (iv) Major, medium and minor irrigation facilities, (v) Non-ferrous mining and metallurgical industries, (vi) Petroleum and (vii) Water supply and sanitation

⁹ As per revenues under these seven heads

this Chapter. Issues like governance of resources and mandates for levying revenues on resources by the Union as well as State Governments have also been discussed. Graphical representation on revenues derived from exploitation of natural resources have also been included in the Chapter for effectively establishing the importance of natural resources to the Governments in the country which is more reason for effective monitoring of these resources for their sustainability in the future.



CHAPTER - X

NRA - WAY FORWARD

10.1 Way Forward - introductory

Thus far, NRA has been discussed as to its basics to its implementation world-wide vis-à-vis present status in India, the SNA and the SEEs prescribed by the UN, Role of CAG in implementation of NRA, listing and governance of resources in India and mandate for imposition of taxes which are all inter-connected and plays distinct and definite role in designing the way forward for NRA in India. Also, the laudable efforts of MoSPI in bringing out the EnviStats 2018 listing the major natural resources across the country and enumerating their stock is a major step forward towards preparation of the physical asset accounts and serves as a testimony that preparation of Asset Accounts is possible through collection of data from the source agencies maintaining records in respect of these resources. Further, the present scenario of reporting the revenues collected by the States and the Union from exploitation of natural resources through the Finance Accounts of the Union and the States has also been discussed. Nevertheless, the revenues from exploitation of natural resources accrue through a well defined mechanism in the Union and State Governments which notify the rates of royalty, cess, net present value etc to be collected on exploitation of resources by the Government as well as private players. These mechanisms for valuation of resources are also among those prescribed by the SEEA (CF). This undoubtedly provides India an advantage in dealing with the valuation of the resources, at least as one of the methodologies for valuation of resources. Besides, the prevalent average market prices of produces including the natural resources are available in the websites of the IBM and also with the Statistical Departments in the States which can be used to ascribe market value to the resources. Thus, for the Asset Accounts of resources, there would be two pronged valuation, one the revenues that are accrued to the Governments and second the market prices of the produces. These have been discussed in details under the respective chapters on preparation of Asset Accounts of four natural resources namely mineral and energy resources, water, land and forest resources and the chapter on Valuation of Resources.

10.2 Implementation stages prescribed by SEEA -CF

As regards the stages of implementation of NRA to depict the interrelationship between the economic system and the environment as discussed in Chapter IV, the SEEA (CF) envisages compilation of the following accounts :

- (a) *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;*
- (b) *Supply and use tables in physical and monetary terms showing flow of natural resource inputs, products and residuals;*
- (c) *A sequence of economic accounts that highlights depletion adjusted economic aggregates; and*
- (d) *Functional accounts which records transactions and other information about economic activities undertaken for environmental purposes.*

However, while prescribing the aforesaid milestones for implementation of NRA across the world, the SEEA (CF) has also envisaged constraints to be faced by the countries in implementing NRA. SEEA (CF), thus, prescribed for flexibility in designing the accounts based on the specific environmental issues faced by a Government. The Green National Accounts in India - A Framework report by Professor Sir Partha Dasgupta has also endorsed implementation of these four steps albeit through the six step plan recommended by them.

In the light of above two documents, an implementation strategy is chalked out laying down the way ahead into short, mid and long term goals as discussed in the succeeding paragraphs.

10.3 Implementation Strategy - the road ahead

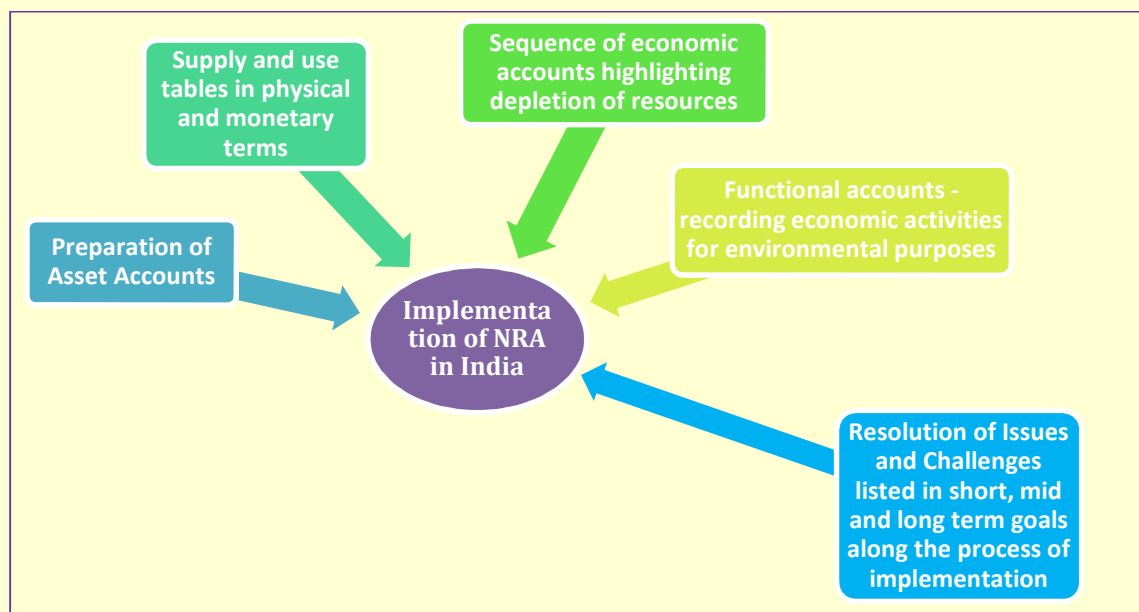
As against the four stages of NRA implementation envisioned by the SEEA (CF) and attainment of various stages by different countries as discussed in some of the preceding chapters of this paper, India is at its nascent stage as any form of *periodic* Asset Accounts is yet to be generated as on date, *i.e.* the first stage. Consequently, an implementation strategy detailing the way forward is the need of the hour.

This Chapter, therefore, suggests the way forward in a structured manner and apart from suggesting the strategies to attain the four stages of implementation as per SEEA (CF), also deals with couple of issues and challenges and proposes to include the private sector in the overall processes of NRA. However, bringing the private sector may need the involvement and support of a number of agencies like the Ministry of Corporate Affairs, Ministry of Revenue to name a few. The details are in the succeeding paragraphs.

10.3.1 Stages and steps involved in implementation of NRA in India

As discussed in the preceding paragraph, the stages of NRA as prescribed by the SEEA (CF) and other issues, challenges and inclusion of private sector are shown through the block diagram below.

Block diagram No. 3 showing stages involved in implementation of NRA in India and issues to be faced during the course of implementation



The detailed strategy - divided into short spells to effectively handle the above stages and challenges are discussed as follows.

10.3.1.1 Short term goals

| Highlights | Years covered | Challenges to address |
|--|--------------------|--|
| <ul style="list-style-type: none"> Preparation of Asset Accounts on mineral and energy resources in States Initiation and preparation of disclosure statement on revenues and expenditure related to NRA | 2019-20 to 2021-22 | <ul style="list-style-type: none"> Mandating the reporting requirements by private sector as to use of resources, water and release of effluents/ residuals Identifying the authority to manage and monitor online information from private sector |

The main objective of preparation of NRA hinges on sustainability of resources and helping the Governments with sound data for effective policy decisions. Towards this, the Asset Accounts proposed to be prepared would largely help in capturing extraction/exploitation of natural resources which are of economic importance to the State Governments on a year to year basis. This would help in measuring the usage against the total stock available leading to an estimation of sustainability of

resources for the future generations. Such information would also help the Government/policy makers to opt for alternative action plan, for example, resorting to clean source of energy, taxing the water usage for industrial/commercial purposes to discourage over exploitation and so forth. Also, the information garnered by preparation of such Asset Accounts would help the cause of SDGs as well as to contain effects of climate change.

The preparation of Asset Accounts¹⁰ for mineral and energy resources in the States could be implemented with immediate effect and may form part of the short term goals. This practice may commence from the financial year 2019-20 to be prepared in 2020-21 onwards for the States. While the information presently and readily available with the source departments could be used to start the accounts, additional inputs may be gradually inserted in subsequent years as and when they become available as envisaged in the SEEA (CF). **Details regarding preparation of Asset Accounts in respect of mineral and energy resources are discussed in Chapter XI.**

The first step - Asset Accounts on Mineral & Energy Resources in States

Preparing the asset accounts

The SEEA (CF) prescribes that the intent of asset accounts is to record the opening and closing stock of environmental assets and the different types of changes in the stock over an accounting period. One purpose of accounting for environmental assets is to assess whether current patterns of economic activity are depleting and degrading the available environmental assets. Information from asset accounts can be used to assist in the management of environmental assets and valuation of natural resources and land can be combined with valuation of produced and financial assets to provide broader estimates of national wealth.

In monetary terms, the same entries are made but an additional entry is included for the purpose of recording the revaluation of the stock of environmental assets to account for the changes in the value of assets over an accounting period that due to movements in the price of assets.

Table - 8 Showing Basic form of an asset table

| Opening stock of environmental asset |
|---|
| Growth in stock |
| Discoveries of new stock |
| Upward reappraisals |
| Reclassifications |
| Total addition of stock |

¹⁰ 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

Reduction of stock

| |
|--|
| Extractions |
| Normal loss of stock |
| Catastrophic losses |
| Downward reappraisals |
| Reclassification |
| Total reduction in stock |
| Revaluation of the stock* |
| Closing stock of environmental assets |

* Only applicable for asset accounts in monetary terms.

Simultaneously, the challenges in the short term goals would include bringing the private sector into the fold of NRA management, mandating the reporting requirements and setting up online platforms for inputs by the private sector entities.

Private Sector to be brought under the ambit of NRA

These are discussed in details in Chapter XVI.

Apart from the Asset Accounts, another target of short term plan would be to initiate and prepare the disclosure statement on revenues and expenditure related to NRA. The work on such disclosure statement may commence in 2020-21 and targeted to be completed and got approved by GASAB

Board by 2021-22. **This has been discussed in chapter XVII.**

Need for separate disclosure on NRA

10.3.1.2 Mid-term goals

| Highlights | Years covered | Challenges to address |
|--|--------------------|---|
| <ul style="list-style-type: none"> Preparation of National Asset Accounts on mineral and energy resources Preparation of Asset Accounts in respect of other three resources namely water, land and forest resources Preparation of supply and use tables in physical and monetary terms showing flow of natural resource inputs, products and residuals | 2022-23 to 2024-25 | <p>Periodicity of the Asset Accounts of Water, Land and Forest resources to be decided</p> <p>Mapping the periodicity of data management with the requirement of Asset Accounts</p> <p>Decision on the agency which would prepare the Asset Accounts in respect of the resources at national level (preferably MoSPI)</p> |

As regards the target proposed for the mid-term goals covering the period 2022-23 to 2024-25, the Asset Accounts for resources like water, land and forests may be initiated for preparation. **These are discussed in details in Chapters XII to XIV.** Before taking up the preparation of Asset Accounts, *the decision of periodicity of Asset Accounts as discussed in the challenges column above will have to be firmed up* so that the Asset Accounts could be taken up and prepared during the targeted timeframe.

Besides preparation of Asset Accounts in respect of three resources as discussed above, mid-term goals would also include ground work on the second stage of NRA as envisaged in SEEA (CF), *i.e.* Supply and use tables in physical and monetary terms showing flow of natural resource inputs, products and residuals. The disclosure statement on revenues and expenditure related to natural resources as envisioned under the short term goals, would substantially help in preparing the supply and use tables showing the flow of natural resource inputs, products and residuals.

Further, asset accounts in respect of mineral and energy resources in respect of the Union Government may commence from 2022-23 after the preparation of asset accounts for the States settles down in two/three years. For this, gross total of the mineral and energy resources as compiled by the States would have to be added by the resources available in the ocean basin (which are governed solely by the Union Government) and any other resources which generates revenues only for the Central Government to arrive at the total national reserve of mineral and energy resources which can then continue to be prepared biennially.

Similar to the short term goals, the mid-term goal period would involve some issues and challenges as stated in the table above. These are (i) deciding the periodicity of the Asset Accounts in respect of other three resources namely water, land and forest resources, (ii) mapping the data by the concerned agencies responsible for gathering and maintaining data in respect of the above resources with the requirements of the Asset Accounts of these three resources and (iii) identification of the entity which would prepare the Asset Accounts in respect of the resources at national level. **Issues and challenges are discussed in details in Chapter XV.**

10.3.1.3 Long term goals

| Highlights | Years covered | Challenges to address |
|---|-----------------|-----------------------|
| <ul style="list-style-type: none"> Preparation of the economic accounts highlighting depletion adjusted economic aggregates; and Preparation of functional accounts recording transactions and other information about economic activities undertaken for environmental purposes. | 2025-26 onwards | Nil |

Subsequent to rolling out of the short and mid-term goals during 2019-20 to 2024-25 which would establish the first two stages namely system of regular preparation of Asset Accounts and the supply and use tables as envisaged in the SEEA (CF) as well as the report on Green National Accounts in India of Professor Sir Partha

Dasgupta, the third and fourth stages of NRA, *i.e.* a sequence of economic accounts highlighting depletion-adjusted economic aggregates and functional accounts recording transactions and other information about economic activities undertaken for environmental purposes may need to be planned and rolled out.

10.4 Availability of information for the Asset Accounts

As preparation of Asset Accounts are being initiated for the first time in the States, the process is bound to face difficulties like availability of data/information required for feeding into the tables. Though best efforts have been made to identify all possible sources of data for the different sets of tables, yet there could be instances of non-availability of explicit data. Contextually, the SEEA (CF) while foreseeing these initial hiccups has provided for flexibility in preparation of accounts wherein it has been envisaged that the tables during the initial years may be prepared with as much data as possible which will evolve through years and data may be filled in during subsequent years as and when the same is available. However, efforts may be continued to be made to ensure generation of data required so that these could be used for the Asset Accounts in the future.

10.5 NRA Cell in States to facilitate preparation of Asset Accounts

The Asset Accounts may be prepared by the concerned States, to start with, and gradually rolled over to the national level. To facilitate this, each State may constitute an NRA Cell with representatives from the administrative departments in the State Governments, Statistical Department, Accountants General (Audit and A&E). After the Asset Accounts on the major natural resources are prepared by the States, these Accounts may be considered for inclusion in the Finance Accounts of the States after necessary approvals.

10.6 Summing up

Thus, the above discussions provide the way forward for NRA in India. The four stages of NRA as envisaged by SEEA (CF) has been slated for implementation through three term plans which if acted upon will also subsume the issues and challenges besides bringing the private sector within the ambit of NRA through the course of implementation. Preparation of Asset Accounts in respect of four selected resources *i.e.* mineral and energy resources, water, land and forestry and wildlife resources is discussed in greater details in succeeding four Chapters XI to XIV while Chapter XV discusses the issues and challenges and Chapter XVI is about private sector participation. Essentially, preparation of Asset Accounts in respect of the four selected resources would enable achievement of one out of four stage implementation of NRA in India. For the other three stages of NRA, GASAB would be coming up with separate approach papers in due course of time.



CHAPTER - XI PREPARATION OF ASSET ACCOUNTS - MINERAL AND ENERGY RESOURCES

11.1 Mineral and energy resources - basic postulates

The term 'Mineral' means a class of substances occurring in nature as a result of geological processes and are mined for their intrinsic values. Minerals are the vital raw material for basic industries, the major source for development in any country. Mineral resources are finite and non-renewable on any human timescale. India has a fairly large variety of mineral deposits and the endowment is quite adequate with exception of few deficient minerals. Considering the ever-increasing population, growth rate of economy and demand, these mineral resources are bound to get exhausted sometime in future. Thus, the knowledge of endowment of mineral resources and their effective management are of utmost importance in order to provide an uninterrupted sustainable supply of minerals to meet the domestic demand as well as for foreign trade in order to boost the national economy. Yet, availability of data base of resources would also aid in finding out alternate source of clean energy to reduce carbon pollution that's threatening the planet.

Minerals in general have been categorised into three classes, namely - **fuel** (petroleum, natural gas etc), **metallic** (iron, copper, aluminium etc) and **non-metallic** (salt, gypsum, phosphates etc). Apart from these major minerals, minor minerals (sand, stone, boulders, clay etc) also play a major role in the economy of the States.

11.2 Mineral and energy resources - in India

India possesses a wide range of minerals and other natural resources. Domestically supplied minerals form an important underpinning for India's diversified manufacturing industry, mining industry as well as a source of modest export revenues.

Among mineral resources, iron ore (generally of high quality) and ferroalloys - notably manganese and chromite - are particularly abundant and all are widely distributed over the country. Other exploitable metallic minerals include copper, bauxite (the principal one of the aluminum), zinc, lead, gold and silver. Among

important non-metallic and non-fuel minerals are limestone, dolomite, rock phosphate, building stones, ceramic clays, mica, gypsum, fluorspar, magnesite, graphite and diamonds.

Further, an evaluation of the stock of minerals by CSO between 2005 and 2015 has revealed that many minerals are exhausting fast. This, while pointing towards possible indiscriminate use of natural resources, also highlights the importance of preparation of physical stock and monitor their usage on sustainable basis.

Among the fossil fuels, India is well endowed with coal and modestly so with lignite. Coal supplies are widespread and comes from some 500 mines, both surface and deep - pit distributed over a number of States. By far the most important coal producing region is along the Damodar River, including the Jharia and Raniganj fields in Jharkhand and West Bengal which account for about half the nation's output and virtually all the coal of cooking quality. Also, coal is in abundant and easy to mine in the Chota Nagpur Plateau, which is the principal source area for coking coal. Domestic reserves of petroleum and natural gas, though abundant, do not meet the country's large demand.

Petroleum fields are located in eastern Assam (India's oldest production region)

and in Gujarat and offshore in the Arabian Sea on an undersea structure known as the Bombay High. Several other onshore and offshore petroleum reserves have been discovered, including sites in Tamil Nadu, Andhra Pradesh and Arunachal Pradesh. As per the EnviStats 2018, total crude oil recoverable reserves stood as 635.59 million MT while reserves of natural gas stock was calculated as 1,251.99 billion cum.

Important mineral and mineral oil reserves in various parts of the country are shown in the table and map below:

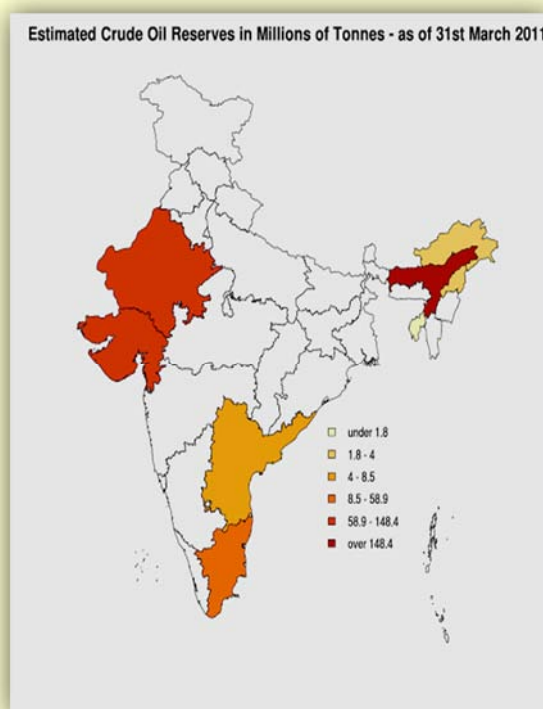
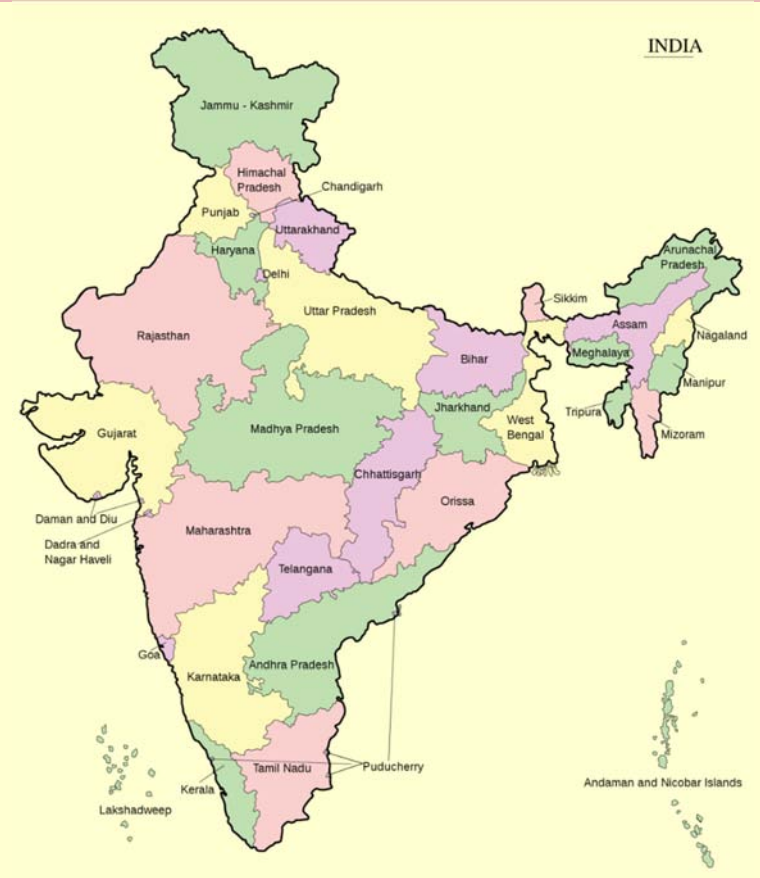


Figure 4 (Estimated crude oil reserves in India)

Mineral reserves across the country

| State | Prominent Minerals |
|-----------------------|--|
| Andhra Pradesh | Barytes, Ball Clay, China Clay, Dolomite, Fireclay, Iron, Quartzite, Manganese, Laterite, Mica, Ochre, Quart/silica sand |
| Assam | Petroleum and Natural Gas, Coal |
| Chhattisgarh | Coal, Dolomite, Bauxite, Iron, Fireclay, Limestone, Quartzite, Quartz/silica sand |
| Goa | Iron, Bauxite |
| Gujarat | Bauxite, Marl, Petroleum and Natural Gas, Chalk, Bentonite, China clay, Dolomite, Lignite, Limestone, Laterite, Quartz/silica sand, Fireclay, Manganese, Talc/soapstone/steatite |
| Jharkhand | Coal, Graphite, Bauxite, Iron, Copper, Kyanite, Dolomite, Manganese, Talc/soapstone/steatite |
| Karnataka | Gold, Iron, Manganese, Limestone, Dolomite, Dunite Magnesite, Quartz/silica sand, Granite, Silver, China clay, Chromite, Copper, Quartzite |
| Madhya Pradesh | Diamond, Copper, Manganese, rock phosphate, Limestone, Diaspore, Laterite, Bauxite, Coal, Pyrophyllite, Dolomite, Iron, Ochre, China clay |
| Maharashtra | Fluorite, Kyanite, Bauxite, Manganese, Coal, Iron, Limestone, Quartz/silica sand, Quartzite, Sillimanite, Dolomite |
| Odisha | Chromite, Garnet, Bauxite, Manganese, Iron, Quartzite, Dolomite, Coal, Pyrophyllite, Titanium minerals, Dunite, Limestone, Quartz/silica sand |
| Rajasthan | Lead and zinc, Wollastonite, Silver, copper, Limestone, Rock phosphate, Talc/soapstone/steatite, Gypsum, Ochre, Bentonite, Fuller's earth, Feldspar, Calcite, Ball clay, China clay, Dolomite, Fireclay, Iron, Lignite, Mica, Quartz/silica sand, Granite, Manganese |
| Tamil Nadu | Vermiculite, Dunite, Fireclay, Graphite, Lignite, Limestone, Magnesite, Quartz/silica sand, Titanium Minerals, Zircon, Sillimanite, Bauxite, Feldspar |
| Telangana | Coal, Manganese, Limestone, Barytes, Dolomite, Feldspar, Quartz/silica sand, Laterite, Shale, Chinaclay, Iron |
| Uttar Pradesh | Diaspore, Pyrophyllite, silica sand, Coal |
| West Bengal | Coal, China clay, Fireclay, Graphite, Quartz/silica sand |



Minor Minerals : Other than the aforesaid metallic, non-metallic and fuel minerals, there are minor minerals namely sand, stone, boulders, shingle etc, the source of which may be riverine or from hill quarries. The term 'minor mineral' has been defined in clause(e) of Section 3 of the Mines and Minerals (Development and Regulation) Act, 1957 as - 'minor minerals' means building stones, gravel, ordinary clay, ordinary sand other than sand used for prescribed purposes, and any other mineral which the Central Government may, by notification in the Official Gazette, declare to be a minor mineral".

Chapter IX of this paper provides the details on mandate, governance, legislations, management regarding mineral and energy resources.

11.3 Preparation of Asset Accounts

As an initial step, preparation of Asset Accounts is the basic yet the most important component among the four stages of NRA implementation as envisaged by SEEA (CF) and also endorsed by Professor Sir Partha Dasgupta in the Report on Green National Accounts in India - A Framework. Preparation of Asset Accounts has, therefore, been given maximum thrust in this Paper. ***Accordingly, the short term plan covering period 2019-20 to 2021-22 envisioned in this paper proposes to initiate and firm up the Asset Accounts in respect of mineral and energy resources in the States.***

As discussed in Chapter X, the SEEA (CF) envisages recording the flow of physical assets on four major classifications, i.e. opening stock, additions, reductions and closing stock. For such purpose, SEEA (CF) also prescribed a general structure of account which is given in **table 8** of Chapter X. EnviStats 2018 has attempted to provide the data of mineral and energy resources in the country - State wise, yet these pertain to only the stock of mineral resources for the years ending as on 2005, 2010 and 2015. Further, these data sets lack year to year position of stock and exploitation of resources which is the essence of NRA. **This paper suggests to institute a mechanism for preparation of Asset Accounts, annually in the States across the country - which can be later consolidated into a national database. And by addition the off-shore stock of petroleum product, it would be possible to prepare the national Asset Accounts on mineral and energy resources.**

The Asset Accounts are expected to capture the stock and extraction of resources and while linking the physical flows of these resources namely petroleum, non-ferrous mining and metallurgical industries, coal and lignite, and minor minerals (sand, stone, boulders etc), the Accounts would also project the monetary implication of such extraction to the Government exchequer as well as their impact in the economy. Towards this, the revenues involved in exploited resources would

provide the Government valuation while the average market price (these are discussed in Chapter on Valuation of Resources) would provide the impact of these resources in the economy. The formats of the Asset Accounts have been designed in line with the broad framework prescribed by SEEA (CF) while making country specific adjustments to match the desired outcome.

The tentative design of the Asset Accounts, management and availability of data, suggested methodology for preparation of the Asset Accounts along with a sample Asset Account are discussed in the succeeding paragraphs.

11.3.1 Suggested design of the Asset Accounts

The Asset Accounts is suggested to be two-pronged, one showing the physical flows of the resources while the second table is designed to capture the detailed break-up of the opening stock, addition and extraction (reduction) and the closing stock, resource-wise. The second table would also serve as data feeder to table on physical flows. The second table also seeks to capture the economic implication of exploitation of resources by adding two distinct columns on valuation of resources further bifurcated to project the revenues accrued to the Government(s) on account of royalty collected on extraction of resources and the average market value of resources which impacts the economy.

The tentative designs of the tables are discussed below.

Table - 9 Showing Asset Accounts on physical flows of mineral and energy resources

| Classification | Sub-classification (may vary from State to State and Union) | Opening stock of proved reserves | Addition to stock* | Reduction in stock | | | Closing stock of proved reserves |
|--------------------------------------|--|----------------------------------|--------------------|----------------------|----------------|---------------------|----------------------------------|
| | | | | Extracted for use in | | Other extractions** | |
| | | | | Govt Sector | Private Sector | | |
| (in tonnes/cum - as the case may be) | | | | | | | |
| Major Minerals | Iron Ore | | | | | | |
| | Manganese | | | | | | |
| | Limestone | | | | | | |
| | Barites | | | | | | |
| Fossil fuel | Coal | | | | | | |
| | Petroleum | | | | | | |
| | Natural Gas | | | | | | |
| Minor minerals | Sand | | | | | | |
| | Stone, boulders, aggregate | | | | | | |
| | Shingle | | | | | | |
| Other resources, if any | | | | | | | |

* - to include - Growth in Stock, discoveries of new stock, reclassifications etc

** - to include - extractions other than those for **Government** and **Private** Sector such as untaxed extractions (if any), normal reduction in stock, catastrophic losses, downward reappraisals, cases of illegal mining, reclassifications etc

The second table of the Asset Account in physical and monetary terms showing stock of asset at the beginning and end of each of accounting years and changes in stock of mineral and energy resources during the years and closing at the end of the year showing the resource wise position including the valuation of resources is tentatively designed as under.

Table - 10 Showing Subsidiary Asset Accounts linking detailed physical flows in respect of mineral and energy resources with the valuation of resources

| Particulars | Classification of minerals (illustrative only and may vary) | Physical unit (in tonnes/cum) extracted showing Govt, Private and other sector | Valuation of resources | | |
|---|---|--|--|----------------------------|--|
| | | | Revenue involved (in crore) showing Govt, Private and other sector | Total revenue implications | Average Market value (as ascertained from the IBM or State Statistical Department) % |
| Opening stock/availability of resources at the beginning of the year | Coal | | | (a) | (b) |
| | Petroleum | | | | |
| | Natural Gas | | | | |
| | Iron Ore | | | | |
| | Sand | | | | |
| | Stone | | | | |
| Additions during the year: Growth in Stock Discoveries of new stock Reclassifications Total Addition : | Coal | | | | |
| | Petroleum | | | | |
| | Natural Gas | | | | |
| | Iron Ore | | | | |
| | Sand | | | | |
| | Stone | | | | |
| Reductions during the year: Extractions (on recovery of royalty, cess, fees, NPV etc) # | Coal | | | (c) | (d) |
| | Petroleum | | | | |
| | Natural Gas | | | | |
| | Iron Ore | | | | |
| | Sand | | | | |
| | Stone | | | | |
| Revenue related to exploitation of resources out of total revenue included in Statement 14 of State Finance Accounts/Statement 8 of Union Finance Accounts pertaining to four major heads ¹¹ | | | | (e) | |
| Other extractions, not taxed (if any) | | | | | |
| Normal reduction in stock Catastrophic losses including natural and manmade disasters Downward reappraisals Reclassifications | | | | | |
| Reduction due to illegal mining activities \$ | | | | | |

¹¹ Petroleum, non-ferrous mining and metallurgical industries, coal and lignite

Concept Paper on Natural Resource Accounting in India - an initiative of GASAB

| | | | | | |
|--------------------------|-------------|--|--|-----|-----|
| Total reduction : | | | | (f) | (g) |
| Closing stock | Coal | | | (h) | (i) |
| | Petroleum | | | | |
| | Natural Gas | | | | |
| | Iron Ore | | | | |
| | Sand | | | | |
| | Stone | | | | |

Notes :

(a) Rate of royalty in respect of each of the resources multiplied by opening balance of physical units to appear here. Sub-tables may be prepared as required to work out the figures in respect of each of the resources.

(b) Average market price as available in the website of IBM in respect of each of the resources multiplied by the opening balance of physical units to appear here. Sub-tables may be prepared as required to work out the figures in respect of each of the resources.

(c) Total of column 4 in respect of extraction of resources to appear here.

(d) Average market price as available in the website of IBM in respect of each of the resources multiplied by the resources extracted during the year to appear here.

(e) - Revenues earned by the entities and as reported through the Finance Accounts may be incorporated here. This will be same as (c) as it depicts the total revenues realised by the entity on exploitation of resources.

(f) and (g) - may be same as (c) and (d).

(h) Rate of royalty in respect of each of the resources multiplied by closing balance of physical units to appear here. Sub-tables may be prepared as required to work out the figures in respect of each of the resources.

(i) Average market price as available in the website of IBM/ available with the States/Union in respect of each of the resources multiplied by the closing balance of physical units to appear here. Sub-tables may be prepared as required to work out the figures in respect of each of the resources.

- please refer to preceding table - extraction of resources may be shown separately for **Government**, **Private** Sector and **Others**.

% - The IBM compiles and releases average market value of minerals on monthly basis. Besides, the Statistical Departments in the States maintain the market prices of minor minerals (sand, stone, boulders etc). The average of these prices could be used to fill up these columns. Sub-tables may be prepared as required to work out the figures in respect of each of the resources.

\$ - Information may be gathered from all possible sources including those detected by the administrative Departments like Mining, Environment & Forests and also from other sources like NHAI, PWD, Inspection Reports of Accountant General (Audit) etc

- Physical unit may be reckoned as per the usual practice, like standard cubic meter for natural gas, tonnes for metallic and non-metallic minerals, cubic feet for timber, cubic meter for minor minerals and so on.

- Opening Stock of resources :** The SEEA (CF) envisages that, ideally, estimates of the opening and closing stocks of an asset should be compiled with information pertaining to the reference dates of the accounting period. However, if information in respect of those dates is not

directly available, relevant information may need to be time-adjusted. From time to time, new information will emerge that leads to a change in the assumptions underlying a set of estimates. When additional information is being incorporated, it is important that the estimates continue to reflect the quantities and values that could reasonably be expected at the reference dates.

- **Additions** : Additions in stock includes mainly discoveries in new stock, reclassifications, opening up of new blocks to add to proved reserves, reappraisals etc. Of these, opening up of new blocks may occur in some years; otherwise, additions will more or less remain 'nil'.
- **Reductions** : The SEEA (CF) prescribes reduction in stock to be enumerated under five distinct categories, i.e. extractions, normal reductions in stock, catastrophic losses, downward reappraisals, and reclassifications. Of these, reduction on account of extraction of resources would be regular phenomenon while other causes of reduction may occur once in a while.
- **Closing stock** : The resultant value of opening stock, plus the additions, reduced by the reductions would lead to closing stock of resources. However, non-ascertainability of opening stock would result in non-determination of the closing stock. Similar to opening stock, appropriate explanation would have to be inserted against reasons hindering calculation of closing stock.

11.3.2 Management of resources

The following agencies of Government of India are mandated to collect and manage data in respect of the resources mentioned against them:

| Indian Bureau of Mines | Ministry of Coal | Ministry of Petroleum & natural Gas |
|---|------------------|-------------------------------------|
| <ul style="list-style-type: none"> • All major minerals - metallic and non-metallic • Except minor minerals (sand, stone, boulders etc) and atomic minerals | Coal and Lignite | Petroleum and natural gas |

Functions of these three Departments in management of resources are briefly mentioned below.

11.3.2.1 Indian Bureau of Mines

The objective of the IBM is to promote systematic and scientific development and optimum utilisation of mineral resources of the country (both on-shore and off-shore). IBM is also mandated to collect, collate and organise into a database, all information on exploration, prospecting, mines and minerals in the country in the shape of a National Mineral Information Repository and take steps to publish and disseminate the same function as the National Technical Regulator in respect of the mining sector and lay down regulations, procedures and systems to guide the State Governments (first tier of regulation).

11.3.2.2 Ministry of Coal/Coal Controller

The Ministry of Coal is responsible for development and exploitation of coal and lignite reserves in India. It is also responsible for all matters relating to production, supply, distribution and prices of coal in the country.

11.3.2.3 Ministry of Petroleum and Natural Gas

The Ministry of Petroleum & Natural Gas is responsible with exploration and production of oil and natural gas, refining, distribution and marketing, import, export, and conservation of petroleum products. Exploration for and exploitation of petroleum resources, including natural gas and coal methane, gas hydrates and shale gas.

11.3.3 Availability of data

Monthly production of minerals : Although these three agencies as stated above are mandated to govern the resources mentioned against them, the IBM collects, consolidates and publishes the data on monthly production of minerals. IBM maintains a fully computerized database on National Mineral Inventory of 71 minerals. The publication 'Monthly Statistics of Mineral Production' for a month gives provisional figures for that month and the revised figures for the previous month. Similarly, the latest cumulative figures of production beginning from April of the year up to the current month are also published in the current issue of the Monthly Statistics of Mineral Production along with figure for the corresponding period of the previous year. Similar information on monthly production of crude oil and natural gas are also available in the website of Ministry of Petroleum & Natural Gas.

The following information are readily available in the website of IBM:

| Name of the database/reporting mechanism | Information/data that can be accessed |
|--|--|
| Mining Plans Application | Stock of proved reserves - These information available mine-wise can be accessed through the Directorate of Geology and Mines in the States to ascertain the total stock of each of the minerals at any given time |
| Monthly production of minerals | Total production of minerals during the month - showing separately (i) fuel minerals, (ii) metallic and (iii) non-metallic minerals, (iv) state-wise production of minerals |
| Average sale price | State-wise average sale price of minerals - monthwise (data till the month of September 2019 is available) |

Enumeration of stock of mineral reserves : The website of IBM also contains detailed information on the stock of mineral reserves - State wise or the National

Mineral Inventory (NMI). However, the last such report is available as of 1 April 2015. The NMI is an important activity as per Charter of Functions of Indian Bureau of Mines. This activity was initiated in 1968 and accordingly, preparation of inventory of 34 important minerals was taken up in 1971. Subsequently, from 1980 onwards, updation of NMI was taken up quinquennially, with inclusion of various other minerals periodically. The present publication is for NMI as on 1.4.2015 for 71 minerals.

11.3.4 Other probable source of data on mineral and energy resources

Though the IBM is mandated to consolidate the monthly production figures of all resources except atomic and minor minerals, yet, the principal sources of all such information rests in the concerned Department of Geology and Mines in each States as the statutory provisions of Mines and Minerals (Development and Regulation) Act prohibits removal of any mineral without obtaining a permit on payment of royalty to the concerned Government. Along with the data on major minerals, it also holds the data in respect of minor minerals like sand, stone, boulders etc.

Apart from these agencies, data can be accessed from a number of other agencies which are mentioned in the table below.

Table - 11 Showing source of data (including probable reports/publications)

| Major Minerals | Minor minerals |
|--|---|
| <ul style="list-style-type: none"> • Geology and Mining Department (<i>mining plans</i>) • Mining Corporations (wherever in place) | <ul style="list-style-type: none"> • E, F & CC Department in each States (<i>working /mining plans</i>) • Geology and Mining Department (<i>working /mining plans</i>) • Public Works Department, Roads/buildings etc Divisions (<i>Data on mineral use during the period</i>) • National Highway Authority of India (<i>Data on mineral use during the period</i>) • Pollution Control Boards |

Thus, it transpires from the above that extraction/exploitation of mineral and energy resources are readily available and can be consolidated for preparation of Asset Accounts. This is further elaborated in the section under methodology for preparation of Asset Accounts.

11.3.5 Reporting mechanism

The IBM is mandated under Mineral Conservation and Development Rules (MCDR) 1988 to require all the mine owners, managers etc and the mineral based traders/exporters/stockists/end-users to register with IBM and the submit the following returns in prescribed formats :

- Monthly Return: Before 15th of every month in respect of preceding month (applicable for mine owners, managers etc)
- Annual Return : Before 1st July of each year for the preceding financial year (applicable for mine owners, managers etc).
- Monthly Return : Before 15th of every month in respect of preceding month (applicable for mineral based traders/exporters /stockists/end-users)
- Annual Return : Before 1st July of each year for the preceding financial year (applicable for mineral based traders/exporters /stockists/end-users).

11.3.6 Geo-tracking of mineral extraction

The Ministry of Mines in coordination with IBM has developed an app for Geo-tracking and monitoring of exploitation of resources mainly to track illegal mining named Mining Surveillance System (MSS). MSS is a satellite based monitoring system which aims to establish a regime of responsive mineral administration, through public participation, by curbing instances of illegal mining activity through automatic remote sensing detection technology. The advantages of remote sensing technology based monitoring system are that it is transparent, biasfree and independent as the system has no human interface, deterrent and speed up response and action and also helps in effective follow up.

11.3.7 Methodology for preparation of Asset Accounts

Methodology for preparation of the Asset Accounts in respect of mineral and energy resources would consist of three vital parts - **identification of major minerals contributing revenues to the State exchequers, enumeration of the opening stock and third is the reduction due to exploitation of resources**. Other elements like additions would not occur very often and rather take place once in a while after discovery of new stock or reclassification of resources or addition to the proved reserves which are very rare phenomenon. The closing stock would normally be the difference of opening stock and the reduction there from.

11.3.7.1 Identification of major mineral resources in the States : IBM has been periodically preparing the stock report of metallic, non-metallic and fuel minerals, State - wise in a five year periodicity and last such report was prepared in 2015. The stock of mineral and energy resources enumerated in the EnviStats 2018 has been sourced from these data sets consolidated by the IBM. Thus, listing of major resources including coal and petroleum products are already done by the IBM as well as included in the EnviStats 2018. Regarding the minor minerals like sand, stone, boulders in each States, the Department of Geology and Mines have readily available data on their stock and extraction vis-à-vis revenue realisation.

11.3.7.2 Opening Stock and Extractions : The other two sets of information required for smooth preparation of Asset Accounts are - the opening stock and the

exploitation of resources. There can be multipronged approach for preparation of the Asset Accounts. Given the online availability of data/information regarding (a) production of minerals with the IBM in respect of the metallic, non-metallic and fuel minerals - which are collected and consolidated monthly, (b) consolidation of data on average sales price of minerals - monthly coupled with the other systems installed in collecting the information regarding the availability of proved reserves across mines periodically, initiation of Asset Accounts in the States can be rather easy than comprehended. These are discussed in the succeeding paragraphs :

Methodology 1

The first approach could be the conventional system of gathering information regarding the opening stock of minerals and extractions during the period of the Asset Accounts from the administrative Departments governing the resources. While the Departments administering the resources could provide the information on physical accounts, the Finance Department can have the information on revenues while the Statistical Department/information available in the website of IBM can help with the data on market value. Upon receipt/consolidation of the information, the Asset Accounts can be prepared.

The second approach could be rather proactive. As the IBM and the EnviStats 2018 has provided the stock of minerals (metallic, non-metallic and fuel minerals) as of 1 April 2015, this could be held as the base. The data on monthly production of

Methodology 2

minerals also available in the website of the IBM could be used to reducing the volume of minerals that have been excavated during the intervening period to arrive at the opening stock of the desired periodicity of the Asset Accounts. For example, if the desired periodicity of the Asset Account is for 2018-19, the opening stock of minerals as of 1 April 2015 could be deducted by the corresponding monthly production figures for the years 2015-16, 2016-17 and 2017-18 to roughly arrive at the opening stock of minerals as of 1 April 2018 as shown through the table below:

Ascertaining the opening stock

Table 12 showing methodology of working out the opening balance with available information

| Name of minerals | Opening stock as on 1 April 2015 | Annual production (considering the monthly production of minerals as available in website of IBM) during | | | Closing stock as on 31 March 2018 or opening stock of 1 April 2018 |
|---|---|--|---------|---------|--|
| | | 2015-16 | 2016-17 | 2017-18 | |
| Minerals economically important for each States may be included in the Asset Accounts | Stock of minerals as of 1 April 2015 available in the website of IBM and also replicated in EnviStats 2018 by MoSPI may be used | Monthly production of minerals is available online at the website of IBM (www.ibm.gov.in - divisions - mining and mineral statistics - monthly statistics of mineral production) | - do - | - do - | Resultant balance of deduction of annual productions of three years from the opening balance |

However, there could be some issues like stock of excavated minerals as of 1 April 2015 which will have to be gathered, discussed and clarified from the concerned Department of Geology and Mines in the States and accordingly adjusted in the Accounts.

Thus, the aforesaid methodology could be used to ascertain the opening stock of resources during the period of Asset Accounts - in respect of major minerals. The monthly production data available in the website of IBM could be used to project the extraction of resources during the period- with adjustments of stock of excavated minerals as on the first and last date of account period. Also, the gross extraction would have to be segregated into two sectors - Government and private sector usage as provided in the sample Asset Accounts as at table 9 above. This data is also available, year-wise, in the website of IBM in the page - statistical profiles of minerals under mining and mineral statistics.

Monthly figures of extraction of mineral resources

11.3.7.3 Minor Minerals : As regards the minor minerals, the information are available with the Departments of Geology and Mining in the States which would have to be collected, consolidated and adopted in the same manner alike major minerals for incorporation in the Asset Accounts. The format for mining plan to be submitted before taking up any mining activity as available in the website of IBM requires information on geological and recoverable reserves and grade, duly supported by standard method of estimation and calculations giving split up of various categories like proved, probable and possible reserves in the entire leasehold. As envisaged by SEEA (CF), proved reserves may be considered as the stock on the date of application while the subsequently monthly production may be deducted in similar manner as worked out for major minerals under methodology 2 above to ascertain the opening stock of minor minerals at any given date.

An example of preparation of Asset Accounts so far as the reduction due to extraction of resources, which is the most vital element of the Asset Accounts, is attempted below. Resources physically removed is mapped with the revenues deposited with the State Government. For the sample table, data collected by the Office the Accountant General (Audit), Andhra Pradesh from the Department of Mines and Geology, Andhra Pradesh for one of the Performance Audit on Department of Mines and Geology has been used. Also, the revenues generated through exploitation of these resources as depicted in the Finance Accounts of Andhra Pradesh for the corresponding years have been taken into consideration. These revenue figures tally with the resource wise revenues collection as gathered by the Audit Office from the Department of Mines and Geology, Andhra Pradesh. The sample table below covers a period of two years 2010-11 and 2011-12:

Table 13 Showing example of mapping revenue and physical flow of resources

| Name of mineral | Unit | 2010-11 | | 2011-12 | |
|----------------------|----------------|---------------|-------------------------------|------------------------|-------------------------------|
| | | Qty exploited | Revenue involved (₹ in crore) | Physical Qty exploited | Revenue involved (₹ in crore) |
| Coal | In mn tonnes | 51.33 | 682 | 51.03 | 788 |
| Barites | | 1.3 | 19 | 1.43 | 12 |
| Iron Ore | | 1.31 | 11 | 1.48 | 7 |
| Limestone | | 52.5 | 330 | 65.04 | 411 |
| Limestone slabs | In mn sq meter | 12.5 | 7 | 15.02 | 8 |
| Granite | In mn cum | 0.93 | 169 | 1.25 | 250 |
| Gravel | | 45.09 | 117 | 72 | 158 |
| Road metal | | 91.65 | 303 | 114.58 | 379 |
| Sand | In lakh cum | 334.31 | 158 | NA | 127 |
| Crude oil | In lakh tonnes | 3.6 | 155 | 3.04 | 130 |
| Natural Gas | In mn cum | 1384 | NA | 1353 | NA |
| Other minerals | -- | | 114 | | 67 |
| Total revenue | | | 2,065 | | 2,337 |

Physical qty may be appropriately inserted at # at table 10 above

As depicted in relevant head of Finance Accounts and inserted at (a) at table 10

Note : mn - million, cum - cubic meter

Source : Revenue involved - Finance Accounts of Andhra Pradesh for relevant years and quantity exploited - information collected from the Department of Mines and Geology, Andhra Pradesh as provided in the Performance Audit on Department of Mines and Geology, Government of Andhra Pradesh (Report No. 2 of 2014).

Needless to state here that the data on stock of major mineral resources namely coal, barites, iron ore, crude oil, natural gas etc as available in the website of IBM and also replicated in EnviStats 2018 by MoSPI as of 1 April 2010 (stock enumeration available every five years i.e. 2015, 2010, 2005 and so on) could be used as opening stock. The resultant figures after deducting the extractions during 2010-11 and 2011-12 from the opening stock as on 1 April 2010 would throw up the closing stock of minerals as of 31 March 2012.

A word of caution : The above discussions would reveal that different sources are used to gather and consolidate figures like opening stock is worked out from the data available with the IBM while two theories are discussed to work out the extractions - first the figures of IBM available in their website while the other is directly sourced from the Department of Geology and Mining of a State. Whatever be the methodology of data collection and consolidation, specific notes must be added under the tables to clearly state the source of information. Besides, every possible effort may be made to effect reconciliation of data by gathering information from all possible sources so that the Asset Accounts prepared are valid, reliable and acceptable.

11.3.7.4 Ascribing valuation to extracted resources

Another salient feature of the suggested design of Asset Accounts is ascribing valuation to the extracted resources as may be seen from the column 5 - 7 of Table 9 above. Various techniques of valuation rendered by different authors, reports, SEEA (CF), Green National Accounts in India - A Framework report by Professor Sir Partha Dasgupta and also practiced in different countries have been discussed in the Chapter - V on Valuation of Resources. From these discussions, two methods of valuation of resources emerge - the revenue accrued to the Governments and the average market value. While the first would help ascertain the valuation of the resources or the stream of revenues to its principal owner - the Government, the second would help in ascertaining the importance of these resources to the economy.

The source of information on revenues contributed to the Union/States from exploitation of resources are gathered through a well laid out machinery and reported yearly in the Finance Accounts of the Union and the States, and the average market price of major minerals are collected, consolidated and disseminated by the IBM, monthly. These are available online in the website of IBM. As regards the minor minerals, the average market price is maintained by the Statistics Departments in the States which can be gathered for incorporation in the Asset Accounts.

11.4 Systemic approach for continuity in data collection

While the methodology for preparation of Asset Accounts discussed above is for the past years as the first such Account is proposed to be initiated from 2019-20 or even a year before, systems would need to be devised for concurrent data gathering - on month to month basis from the concerned Departments in the State mandated to govern and monitor mineral and energy resources. This will ensure regular flow of information from the source agency and enable preparation of Asset Accounts independently in the States while information available with other sources can be used for reconciliatory purposes.

Accordingly, suitable formats for reporting mechanism would need to be developed. While the format may be designed in the same manner as the Asset Accounts as at table 9 above with suitable State - specific modifications, the information on opening and closing stock may be obtained only for the months April and March of succeeding year respectively.

11.5 Summing up

The aforesaid discussions would indicate that preparation of Asset Accounts in respect of mineral and energy resources in the States as part of the short term goals (2019-20 to 2021-22) is indeed possible to materialise. More importantly, majority of such Asset Accounts consisting of major minerals (fuel, metallic and non-metallic minerals) can be made with existing information/data which are readily available online while details of minor minerals could be gathered from the Department of Geology and Mines in the States. This would mean that the whole idea of stage 1 of SEEA (CF) guidelines for implementing NRA is given effect in respect of the resources which are of economic importance to the State Governments while the national accounts would follow.



CHAPTER - XII PREPARATION OF ASSET ACCOUNTS - WATER RESOURCES

12.1 Water is life-*Jal hi Jeevan hai*

Water is one of the most essential natural resources for any life on planet and thus aptly said: '*Jal hi jeevan hai*' (Water is life). India is endowed with a rich and vast diversity of natural resources, water being one of them. Sector wise demand of water can be broadly categorised under irrigation, industry, energy, domestic use and others. For optimal sustainable development, maintenance of quality and efficient use of water resources to match with the growing demands on the precious natural resource of the country is necessary. Its development and management plays a vital role in agriculture production, integrated water management is vital for poverty reduction, environmental sustenance and sustainable economic development. India is a diverse country and has a variety of climate which in turn affects the water resources and their utilisation.

12.2 The Water Cycle

Precipitation is a vital component of how water moves through Earth's water cycle, connecting the ocean, land, and atmosphere. The water cycle describes how water evaporates from the surface of the earth, rises into the atmosphere, cools and condenses into rain or snow in clouds, and falls again to the surface as precipitation. The water falling on land collects in rivers and lakes, soil and porous layers of rock, and much of it flows back into the oceans, where it will once more evaporate. The cycling of water in and out of the atmosphere is a significant aspect of the weather patterns of Earth.

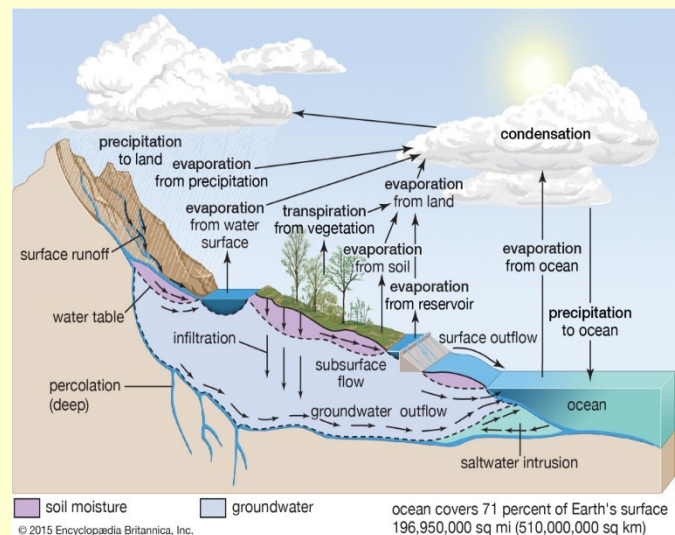


Figure 5 showing the water cycle

12.3 Water resources in India vis-à-vis climate change

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. This threat emanates from accumulated greenhouse gas emissions in the atmosphere, anthropogenically generated through long term and intensive industrial growth and high consumption lifestyles in developed countries.

Climate change may alter the distribution and quality of India's natural resources and adversely affect the livelihood of its people. With an economy closely tied to its natural resource base and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat because of the projected changes in climate. The global warming may affect the hydrological cycle which could result in further intensification of temporal and spatial variations in precipitation, snow melt and water availability. The report on "India's Initial National Communication to the United Nations Framework Convention on Climate Change" published by Ministry of Environment and Forests, Government of India in the year 2004 identifies the following projected impacts of climate change on water resources. "It is obvious that the projected climate change resulting in warming, sea level rise and melting of glaciers will adversely affect the water balance in different parts of India and quality of ground water along the coastal plains. Climate change is likely to affect ground water due to changes in precipitation and evapo-transpiration. Rising sea levels may lead to increased saline intrusion into coastal and island aquifers, while increased frequency and severity of floods may affect groundwater quality in alluvial aquifers. Increased rainfall intensity may lead to higher runoff and possibly reduced recharge." Some of the possible identified implications of climate change on water resources are listed below:

- Decline in the glaciers and the snowfields in the Himalayas;
- Increased drought like situations due to overall decrease in the number of rainy days over a major part of the country;
- Increased flood events due to overall increase in the rainy day intensity;
- Effect on groundwater quality in alluvial aquifers due to increased flood and drought events; Influence on groundwater recharge due to changes in precipitation and evapo-transpiration; and
- Increased saline intrusion of coastal and island aquifers due to rising sea levels.

With a view to address the related issues, the National Action Plan on Climate Change (NAPCC) has been prepared by the Government of India as has been discussed in Chapter III under Climate Change vis-à-vis NRA.

12.4 National Water Mission and National Water Policy

The Government of India has enacted the National Water Policy (NWP) and established a National Water Mission. The main objective of the National Water Mission (NWM) is 'conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management'. The five identified goals of the Mission are (a) comprehensive water data base in public domain and assessment of impact of climate change on water resources, (b) promotion of citizen and state action for water conservation, augmentation and preservation, (c) focused attention to vulnerable areas including over-exploited areas, (d) increasing water use efficiency by 20 per cent and (e) promotion of basin level integrated water resources management.

The NWP - initially enacted in 1987 has been revised twice, in 2002 and again in 2012. The NWP 2012 envisaged that Public policies on water resources need to be governed by certain basic principles, so that there is some commonality in approaches in dealing with planning, development and management of water resources. The activities of the Ministry of Water Resources (*Jal Shakti*), Government of India are broadly guided by these statutes and visions.

12.5 Types of water resources - inland and ground water

By its nature, water resources can be classified into two distinct categories. The first being surface water or inland water resources while the second is ground water. These are discussed below:

12.5.1 Inland Water Resources :

Inland water resources include both fresh and brackish water bodies. While freshwater is naturally occurring water with low concentration of salt, brackish water has a salt concentration varying between that of freshwater and marine water. Inland Water Resources of the country are categorized as : rivers and canals; reservoirs; tanks, lakes & ponds; lakes and derelict water bodies; and brackish water. In India, rivers and canals run throughout the country with total length amounting to 1.9 lakh kilometers and the total water bodies other than rivers and canal cover an area of around 7.31 Million Hectare (M. ha). (Source : Annual Report 2017 - 18 , Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Co-operation & Farmers Welfare).

Table - 14 showing details of surface water resources

| Source of water | Available resource |
|---|--------------------|
| Rivers and canals | 1,95,095 sq km |
| Other Water Bodies | |
| Reservoirs | 2.93 M ha |
| Tanks and Ponds | 2.43 M ha |
| Flood plain lakes and derelict water bodies | 0.80 M ha |
| Brackish water | 1.15 M ha |
| Total | 7.31 M ha |

Note : M Ha = million hectares.

Out of the total river and canal basin water sources, Uttar Pradesh and Jammu & Kashmir have the longest length of rivers and canals of 28,500 kilometres and 27,781 kilometres respectively. The inland water resources are unevenly distributed across the states, with the expanse ranging from 9.89 lakh hectares in Odisha and 8.11 lakh hectares in Andhra Pradesh (including Telangana) to negligible amounts in the smaller States of Mizoram, Sikkim and Puducherry.

12.5.2 Ground Water Resources :

Water is an indispensable natural resource for life on this planet. Groundwater has emerged as the main source for agriculture, domestic and the industry. Ground water has slowly become the mainstay of India's agriculture and drinking water security as it is considered a dependable source. It is an invisible yet finite resource. India being a home to more than 1.3 billion people, the increasing population, urbanization and non-uniform extraction have accelerated depletion of ground water resources. This is reflected in falling ground water levels trends and contamination of aquifers. In addition, there has not been adequate thoughtfulness to water conservation, efficiency in water use, water re-use & recycle, groundwater recharge, and ecosystem sustainability. This calls for dedicated plans and schemes to manage this scarce resource.

National Compilation on Dynamic Groundwater Resources in India - 2017 released in July 2019 revealed the following details :

Table 15 showing details of ground water resources

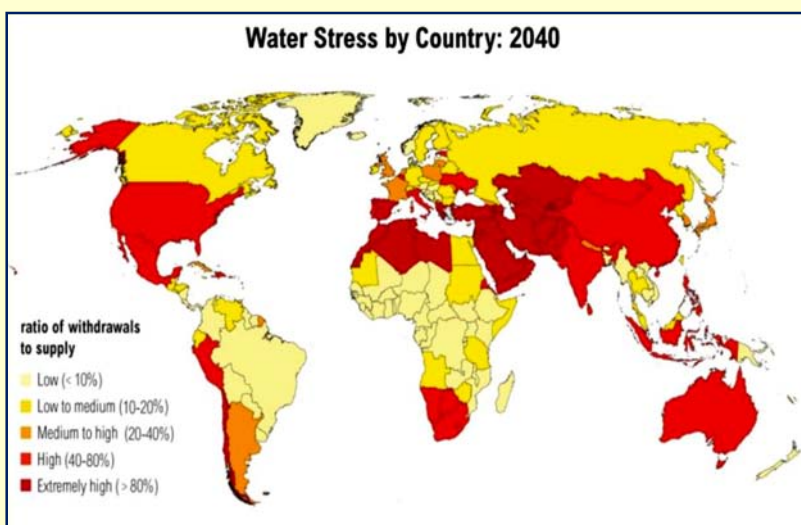
| At a Glance | |
|--|--------------------|
| Total annual ground water recharge | 431.86 billion cum |
| Annual extractable ground water resource | 392.70 billion cum |
| Annual ground water extraction | 248.69 billion cum |
| Stage of ground water extraction | 63.33 per cent |
| Categorisation of Assessment Units across the country | |
| Total assessment units | 6,881 units |
| Safe | 4,310 units |
| Semi-critical | 972 units |

| | |
|----------------|-------------|
| Critical | 313 units |
| Over exploited | 1,186 units |
| Saline | 100 units |

As per information available with the CGWB, 60 per cent of the country's irrigation needs are met through ground water while 85 per cent and 50 per cent of rural and urban drinking water respectively are accommodated by ground water sources. Resultantly about 60 per cent of the country is seeing a decline in ground water table.

12.6 Need for Water Accounting - difficult times lurking ahead

There are a lot of studies conducted on current and forecast water stress/scarcity in different parts of the world. Prominent among them is the study conducted by the World Resources Institute which predicted that 36 countries around the world will suffer from the extreme water stress by 2040.



Thus, the statement when seen with the map would reveal that more than half of world population will be living under medium to extremely high water stress; most countries suffering from extreme water stress are located in North Africa, Middle East and Asia. In order

to address and mitigate the water scarcity issues it is important to determine the reasons and the level of the scarcity in a particular country or region. The following chapter will describe several generations of indexes and indicators attempting to evaluate and measure the water scarcity.

In India, industrialisation and urbanisation mounts the greatest pressure on the freshwater resources of the country. This pressure along with the constantly increasing population growth is translating into mounting pressure on the fresh water reserve in the country rendering large parts of the country water stressed¹² and as per available information, ground water was over exploited by 16 per cent as of 2013. An analysis on per capita water availability in India between 1951 to

¹² As per Falkernmark Water Stress Indicator, a per capita availability of less than 1,700 cubic mtr is termed as a water stressed condition while if per capita availability falls below 1,000 cubic mtr, it is termed as water scarcity condition.

2051 showed the country being water stressed from 2011 onwards and the per capita water availability is registering a decreasing trend from 1,544 cubic meter per year per capita in 2011 to a projection of 1,174 cubic meter per year per capita in 2051¹³. As per a Report on 'India: Support for the Implementation of the National Water Mission by State Governments in India: Scoping Study for a National Water Use Efficiency Improvement Support Program' released in November 2014 funded by Asian Development Bank, as a result of rising water demand many river basins will be physically water scarce by 2050. As quoted in the Report, of the 19 river basins in India, eight already have a potentially utilizable water resource of less than 1,000 m³ /capita¹⁴, with a further seven currently with less than 1,500 m³ /capita.

Only the Narmada (2,448 m³ /capita) and the Mahanadi (2,341 m³ /capita) river basins have adequate water resources available into the foreseeable future. By 2050, 10 river basins, with 75 per cent of the total population, will have developed all of the potentially utilizable water resources with the consequence that water reallocation between sectors will be a necessity and common occurrence in these basins. It is predicted that in many basins, groundwater, with the current levels of recharge and groundwater use patterns, will be in severe crisis; some already are at catchment and sub-basin level.

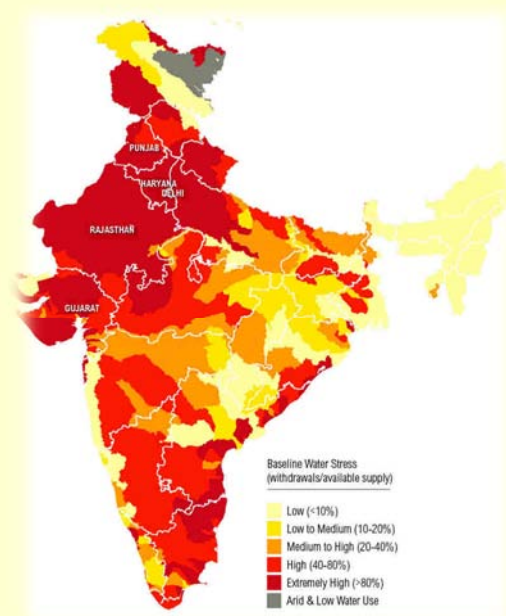


Figure 6 (Status of water across India)

According to the 12th Five Year Plan the water budget based on Ministry of Water Resources (MoWR) estimates shows utilisable water of 1,123 billion cum against a current estimated demand of 710 BCM. The Standing Committee of the MoWR estimates that this water demand will rise to 1,093 BCM by 2025. Other calculations, however, are not so optimistic, with the 2030 Water Resources Group (2009) predicting that with the current pattern of demand for water, about half the demand will be unmet by 2030.

The corresponding impact of depleting ground water is discussed in the following paragraph.

¹³ The per capita availability from 2015 onwards has been calculated from 2017 WRA estimate.

¹⁴ According to international convention basins with less than 1000 m³ /capita are classed as water scarce

12.7 Usage of surface water vis-à-vis ground water

In the preceding paragraphs, an attempt has been made to discuss about the availability and usage pattern of both types of water resources, surface water and ground water. However, fact remains that while data on availability and usage pattern is available in the public domain in respect of the ground water, similar comparable data is not readily available for the surface water, at least in public domain. However, the demerits of indiscriminate drawal of ground water, some of which could have severe damaging effect in the long run, are as discussed below:

Reduced surface-water flows In most areas, the surface and ground water systems are intimately linked. Ground-water pumping can alter how water moves between an aquifer and a stream, lake, or wetland by either intercepting ground-water flow that discharges into the surface-water body under natural conditions, or by increasing the rate of water movement from the surface-water body into an aquifer. In either case, the net result is a reduction of flow to surface water, though the full effect may take many years to develop.

A related effect of ground-water pumping is the lowering of ground-water levels below the depth that streamside or wetland vegetation needs to survive. The overall effect is a loss of riparian vegetation and wildlife habitat.

Land subsidence is “a gradual settling or sudden sinking of the Earth’s surface owing to subsurface movement of earth materials.” Though several different earth processes can cause subsidence, more than 80 percent of the subsidence in the United States is related to the withdrawal of ground water (Galloway and others, 1999).

Deterioration of water quality Coastal aquifers tend to have wedge-shaped zones of saltwater underlying the potable freshwater. Under natural conditions the boundary between the freshwater and saltwater tends to be relatively stable, but pumping can cause saltwater to migrate inland, resulting in saltwater contamination of the water supply. Inland aquifers can experience similar problems where withdrawal of good-quality water from the upper parts of inland aquifers can allow underlying saline water to move upward and degrade water quality. Additionally, where ground water is pumped from an aquifer, surface water of poor or differing quality may be drawn into the aquifer. This can degrade the water quality of the aquifer directly or mobilize naturally occurring contaminants in the aquifer.

The above narratives and evidences make it rather inevitable to control and monitor the use of ground water more effectively. Besides, the discussion also highlights the need for switching the reliance of the water users from ground water more towards the surface water. This may be attempted by involving the public through awareness building and measures such as water budgeting by prescribing

the maximum ceiling of water use depending upon the water table of the area. This will ensure community participation or '*jan bhagidari*' in management of water resources which is a life source.

12.8 Water scarcity and security in India

The Water Scarcity and Security in India by N G Hegde (2012) has listed the following reasons associated with continuous narrowing of the gap between the rising water demand and available water resources, which are as follows:

Over exploitation of groundwater : Over 20 million wells are pumping water with free power supply provided by some of the States resulting in depleting groundwater resources which in turn affects the water table in the country by 0.4 meter every year;

Intrusion of sea water : In the coastal areas, heavy intrusion of the sea water has made fertile agricultural land unfit for cultivation;

Sub-Optimal utilisation leading to erosion : Infrastructure development and investment in water sector has been low. The utilisation of the created facilities in fact has also not been optimum resulting in soil erosion and siltation because of the poor catchment area development; and

Inefficient water usage : It is estimated that over 70 per cent of the irrigation water is wasted depriving the dry areas of irrigation. Indian farmers have traditionally been practicing flow irrigation which has adverse effects like heavy soil erosion, leaching of fertilizers, increasing the infestation of pests, diseases and also suppressing the crop yields. Distribution of water in open canals, flood irrigation and charging for water, based on area irrigated instead of quality of water supplied are all causing this inefficient use of water resources.

12.9 Management of Water Resources in India

In India, there are primarily two departments managing water resources namely Central Water Commission which manages the surface water while the Central Ground Water Board monitors the ground water resources in the country. Both the departments are under the Ministry of Water Resources (*Jal Shakti*), Government of India. And in the States, while the surface water is managed by the Water Resources Department and the Irrigation Departments, ground water in the States are managed by the State Ground Water Departments and Public Health Engineering Departments.

Central Water Commission

Central Water Commission is an attached office of the Ministry of *Jal Shakti*, Department of Water Resources, River Development and Ganga Rejuvenation, Government of India. The Commission is entrusted with the general

responsibilities of initiating, coordinating and furthering in consultation with the State Governments concerned, schemes for control, conservation and utilisation of water resources throughout the country for the purpose of flood control, irrigation, navigation, drinking water supply and water power development.

Central Ground Water Board

Central Ground Water Board is mandated to sustainable development and management of ground water in the country and also to develop and disseminate technologies besides monitoring and implementing national policies for the scientific and sustainable development and management of India's Ground Water Resources including their exploration, assessment, conservation, augmentation, protection from pollution and distribution, based on principles of economic and ecological efficiency and equity.

Water data in respect of surface water resources are managed by the CWC while the CGWB manages the information relating to ground water resources. Besides, in line with the National Water Mission, the Ministry of *Jal Shakti* has been working on bringing water based records on public domain. Towards this, the Ministry has undertaken National Hydrology Project to improve the extent, reliability and accessibility of water resources information and to strengthen the capacity of targeted water resources management institutions in India, which is the basis for management and development of water resources. Among the components of the National Hydrology Project are two information systems on (i) Water Resources Information Systems and (ii) National Water Informatics Center. These systems once implemented are expected to bring diverse water resources data into one platform.

12.10 Understanding water scarcity indexes

Though the Falkenmark indicator¹⁵ is widely used in India to gauge water stress levels, there are diverse opinions across the world over use of this technique. It is argued¹⁶ that the Falkenmark indicator has its limitations as :

- *It ignores important regional difference in water availability, only measuring water scarcity at a country level;*
- *It fails to account for whether or not those water resources are accessible, for example, some of the freshwater resources of a country may be stored deep underground or may be heavily polluted;*
- *It does not include man-made sources of freshwater such as desalination plants which increase water availability beyond what is naturally available;*

¹⁵ A value of 1,700 cum/capita/year was used as the threshold to water stress conditions.

¹⁶ In a paper on 'Understanding water scarcity : Definitions and measurements' by Chris White uploaded in the website of Global Water Forum backed by UNESCO.

- *It does not account for the fact that different countries, and regions within countries, use different amounts of water.*

Apart from the Falkenmark indicator, there are other indicators used worldwide as follows :

- ✓ *Water used to availability ratio*
- ✓ *Physical and economic water scarcity - the IWMI¹⁷ indicator*
- ✓ *Water poverty index.*

However, these are artificial and best guesses rather than evidence-based techniques. There are inherent limitations about the utility of these indicators when seen against the complexity of water management challenges as these indicators are insufficient to take into consideration the complex socio-economic backdrop driving water demands.

12.11 Absence of database on water dependability among users in India

Though a range of data sets on availability and use of water resources are available on public domain or with the agencies while the National Hydrology Project is also working on bringing further information on one platform, yet it appears that the country do not have a database showing dependability of various sectors like irrigation, industry, energy and domestic on each of the water resources - the surface water and the ground water resources.

The States may initiate preparation of a database showing percentage share on use of surface water and ground water in respect of various types of water users. Consequently, the pressure on surface as well as ground water would be able to be recognised which can thereafter be used for policy decisions on discouraging indiscriminate use of ground water resources and shifting these users towards surface water or vice versa depending upon availability of resources.

12.12 Preparation of Asset Accounts - Water Resources

As discussed in Chapter X, preparation of ***water Accounts is suggested to be part of mid-term goals to be effective from 2022-23 onwards.*** Because, full data sets in respect of water resources are not readily available in the public domain besides some inherent challenges like certain data sets being classified in nature etc which would continue to hinder the process of data consolidation and preparation of Asset Accounts. However, those classified data mainly relate to surface water resources (river basins).

The water resources play a major role in agriculture, hydropower generation, industrial/domestic usage, forestry and with the ever increasing population and

¹⁷ International Water Management Institute

due to the depleting water levels across the country, meeting the increased demand in future would pose a major challenge. Unlike other environmental assets, such as timber resources or mineral resources that are subject to slow natural changes, water is in continuous movement through the processes of precipitation, evaporation, run-off, infiltration and flows to the sea. Also, the cycle in which data is maintained in respect of water resources slightly differs from the financial year as the hydrological year commences from June and ends in May.

Asset accounts for water resources focus on the inflows and outflows of water to and from the land surface and subsurface, and on the destination of these flows. In conjunction with information on instream uses of water (e.g., fish breeding and run-of-the-river hydropower generation), seasonal variation of flows of water, and other factors, such a focus allows assessment of the availability of water to meet demands from the economy and to assess whether those demands are consistent with the longer-term sustainability of water supply.

Water accounts can play a pivotal role in bringing in the data together which can provide vital inputs as to the depletion of water levels over the period serving as an impetus for more focused studies on utilisation patterns for policy decisions towards sustainability of water resources for the future.

Till the issues hindering availability of full data on surface as well as ground water resources are resolved, the following suggested asset accounts on water resources in the States could enable them to get at least an idea of the available water resources vis-à-vis its uses and whether the available water resources is sustainable or water tables are depleting. Consequently, these accounts can help to install systems to regulate use of water by various categories of users to achieve sustainability of water resources in the long run. Also, availability of water accounts would aid in the Governments to shift reliance from ground water resources to surface water resources by converting available riverine water resources into supply water besides helping the authorities in prioritising allocation of water resources to various categories of users as envisaged in France and other countries.

Table 16 Tentative Asset Account for Water Resources (State-wise) for the period _____
(water flows in billion cum and revenues ₹ in crore)

| | Surface water (unclassified data) | | | Ground water | Total |
|--|-----------------------------------|-------|----------------------------|--------------|-------|
| | Dams/ Reservoirs | Lakes | Rivers, canals and streams | | |
| Annual requirement of water by the following categories of users | | | | | |
| Irrigation | | | | | |

Concept Paper on Natural Resource Accounting in India - an initiative of GASAB

| | | | | | |
|--|--|--|--|--|--|
| Industries | | | | | |
| Domestic use | | | | | |
| Annual availability of water resources | | | | | |
| Additions to stock | | | | | |
| Precipitation | | | | | |
| Returns | | | | | |
| Inflows from other territories | | | | | |
| New discoveries | | | | | |
| Reduction from available resources | | | | | |
| Natural discharge | | | | | |
| Natural/man made disasters | | | | | |
| Supplies for the following users | | | | | |
| Irrigation | | | | | |
| Industries | | | | | |
| - Government | | | | | |
| - Private | | | | | |
| Domestic | | | | | |
| Outflows (to other territories, sea, inland water resources) | | | | | |
| Supplies on which water rates are levied | | | | | |
| Irrigation | | | | | |
| Industrial | | | | | |
| (Govt/Private) | | | | | |
| Domestic | | | | | |
| Others | | | | | |
| Free supplies | | | | | |
| Irrigation | | | | | |
| Industrial | | | | | |
| (Govt/Private) | | | | | |
| Domestic | | | | | |
| Others | | | | | |
| Revenues generated through usage of water * | | | | | |
| Irrigation supplies | | | | | |
| Industrial supplies | | | | | |
| Domestic supplies | | | | | |
| Others taxed supplies if any | | | | | |
| Variation between available resources and resources used during the year for different users | | | | | |
| Irrigation users | | | | | |
| Industrial users | | | | | |
| Domestic users | | | | | |

* - These figures would relate these tables with the revenues noted in the Finance Accounts under major, medium and minor irrigation schemes heads of accounts

Data in respect of groundwater and those in reservoirs are collected by the State Groundwater Boards on daily basis while the water data of streams, rivers etc are collected by the CWC

12.13 Source of data for Asset Accounts on Water Resources

While the primary source of water related data would be the CWC, CGWB along with their State formations, water data may also be available from the following sources which may also be used to feed information to the Asset Accounts on water resources.

Table - 17 Showing source of data (including probable reports/publications)

| Water |
|--|
| <ul style="list-style-type: none"> • Indian Meteorological Department • State Water Resource Department • Irrigation Department (<i>data on irrigation potential created, utilised etc</i>) • Public Health Engineering Department (<i>data on water supplies</i>) • Pollution Control Boards • Bore well agencies (<i>data on bore wells drilled across the region</i>) • Municipal bodies including all other sources using any type of water, i.e. apartments, domestic uses, construction agencies, industries using supply or underground water (<i>data on underground water usage and other sources of water supplies</i>) |

Note : The list is illustrative and not exhaustive and may vary from State to State.

12.14 Summing up

It is undeniable that water stress is not that straightforward and cannot be addressed by simple investment or adaptation of technologies. The water-human relation is more complex, it depends on population distribution over a specific area, impact from human activities on the environment and conversely influence of the environment on human life. Additionally, it depends on the ability of different sectors of society to utilize financial resources, incorporate knowledge and technologies, or use its authority to control the access to water resources.

Unlike mineral and energy resources, water asset accounts is expected to meet a number of challenges as discussed in this Chapter. While some of these hindrances are fundamental like wide availability and flow of data, some data being classified in nature; yet there are some avoidable ones like availability of information on water dependability among various types of users which can be developed along the course of preparation of Asset Accounts. Besides, there are other challenges as to curbing indiscriminate drawal of ground water and the need for a regulatory mechanism to control and monitor it. Also, the periodicity of the Asset Accounts and the authority which would consolidate and prepare it would need to be finalised. Nevertheless, this paper suggests initiating water accounts to take effect from 2022-23 thus allowing some time to settle these issues.

However, while the above issues are settled at the national level, the States may initiate preparation of Asset Accounts on Water resources on experimental basis in the above format which will enable the States to gain experience and help evolve the format to include all desired information before the target year of its implementation, i.e. 2022-23 beyond which its statutory use in the country becomes mandatory.



CHAPTER - XIII

PREPARATION OF ASSET ACCOUNTS - FORESTRY AND WILDLIFE RESOURCES

13.1 Forests - the balancer

Forests, by its term would mean an area covered mainly with trees and undergrowth and provides plethora of services from ecological, economic, social and cultural considerations. Forests, serve as the green lungs of the nation by providing ecological services like clean air, watershed protection, water flow regulation and rainfall generation, maintenance of soil-moisture by checking soil erosion, nutrient cycling and climate security etc. Natural forests with the huge stock of flora and fauna not only serve as hub of biodiversity but forests directly sequester Carbon dioxide from atmosphere and play a critical role in checking global warming and climate change as well. Forests check extension of sand-dunes preventing desertification. Healthy forest eco-systems are also necessary for reversal of land degradation.

The deep rooted importance of forests and the necessity to further its sustainable growth has been well acknowledged by the world as evidenced by the numbers of international endeavours towards protection and improvement of forests across the globe. The UN has been pioneering the process with a number of bodies and committees framed to monitor and suggest long term measures towards effective management of the forestry sector. In India, the Intergovernmental Panel on Climate Change, 2013, specifically mentions that 'protecting tropical forests therefore not only has a double-cooling effect, by reducing carbon emissions and maintaining high levels of evaporation from the canopy, but is also vital for the continued provision of essential life-sustaining services'.

India is endowed with rich forest types like Tropical Wet Evergreen Forests, Tropical Moist Deciduous Forests, Tropical Dry Deciduous Forests, Sub Tropical Dry Evergreen Forests, Himalayan Moist Temperate Forests, Sub-Alpine and Alpine Scrub Forests etc.

13.2 Legal framework for management of forests

India has developed a strong legal and policy framework for Forestry sector for sustainable forest governance through National Forest Policy, 1988, Indian Forest Act, 1927, Forest (Conservation) Act, 1980 and Wildlife (Protection) Act, 1972. National Forest Policy, 1988 sets a strategy of forest conservation with principal aim of ensuring environmental stability and maintenance of ecological balance by bringing a minimum of one-third of total land area of the country under forest or tree cover. National Forest Policy is now under revision to incorporate issues those have gained importance in last few decades.

Forestry sector is facing many challenges like forest fires, illegal felling of trees, illegal grazing, encroachments on forest lands, degradation of forest eco-systems etc. All protection related issues of forest and wildlife sector are dealt in Indian Forest Act, 1927, Wildlife Protection Act 1972, Forest Conservation Act, 1980 etc.

13.3 Scientific management of forests - Working Plans

Working Plans are the main instrument of forest management in the country for scientific management of forests. No departmental felling can be carried out without a proper working plan approved by the competent authority in the Environment, Forest and Climate change Department, Government of India. These are very useful document for evaluating the status of forests and biodiversity resources of forest division. These assess the impact of past management practices and prescribe suitable management interventions for future. Mechanisms to revise working plans are essential to keep pace with the trends emerging out of forest-people interface and to address national and international obligations. Currently all working plans are prepared according to National Working Plan Code, 2014.

13.4 Community participation in management of forests

As per the National Forest Policy, 1988, participation of local community living in and around the forest areas is essential for the conservation and development of forests. In order to implement this policy, the Government of India issued a clear Guideline to develop and manage degraded forest land under the custody of State Forest Departments (SFDs) with the help of the local communities and voluntary organizations. In pursuance of these guideline, states came out with their own resolutions on Joint Forest Management (JFM) in the state.

Most of the State Forest Departments notified their resolutions in early 90s and as of now 1,18,000 of Joint Forest Management Committees (JFMC) have been constituted all over the country to develop and manage 22 million hectares of

degraded forestlands. The Government of India through its National Afforestation and Eco-development Board also provide 100 *per cent* central grant for Forest Development Agency (FDA), which is a federated body of JFMCs and State Forest Development Agency (SFDA), which is a consolidated body of FDAs in the state. For the management of the Wildlife Protected Areas, Eco Development Committees (EDCs) are also formed to ensure peoples participation in wildlife conservation.

13.5 International participation

India has been participating in several international summits and conventions on conservation and sustainable development of forest, wildlife and environment. India is actively representing on various international forums on forestry matters viz. United Nations Forum on Forests (UNFF), Committee on Forestry (COFO) of Food & Agriculture organization (FAO) of the United Nations, Asia Pacific Forestry Commission (APFC) of FAO, Centre for International Forestry Research (CIFOR), Asia Pacific Forest Invasive Species Network (APFISN), International Poplar Commission of FAO, UN-REDD of United Nations Framework Convention on Climate Change etc. India has contributed positively to the various conventions on forest and wildlife sector.

13.6 Constitution of CAMPA Fund

Compensatory Afforestation Fund Management and Planning Authority (CAMPA) has been constituted to promote afforestation and regeneration activities for compensating for forest land diverted to non-forest uses. In states State CAMPA has been constituted to receive CAMPA funds collected from user agencies towards compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, Net Present Value (NPV) and all other amounts recovered from such agencies under the Forest (Conservation) Act, 1980. These funds are utilized for compensatory afforestation, assisted natural regeneration, conservation and protection of forests, infrastructure development, wildlife conservation and protection and other related activities.

13.7 Status of Forests in India - 2019

Every two years, Forest Survey of India (FSI) undertakes assessment of country's forest resources, the results of which are presented as the 'India State of Forest Report (ISFR)'. Since 1987, 15 such assessments have been completed and the current assessment is the 16th in the series. Based on the regular nation-wide mapping of forest cover, sample plots based national forest inventory and the specific studies conducted at the national level, the information presented in the ISFR 2019 is primary information on different parameters of the forest resources of the country.

The assessment of tree cover was started since 2001 in India. As per India State of Forest Report (ISFR) released in 2019, total forest and tree cover in the country is 7,12,249 sq km which is 21.67 per cent of total geographical land mass of India which can be classified into three density classes viz. Very Dense Forest (VDF - canopy density >70 per cent), Moderately Dense

Forest (MDF - canopy density 40 - 70 per cent) and Open Forest (OF - canopy density 10 - 40 per cent). Forest cover has increased from 6,38,804 sq km (19.43 per cent) as per ISFR 1989 to 7,12,249 (21.67 per cent) as per ISFR 2019 while the total tree cover outside forests has increased from 81,472 sq km (2.48 per cent) in 2001 to 95,027 sq km (2.89 per cent) in 2019. The current assessment of 2019 shows an increase of 3,976 sq km (0.56%) of forest cover, 1,212 sq km (1.29%) of tree cover and 5,188 sq km (0.65%) of forest and tree cover put together, at the national level as compared to the previous assessment i.e. ISFR 2017.

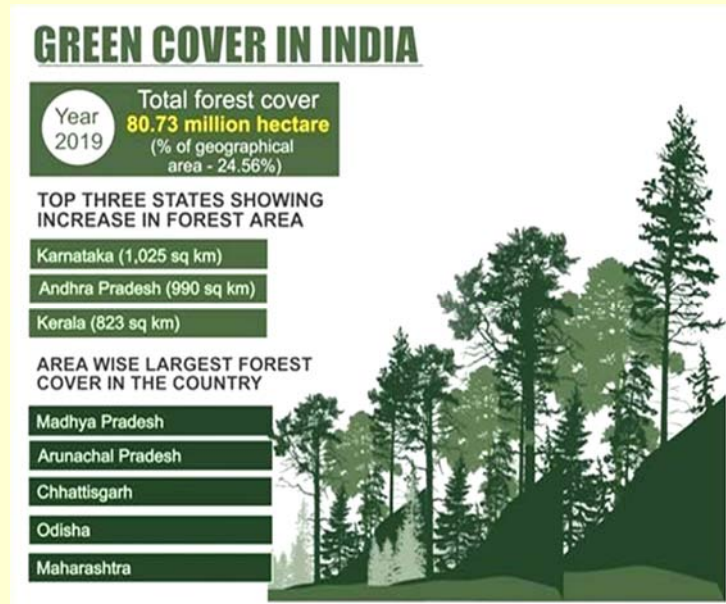


Figure 7 (Assessment of Green Cover)

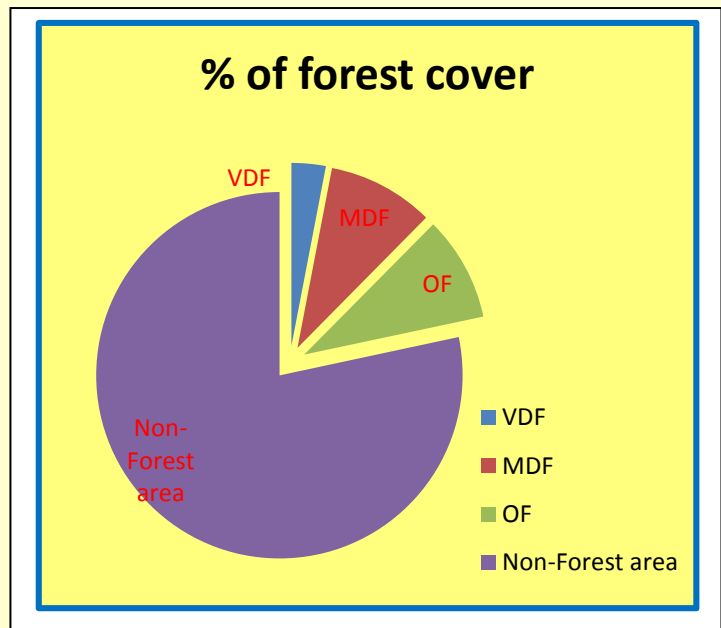


Chart - 2 (Forest cover of India)

13.8 Wildlife sanctuaries and national parks

National Parks and Wildlife Sanctuaries are extremely important for conservation and biodiversity and for ensuring the survival of floral and faunal components, not only for the present but also for the future. It is widely acknowledged that biodiversity is a major driving force for ecosystem functions. The Wildlife Act, 1972 promulgated to protect wildlife and related areas prohibits activities inside the national parks and regulates other activities in and around the wildlife sanctuaries and bio-sphere reserves. Undoubtedly, such an initiative to protect the flora and fauna of the wildlife spheres in the country has limited the activities within the wildlife areas and thus, enabling the cause of bio-diversity to nurture and flourish. At present, India has a network of 700 protected areas i.e. 103 national parks, 528 wildlife sanctuaries, 65 conservation reserves and four community reserves. The details of the protected areas in India are available at <http://www.wilervis.nic.in/Database/Protected Area 854.aspx>. The Government of India provides financial and technical assistance to the State/UT Governments for activities aimed at wildlife conservation through the central sponsored schemes for saving critically endangered species and habitats.

Tremendous biotic pressure from the ever increasing population and industrial activities are causing immense disturbance to the wildlife at large. These have been brought out in the Audit Reports of CAG on environmental issues as listed in Chapter VIII.

The Asset Accounts, once prepared mapping the wildlife areas in the States along with the wildlife stock of major species, will serve as a ready reckoner about the available wildlife areas and stock in the States, areas under encroachment/dispute which will help the authorities in effective decision making.

13.9 India's forests vis-a-vis forestry resources in the World

The Food and Agriculture Organisation of United Nations releases the Global Forest Resource Assessment (FRA) every five years. The last such report was released in 2015. An analysis of India's forests with the top 10 countries in respect of forest areas and forest carbon based on the FRA assessment of 2015 are as follows:

Table - 18 showing forest area for top ten countries in 2015

| Sl. No | Country | Forest area (000 ha) | % of country area | % of global forest area |
|--------|--------------------|----------------------|-------------------|-------------------------|
| 1. | Russian Federation | 8,14,931 | 48 | 20 |
| 2. | Brazil | 4,93,538 | 58 | 12 |
| 3. | Canada | 3,47,069 | 35 | 9 |
| 4. | USA | 3,10,095 | 32 | 8 |
| 5. | China | 2,08,321 | 22 | 5 |

| | | | | |
|-----|----------------------------------|----------|----|---|
| 6. | Democratic Republic of the Congo | 1,52,578 | 65 | 4 |
| 7. | Australia | 1,24,751 | 16 | 3 |
| 8. | Indonesia | 91,010 | 50 | 2 |
| 9. | Peru | 73,973 | 58 | 2 |
| 10. | India | 70,682 | 22 | 2 |

Table - 19 showing forest carbon stock in the top 10 countries

| Sl. No | Country | Carbon Stock (million cum) |
|--------|----------------------------------|----------------------------|
| 1. | Russian Federation | 1,27,900 |
| 2. | Brazil | 82,229 |
| 3. | USA | 41,227 |
| 4. | Democratic Republic of the Congo | 29,683 |
| 5. | Indonesia | 12,489 |
| 6. | Columbia | 8,806 |
| 7. | China | 7,827 |
| 8. | India | 6,754 |
| 9. | Guyana | 6,715 |
| 10. | Angola | 6,485 |

Thus, the status of India's forests when compared to top 10 countries are depicted through the tables above. With 22 *per cent* of its geographical area being covered with forests, India stands at 10th position among World's most forested countries while contributing two *per cent* of forests to the global geographical area.

13.10 Management of Forest Resources

Ministry of Environment, Forest and Climate Change

The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes. The primary concerns of the Ministry are implementation of policies and programmes relating to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development and enhancement of human well-being.

The Ministry also serves as the nodal agency in the country for the United Nations Environment Programme (UNEP), South Asia Co-operative Environment Programme (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and for the follow-up of the United Nations Conference on Environment and Development (UNCED). The Ministry is also entrusted with issues relating to multilateral bodies such as the Commission on Sustainable Development (CSD),

Global Environment Facility (GEF) and of regional bodies like Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Cooperation (SAARC) on matters pertaining to the environment. The broad objectives of the Ministry are as follows:

- Conservation and survey of flora, fauna, forests and wildlife;
- Prevention and control of pollution;
- Afforestation and regeneration of degraded areas;
- Protection of the environment; and
- Ensuring the welfare of animals.

These objectives are well supported by a set of legislative and regulatory measures, aimed at the preservation, conservation and protection of the environment. Besides the legislative measures, the National Conservation Strategy and Policy Statement on Environment and Development, 1992; National Forest Policy, 1988; Policy Statement on Abatement of Pollution, 1992; and the National Environment Policy, 2006 also guides the Ministry's work.

Forest Research Institute, Dehradun

Forest Research Institute (FRI), Dehradun made a humble beginning as the Forest School established in 1878. Initially named as Imperial Forest Research Institute, FRI came into being in 1906. Later renamed as Forest Research Institute and Colleges, with a number of centres located at different places all over the country administering research as well as training of Forest Officers and Forest Rangers. After reorganisation of Forestry Research in the country and creation of Indian Council of Forestry Research and Education in 1988, the training and research centers were given an independent status of institutes. FRI, now one of the institutes under ICFRE, was conferred the status of Deemed University in 1991.

Forest Survey of India

Forest Survey of India (FSI) is an organisation under the Ministry of Environment, Forest and Climate Change, Government of India. Its principal mandate is to conduct survey and assessment of forest resources in the country. It started as an organization called Pre- Investment Survey of Forest Resources (PISFR) in 1965 as FAO/UNDP/GOI Project. The changing information needs resulted in enlarging the scope of activities of PISFR and it was re-organized as Forest Survey of India in 1981.

The objectives of FSI *inter-alia* includes:

- Preparation of State of Forest report biennially, providing assessment of latest forest cover in the country and monitoring changes;
- Conducting inventory in forest and non-forest areas and database on forest resources;
- Functioning as nodal agency for collection, compilation, storage and dissemination of spatial database on forest resources; and
- Conducting training and strengthening research and development on applied forest survey techniques.

13.11 Management of Wildlife in India

In order to combat wildlife related crimes, Government of India has besides putting in place the stringent Wildlife Act, 1972, established a Wildlife Crime Control Bureau with five regional offices. The wildlife divisions deal with the policy and law matters and knowledge management for facilitating processes and analysis for evolution of policy and law for conservation of biodiversity and protected area network in the country. Wildlife division of the Ministry of Environment, Forest and Climate Change provides technical and financial support to the States for conservation and protection of wildlife areas across the states. Besides, there are other bodies like the Central Zoo Authority and the Wildlife Institute of India at Dehradun which are dedicated to wildlife preservation and development activities.

13.12 Need for Forest Asset Accounts

Forest is a dynamic natural resource because of the ecosystem cycles as well as its anthropogenic interfaces. In India, the dynamism of forests is greatly influenced by forest-people interaction. There is a large scale demand on forests for ecosystem services, meeting needs of people living close to forests for fuel wood, fodder, timber, non-timber forest produces etc and for development. Climate change on the other hand is causing increasing stress on the ecosystems. The significance of assessment and monitoring of forests has never been so high as in the present times. India took an early lead in remote sensing based forest cover monitoring as well as in forest inventory with use of latest technologies and improved methodologies in forest monitoring and assessment.

In the recent years, there is a growing recognition of the vital role played by forest ecosystems in ensuring the ecological security of the world. The ecosystem services that forests provide are essential for the existence of life on the Earth. The changes in forest ecosystems are highly dynamic in nature and therefore there is a need for regular monitoring to ensure balance between conservation and development. Asset Accounts can play a pivotal role in consolidating physical stock flows linking with the financials involved in the processes like the expenditure incurred in

increasing the forest areas while also mapping the revenues derived from planned felling of timber/extraction of non-timber forest produces.

13.13 Preparation of Asset Accounts - Forestry and Wildlife Resources

The above narratives would indicate that there is a well laid out system for preparation of overall forest inventory - state-wise across the country in every two years. Further, there has been 0.65 *per cent* growth in overall forest and tree cover in 2019 when compared to the position of 2017, taking the total tree and forest cover to 24.56 *per cent* of the total geographical area. This, when seen against the total target of foresting minimum one third of the total geographical area of the country as laid out in the National Forest Policy, 1988 indicates that India is slowly but steadily moving towards attaining the target. The States may like to map these data with their endeavours towards afforestation activities by incorporating the information of planned forestation activities, expenditure incurred and also deducting the scientific felling of timber for revenue generation. Also, the Asset Accounts will provide at a glance position of the wildlife activities in the States. The data sets, once prepared, would also help in identification of illegal exploitation of forests as well alongwith other disturbances like encroachments, industrial activities etc.

There is deviation between the classification of forests as per the SEEA (CF) and those under which data is maintained in India by the FSI. Thus, in keeping with the information maintained by the FSI and also with the flexibility allowed in SEEA (CF) to modify tables to suit the country-specific needs, the asset account of forests may be designed as under.

Table - 20 showing Asset Account for Forest Resources

| | Dense Forest | Moderately dense forest | Open Forests | Mangroves | Scrub | Non-forest areas |
|---|---------------------|--------------------------------|---------------------|------------------|--------------|-------------------------|
| Opening Stock (in sq km) | | | | | | |
| Additions during the report period | | | | | | |
| Reductions | | | | | | |
| Closing stock | | | | | | |

The second table of the Asset Account in physical and monetary terms showing stock of asset at the beginning and end of each of accounting years and changes in stock of forests during the year and the closing stock at the end of the reporting period. The table would also endeavour to cover the valuation of the forest cover, tentatively. If the States are not evaluating the forests at present, the same may be initially left blank and efforts made to institutionalise the system of valuation of the

forestry sector in each States and accordingly included in the Asset Accounts of the subsequent years.

Table - 21 showing subsidiary Asset Account linking the physical flows of Forest Resources with the valuation of resources

| | Dense Forest | Moderately dense forest | Open Forests | Mangroves | Scrub | Non-forest areas |
|---|--------------|-------------------------|--------------|-----------|-------|------------------|
| Opening Stock (in sq km) (Stock enumerated by ISFR 2019 may be reckoned as opening stock) | | | | | | |
| Additions during the report period | | | | | | |
| Planned additions in sq km/ha (plantation) | | | | | | |
| Expenditure incurred (₹ in crore) | | | | | | |
| Natural growth | | | | | | |
| Reductions | | | | | | |
| Scientific felling | | | | | | |
| Revenue realised ((₹ in crore) | | | | | | |
| Deforestation for developmental activities | | | | | | |
| Net present value realised (₹ in crore) | | | | | | |
| Natural causes/man made disasters | | | | | | |
| Value of forest property lost (₹ in crore) | | | | | | |
| Reported illegal felling | | | | | | |
| Value of forest property illegally felled (₹ in crore) | | | | | | |
| Closing stock | | | | | | |
| Tentative Value of closing stock (₹ in crore) | | | | | | |
| Stock as per ISFR | | | | | | |
| Variations | | | | | | |

The India State of Forest reports are generated by the FSI biennially and the States may carry out analysis of their stock with such Report at two year intervals. The possible reasons for variations could be (i) cases of illegal felling going undetected, (ii) acceptable differences in calculating area of planned forestation and that reported by satellite imagery and so on.

Secondly, the above Asset Accounts may be backed up by major species wise stock enumeration along with their value as per the royalty rates prevalent in the States. Besides, during the valuation of the forest resources, the States may give due weightage to the grade classification of the forest based on the extent and type of forest cover. This will enable the States to have an overall data set about the forestry sector along with the financials which could be used for effective

management of forests and also improving the quality of decision making backed by detailed database.

The Asset Accounts for wildlife resources in the States may be prepared in the format as in table - 22 below:

Table - 22 showing Asset Accounts of major Wildlife Resources

| | National Parks | Wildlife Sanctuaries | Conservation reserves | Community reserves | Bio-sphere reserves |
|---|-----------------------|-----------------------------|------------------------------|---------------------------|----------------------------|
| Opening Stock of wildlife areas (in sq km) | | | | | |
| Percentage of wildlife area in total forest area | | | | | |
| Opening stock of total count of major animals (separate species wise statement may be prepared) | | | | | |
| Area under human encroachment/industrial activities | | | | | |
| Additions, if any during the report period (in sq km) | | | | | |
| Planned additions in sq km | | | | | |
| Increase in number of animals (if census carried out during the year) | | | | | |
| Reductions (in sq km) | | | | | |
| Increased encroachment | | | | | |
| Industrial activities | | | | | |
| Reported poaching cases during the period | | | | | |
| Closing stock of wildlife area (in sq km) | | | | | |
| Closing stock of animals (separate species wise statement may be prepared) | | | | | |

13.14 Source of data for the Asset Accounts

While the concerned environment and forests Departments administering the forest resources in the States may be the primary source of data, information could be gathered from some other sources for cross referencing and reconciliation. Some of the probable sources of data/information are mentioned in the table below.

Table - 23 Showing source of data (including probable reports/publications)

Forestry and Wildlife Resources

- E, F & CC Department in each States (*working plans*)
- Forest Survey of India (*India State of Forest Report published every two years*)
- Mo E,F&CC, GoI
- Government and public sector agencies involved in construction activities (intake of timber along with its source)
- Land Revenue Offices - encroachment and other related activities information
- Wildlife divisions in each States and at the Centre
- Wildlife Institute of India, Dehradun
- Wildlife Crime Control Bureau

The list is illustrative and not exhaustive and may vary from State to State.

13.15 Summing up

The availability of broad based information on forests in every two year interval has been a definite advantage to the States. Besides, the forest cover as reported in 2019 is also registering an increasing trend when seen against the status of 2017. Thus, the overall position of forestry sector can be termed as relatively safe when compared to other resources like water or minerals. Yet, targeted illegal felling of matured and economically important timber species still continues to haunt the forest protection forces and diminishes forest cover while inflicting revenue loss to the State exchequers.

Though planned to be part of the mid-term goals for the years 2022-23 to 2024-25. preparation of the Asset Accounts on forests and timber resources can be initiated by the States on experimental basis which will enable the States to have at a glance position of their forest resources - species-wise, value of such resources as per prevalent royalty rates, extent of unreported illegal felling and so on. Initiation of the Asset Accounts in the States from the current year will allow some cushion for the Accounts to settle down while streamlining the systems to generate the required data presently unavailable for the tables in future till 2022-23 when the preparation of Asset Accounts on forests, timber and biodiversity resources becomes mandatory.



CHAPTER - XIV

PREPARATION OF ASSET ACCOUNTS - LAND RESOURCES

14.1 Land - the Lithosphere

Made up of rocks and minerals and covered by a thin layer of soil, it is an irregular surface with various land forms such as mountains, plateaus, plains, valleys etc. Lithosphere is the domain which provides us with forests, grasslands for grazing, land for agriculture and human settlements. It is also a source of mineral wealth.

14.2 Land resources

Land is a scarce resource required by different sectors of the economy like agriculture, industry, mining, for infrastructure development, urban planning, public utilities, housing etc and there are competing mutually exclusive and often conflicting demands for land and its resources by these economic sectors and for social needs. In this context, it is imperative that effective land use planning and management systems are put in place.

With growing population and changing industrial profile of economies, there is constant dynamism in land use pattern with potential for influencing economic growth, quality of life, management of environmental resources and nation's food supply. But as the resource is limited, it is important that the change in the land use pattern should not be indiscriminate. Land is required for both agriculture and non-agricultural purposes, including establishment of industries, housing, roads, parks, railway lines etc. Further, due to rapid industrialisation and population growth, land resources are under pressure from physical, human and global causes such as soil erosion, desertification, pollution, food shortage, and conflict, water shortage and climate change.

14.3 Factors mounting pressure on Land Resources

While the constantly increasing population could be regarded as the biggest contributory factor for effective management of land resources, there are other

factors too which play independent role in eroding land resources. These are *inter-alia* discussed below:

- Balance between agricultural and industrial activities;
- Degradation of land resources;
- Invasion of coastal land;
- Erosion by river/water bodies;
- Urbanisation due to biotic pressure on the cities.

Though some of the above may be nature driven, problem lies with market driven unplanned diversification and urbanisation resulting in non-sustainable patterns of development. A market driven land use pattern may yield higher returns in the short run, but may pose several unmanageable problems for future generations due to unplanned overexploitation of land, water and other natural resources. On the other hand, different types of land and locations are not equally suitable for different purposes due to their variedness in characteristics.

A substantial chunk of Indian population lives in rural India and are dependable on agricultural resources. Thus, it is of immense importance that a balance is maintained between retaining required land resources for agricultural sector while allocating required land for other sectors like industry, entertainment, ports etc. However, relaxation of extant restrictions on conversion of agricultural land and other land meant for welfare of landless people for non-agricultural purposes more specifically for industries, ports, entertainment parks, golf courses to name a few by different provincial Governments has posed an enormous threat to the agriculture based population. These conversions not only deprive the agriculture/fishery based population of their livelihood but also causes tremendous detrimental impact on the environment like air and water pollution, destruction of marine wealth and so on. Another aspect of concern is invasion of coastal land for industrial and other purposes. In the ecologically fragile and sensitive coastal zones as well, chemical, copper smelting, steel, cement factories, thermal power stations, petroleum refinery and several other polluting industries are being set up. Equally, the green zones, no-development zones declared earlier are being either withdrawn or overpowered to develop hill stations, tourist resorts by private developers.

In this backdrop, a flip side of the issue lies in the land use and land cover pattern followed in India which do not provide for land used for industrial, entertainment, ports etc purposes. In today's rapidly evolving world, more emphatic categorisation of land resources would provide key to monitoring the land use and land conversions, both legally and illegally. Thus, in addition to the land use and land cover categories prevalent in India, other sub-categories are ought to be inserted so as to monitor the above conversions on regular basis.

14.4 Some statistics of Land resources

The evolution of land use statistics in India dates back to 1866 when the British administration took interest in the compilation of land data to enhance its revenue collection. The data collection further refurbished by adding crop forecasts. The wheat forecast was introduced in 1884 and further improved the system in 1900 by addition more crops like oilseeds, rice, jute, indigo and sugarcane. The recommendations of the Royal Commission on Agriculture in 1928 further strengthened the statistical system and increased the coverage. The need for reliable data on area under food crops and food production was felt when there was shortage of food and the great famine of India just after the second World War.

The land use statistics in India were developed as a source of information for planning of agricultural production. Out of the geographical area of 328.73 million hectares, statistics are available for 305 million hectares, i.e. more than 93 *per cent*. As per the latest data available, i.e. as of 2012, the break-up of land cover among various purposes namely, agriculture, barren/unculturable/wasteland, built up, forest, grass/grazing, snow and glacier and wetlands/water bodies were as under:

| Type of usage | Land cover (in sq km) |
|--------------------------------|-----------------------|
| Agriculture | 18,08,210.82 |
| Barren/Unculturable/Wastelands | 396402.69 |
| Built up | 107958.69 |
| Forest | 736859.13 |
| Grass/grazing | 35460.48 |
| Snow and glacier | 63953.61 |
| Wetlands/Water bodies | 138417.58 |
| Total | 3287263 |



Chart - 3 (Types of land cover)

An analysis of the land cover during 2011 - 12 when seen against the figures of 2005-06 would reveal that while the cover on agriculture, grass/grazing land, wetlands/water bodies did not show major change, barren/unculturable/wastelands, built up, forests increased from 11.89 to 12.06 *per cent*, 3.11 to 3.29 *per cent* and 22.33 to 22.42 *per cent*. However, the snow and glacier cover registered an alarming trend of reduction from 2.56 to 1.95 *per cent* between these seven years which could be a matter of grave concern. The present system of land resource monitoring provides data in an interval of six years which is quite a long gap given the rapidly changing economic and societal structure of the countries. Real time data is the essence of the day and thus, there is a need to revisit the periodicity of generation of data in respect of land resources to reduce them to bring them in parity to other similar resources like forests which is released in

every two years. Periodic monitoring of the land cover would generate more information for the public at large and also enable better management of land on sustainable basis.

14.5 Management of Land Resources

The Department of Land Resources, Government of India is mandated to manage the land resources in the country. The vision of the Department is to ensure sustainable improvement in productivity and livelihood/income potential of land, in particular rainfed cultivated areas and culturable wasteland and also to develop an appropriate integrated land information management system, which *inter-alia* improve real time information on land, optimise use of land resources and assist in policy and planning.

The following are the functions of the Department of Land Resources:

- Implementation of watershed programme for development of rainfed/ degraded areas;
- Guide and facilitate States to modernize land record management and build up a land information system;
- Facilitate States efforts to usher in conclusive titling system;
- Administration of Land Acquisition Act and right to fair compensation and transparency in land acquisition and Resettlement Act, 2013 and matters relating to acquisition of land for purposes of the Union and Registration Act;
- To facilitate adoption of policy for Rehabilitation & Resettlement of displaced people; and
- Land reforms, land tenure, land records, consolidation of holding and other related matters.

14.6 Preparation of Asset Accounts of Land Resources

Analysis of the land use classification as defined by the SEEA (CF) and the Indian system of land categorisation indicates deviations. Thus, in keeping with the land use classification used in India and also availability of information, the asset account for land cover may be designed as under :

Table - 25 Showing Asset Account for Land Cover

| Classification | Sub-classification | Opening stock | Addition to stock | Reduction in stock* | Closing stock |
|----------------|------------------------------|---------------|-------------------|---------------------|---------------|
| | | (in sq km) | | | |
| Agriculture | Crop land | | | | |
| | Current shifting cultivation | | | | |
| | Plantation | | | | |
| | Farmland | | | | |

| | | | | | |
|--|------------------------------|--|--|--|--|
| | Fallow | | | | |
| Barren/ unculturable/ Wasteland | Barren Rocky | | | | |
| | Gullied/Ravinous Land | | | | |
| | Rann | | | | |
| | Salt affected land | | | | |
| | Sandy area | | | | |
| | Scrub Land | | | | |
| Built up | Mining | | | | |
| | Rural | | | | |
| | Urban | | | | |
| Forest | Deciduous | | | | |
| | Evergreen/Semi- evergreen | | | | |
| | Forest plantation | | | | |
| | Scrub forest | | | | |
| | Swamp/mangroves | | | | |
| Grass/grazing | Grass/grazing | | | | |
| Snow and glacier | Snow and glacier | | | | |
| Wetlands/Water bodies | Inland wetland | | | | |
| | Coastal wetland | | | | |
| | River/Stream/Canals | | | | |
| | Water bodies | | | | |

* - including natural and man made disasters.

In order to capture all information related to change in land use during the period in each of the States, the following table is proposed.

Table - 26 showing details of changes in land use pattern during the period

| Particulars | | Volume of land | Valuation as per Government Rates | Market Value of land | Purpose of acquisition |
|---|----------------|---------------------------|--|-------------------------------------|---------------------------------------|
| Land acquired by Government during the period (Government acquisition) | | | | | |
| Nature of land which was acquired (existing land use) | Agriculture | | | | |
| | Forest | | | | |
| | Hills | | | | |
| | Coastal zone | | | | |
| | Rural | | | | |
| | Urban | | | | |
| | Others | | | | |
| Land allocated by Government during the period (Government allocations only) | | | | | Further Details of the land use |
| Allocated for the purpose of | Government use | | | | |
| | Industry | | | | |
| | Ports | | | | |

| | | | | | |
|--|---|--|--|--|--------------------------------------|
| | Entertainment zones/parks | | | | |
| | Holiday resorts/tourism | | | | |
| | Golf Course | | | | |
| | Others | | | | |
| Land use changed during the year (other than Government acquisition and Government allotments) | | | | | Purpose for which land is to be used |
| From (existing usage) | To | | | | |
| <ul style="list-style-type: none"> • Agriculture • Forest • Hills • Rural • Urban • Others | <ul style="list-style-type: none"> • Government use • Industry • Ports • Entertainment park • Golf Course • Tourism | | | | |

Note : The types of land classification shown in the table are indicative only and may be changed based on the need.

14.7 Periodicity of data generation - a challenge

As per the present arrangement, land use and land cover data is generated every six years and the last such data was generated upto the year 2018. But, this paper proposes the concerned authorities to revisit the periodicity to make it more frequent like in every two years as is done in case of forestry sector by the Forest Survey of India. The computerisation of land records being overseen by the Department of Land Records will make it easier to monitor reclassification of land if the software is suitably programmed to automatically feed data to the overall land database of each State. That would enable real time data availability as with every entry of change in land use and land ownership the system would change the data on overall data on land use and land cover in the State.

14.8 Source of data for Asset Accounts

While the Department of Land Records, Government of India, National Remote Sensing Center, Department of Space would be the nodal authorities for all land related information, data can be collated from the other authorities like the local registration authority, the town municipalities, *gram panchayats* in the States. However, a requisite manoeuvre in the software of digitisation of land records as discussed above would make it easy to effect changes in the overall database of land use and land cover of the State, on regular basis.

14.9 Summing up

The above paragraphs discussed about the present system of land recording, role of the Department of Land Records, need for periodic Asset Accounts on land records etc. Also, the difficulty in preparing Asset Accounts in the existing system of availability of data in every six years has also been discussed. While this may continue to hinder preparation of Asset Accounts in frequent intervals, other options which could come handy like manoeuvring the digitisation of land records software to feed data to the overall land use database has also been pondered upon. Besides, the continuous pressure to the land belonging to the agriculture based, marine products, forests/hills etc to make room for industries, entertainment parks, tourism, golf course etc have also been discussed to highlight the need for balancing between them. The proposed Asset Accounts has been designed to capture all such details of land use and changes in land use during the reporting period which can provide detailed inputs to policy makers as well as the public at large.



CHAPTER - XV NRA - ISSUES AND CHALLENGES

15.1 While the suggested implementation plan of NRA as discussed in Chapter X (Way Forward) has noted some inevitable challenges to be dealt along the process of implementing the proposed targets, there are some other issues which would continue to hinder NRA. These are discussed in the succeeding paragraphs.

15.2 Issues and Challenges - part of Way Forward

Issues and challenges which will have to be mandatorily dealt with for effective implementation of NRA in India as envisaged in the short, mid and long term plans at Chapter X on Way Forward.

15.2.1 Continued preparation of asset accounts

NRA hinges on continuity of preparation of accounts at periodic intervals and although the MoSPI has prepared a stock account in the shape of EnviStats 2018, the stock position needs to be updated periodically to serve the purpose of NRA. The Report on Green National Accounts in India by Professor Sir Partha Dasgupta has proposed that the Planning Commission (the NITI Aayog) can help in putting in place a mechanism for estimating shadow prices and the natural ranges.

Currently, a number of agencies are involved in the process of economic evaluation and reporting, namely the CSO under the MoSPI, *Niti Aayog* etc. The MoSPI has the mandate for compilation of accounts of the resources at the national level as per the Allocation of Business Rules. While asset accounts of some of the resources would be prepared annually, MoSPI may compile the national asset accounts. In view of their mandate.

15.2.2 Limitations in preparing the asset accounts - mapping the periodicity of data

One of the limitations in preparing the asset accounts is the availability of current information as is evident from the fact that various agencies entrusted with collection and collation of data has been practicing different data periodicities. While the IBM mentions the mineral yearbook of 2018 (latest addition) as its last

compilation, the India State Forest Report has been issued upto 2019. Similar disparity in periodicity and last reported figures exists in respect of land cover and water resources as well. This is also evidenced from the asset account prepared by the MoSPI (EnviStats). In that compilation, data for the years 2005-06 and 2011-12 in respect of land resources could be compiled. Forest resources were analysed for the years 2004-05, 2011-12 and 2015-16. Water data was available upto 2016 while the minerals data for the years 2005, 2010 and 2015 were analysed. Thus, there is a need to map the periodicity of collection of information by the concerned agencies like the NSRC for land records, FSI for Forest resources, CWC and the CGWB for water resources and IBM, Ministry of Petroleum and Natural Gas for the minerals with the periodicity of preparation of asset accounts in every three/four years, henceforth.

Accordingly, the periodicities at which data is collected by these entrusted agencies will have to be aligned with the periodicity of asset accounts, once the commencement year and the next period ending for preparation of asset accounts, is finalised. For example, if the next asset accounts are targeted to be prepared for 2019-23, the agencies would have to gather data accordingly.

15.2.3 Validation of data

Similar to availability of data for the required periodicity, validation of data is another aspect needing attention. Though collection of data from the source agencies is being proposed in this paper, however, if the same is collected and used without validation of data, some sort of disclaimer would have to be inserted in the accounts as to non-validation of data till a robust system of validation of data being maintained by the agencies is installed and starts working.

15.2.4 Multiple agencies in data collection in respect of water resources- issues of data sharing/data conflict/classified data

There are multiple agencies collecting data in respect of the resources. For instance, data in respect of water resources are gathered by CWC/CGWB/Pollution Control Board/Indian Meteorological Department. Not all information on water resources are available publicly and may result in significant delay in collating the data for the asset accounts. Secondly, there are chances of data conflict in view of collection and maintenance of data of same resources by multiple agencies. Thirdly, data in respect of rivers like Ganga, Brahmaputra and Indus are classified and cannot be published publicly. Also, water resources in these rivers are substantial and thus, any asset account prepared without information from these river basins would be rendered incomplete and not project the true and fair picture of water resources in India. As environmental accounting is both a national and international concern which impacts our very survival, a protocol similar to

defence needs to be developed to access data for the mapping of trans-boundary rivers for making asset accounts of water.

15.3 Other probable hindrances

Other challenges which are not directly linked for proposed implementation of NRA in India but would continue to hinder effectiveness of the database and other records related to NRA are discussed below.

15.3.1 Unregulated extraction of underground water

Underground water is often extracted by drilling for domestic as well as industrial purposes and the authorities have little or no knowledge about these activities. And, as the authorities are unaware about the drilling and extraction of water, understandably, no data is available on use of such water for domestic and industrial purposes. While preparing the account of water, these data - though equally important like other water sources, would remain outside the coverage.

Thus, each of these underground usage of water like industries and households/apartments using bore wells would need to be brought under monitoring by fixing water meters. Even if usage of water remains untaxed, the usage would need to be monitored and reported.

15.3.2 Unscrupulous mining companies/agencies

No measure of the Government would suffice and an NRA would fail to deliver its desired results till illegal mining is reasonably curbed or contained. 'Sustainable development', an all-inclusive concept basically means economic and social development that endures over the long-term and its core ethic is intergenerational equity. Sustainability principles have application for all stages of mine life cycle – exploration, mine planning, construction, mineral extraction, mine closure and post-closure reclamation and rehabilitation. These principles include elements such as intra and inter-generational equity, the precautionary principle, scientific mining, management of environmental and socio-economic impacts, creation of substitute capital in the form of social and physical infrastructure and stakeholder engagement.

As per information available in public domain, 3,28,739 cases of illegal mining of sand were detected by the States during 2016-17 to 2018-19 (three year period). The volume of sand seized were not available but the States recovered fine of ₹ 2,703.24 crore¹⁸.

¹⁸ The data excludes information of major States like Assam, Punjab and West Bengal which have not sent the quarterly reports to the IBM which compiles such data. These are cases which were detected by the State machineries and there is no data as to the volume of minerals illicitly removed and could not be detected by the agencies.

Such illicit mining has to be reasonably curbed through concerted efforts and MIS and other certifications so that all mining/extractions/abstraction are brought under the reporting mechanism for optimum management of the resources.

15.3.3 Untapped resources

The data collected by the agencies on mineral reserves may not include the undiscovered resources which exists outside the known deposits. A study by the ASSOCHAM revealed that over 80 billion tons of India's mineral reserves still remain to be tapped. As envisaged in the SEEA (CF), the figures of physical stock in the asset accounts would therefore be dynamic and need to be updated from time to time as and when these new discoveries come to light.

15.3.4 Not all resources are economically exploitable

There are a number of conditions under which natural resources are not available for exploitation i.e. legislatively withdrawal, withdrawal due to Court interventions and ban, natural intervention. For example, the Supreme Court of India ordered complete ban on felling of timer in North East India in 1996. Thus, timber resources which were earning substantial revenues for the States had to be suddenly withdrawn from the system. Similarly, the NGT has banned rat hole mining of coal in Meghalaya. And, coal was one of the principal source of non-tax revenues for Meghalaya. Example of natural intervention is bamboo flowering which occurs after about 50 years and all the standing bamboo stock dies. It takes about four years for the regenerated stock to become exploitable. Thus, in the above circumstances there will be blockage in the physical flow during the intervening period which would need to be explained in the physical asset accounts.

15.3.5 Land laws in the country

As enshrined in the VIth schedule of the Constitution, majority of the land in North East India in the States of Assam, Meghalaya, Mizoram, Tripura having tribal population, are either privately or community owned and the States do not claim any right. The private owners of the land as well as community owners have both the surface right as well as sub-soil rights as also held by the Supreme Court of India in its various pronouncements. Thus, in such conditions, the land-owner and not the State is the owner of the minerals endowed under the land held by him. Removal of minerals from such land, though resulting in depletion, would tantamount to only recovery of royalty by the Governments while the ownership would remain with the land owners. This would have to be appropriately handled while ascribing market value to resources.



CHAPTER - XVI

NRA - PARTICIPATION OF PRIVATE SECTOR

16.1 In the context of requiring environmental related disclosures from business units in the private sector on a periodic basis, the first public announcement was made by the Government of India in 1991, immediately after adopting the financial reforms that liberalized the economic policies of the country. 'Companies act 2013 emphasizes on corporate social responsibility that makes it mandatory for certain class of profitable enterprises to spend money on social welfare activities. Also it provides that the companies are required to give more disclosures besides Company's general state of affair and financial performance regarding conservation of energy and environmental protection. The Union MoEFCC has issued various instructions to prepare environment statements, it is mandatory in the country to get an environmental clearance for all new projects that concerns from both the Union MoEFCC and the corresponding State Government departments of environment. There are various guidelines in this regard and all such projects are expected to obtain environmental and antipollution clearance before they are actually set up. It can be observed through their accounts that mainly the following set of information is disclosed -

- 1) The type of devices installed to control pollution
- 2) The steps taken for energy conservation
- 3) Steps taken for optimum utilization of resource
- 4) Steps taken for decompose the waste water and production process waste
- 5) Steps taken for improving the quality of product and services, production process etc.

India is a fast developing country wherein due to liberalisation and globalisation, private sector plays an increasingly important role especially since the focus on Make in India policies. A large number of private sector players are based on natural resources which are either being consumed in manufacturing activities or exported as it is. The Cases of illegal extraction of natural resources has been

discussed in some of the preceding chapters. This may be carried out by an individual person/entity or in an organised manner. In the wake of such developments and in view of the importance of compiling and certifying environmental accounts, private sector has to be more sensitive and rise to the occasion when the nation is contemplating inclusion of the natural resources in its economic parameters in line with the international best practices and the SDGs 2030. And such efforts cannot succeed without a concerted effort of the Government as well as the private sector.

In view of the importance of participation of the private parties as to the manufacturing industries, export business and other enterprises using natural resources, each of the private sector entities is expected to participate in this process by disclosing and declaring the source of natural resources being consumed/resold or used in any form whatsoever by them including the fact that these were authorised by the concerned entities of the Government on payment of requisite royalty/fees/cess on such resources. Also, they ought to disclose the means of disposal of effluents and other wastes and also amount spent on waste management, their treatment before release and on mitigation of environmental damage Besides, the entities would also need to disclose the source of water resources used in the manufacturing process or other activities.

The declaration would have to be three pronged - first a certificate whether natural resources are used and if yes, a NRA account while the second one is a declaration regarding disposal of effluents and other wastes as per the prescribed procedure including amounts spent on such treatment facilities and also to mitigate environment degradation. The third would be a water account. The Ministry of Corporate Affairs, GoI, The Customs Department, GST authorities of the Center (GSTN) and the State Governments, Real Estate Regulatory Authority have to be involved in the process to make this a pre-requisite for all entities under these authorities to submit the certification and the asset account, mandatorily with the balance sheets/audited accounts, annually.

16.2 Format for asset accounts for private enterprises

Natural Resources Account *(to be filled by any business activity which declares to have used natural resources in manufacturing or any other activities including exports)*

Table 27 Showing Asset Account to be prepared by entities using natural resources

| Natural Resources used during the accounting period | Opening stock | Physical units procured/mined during the accounting period | Whether directly procured/mined from the source under permit from Government agencies or purchased from the market | Amount paid (royalty/fees/cess or market price) and whom the amount is paid to | Physical units used in manufacturing process/exported/consumed | Closing stock |
|---|---------------|--|--|--|--|---------------|
| | | | | | | |
| | | | | | | |
| | | | | | | |

16.3 Format for disclosing information regarding discharge of effluents, treatment facilities and amounts spent on such treatment and mitigation of environmental degradation

| Nature of industry | Details of effluent treatment facilities | Whether effluents treated as per the prescribed parameters | Amount spent on treatment of effluents before release | Whether there has been any release of effluents without treatment | Details of treated industrial effluents released (in the air, land and water separately) | Amount spent on mitigation of environmental degradation | Other information or disclosures, if any |
|--------------------|--|--|---|---|--|---|--|
| | | | | | | | |

16.4 Format for Water Account (to be prepared by any business, private or co-operative body using water from any source)

Table 28 Showing Water Account to be prepared by entities using natural resources

| Reporting items | Response | Units in physical and monetary terms |
|--|----------|--------------------------------------|
| Source of water (municipal supply, under ground boring, purchase from outside source) | | |
| If municipal supply, whether water tax is levied by the authority. If yes, amount paid during the reporting period | | |
| If underground boring, whether permission of competent authority obtained before boring | | |
| Depth at which bore well has been lodged | | |
| Whether water meter affixed for gauging drawal of water from bore well | | |
| Whether volume of water drawn during the period is ascertainable. If yes, details | | |

The declaration and the asset accounts for natural resources and water would need to be part of audited accounts submitted by each of the entities to the authorities stated above. This would ensure monitoring on usage of natural usage including water and also enable the authorities to detect unauthorised extraction/ abstraction of resources.

16.5 Centralised data maintenance and online data entry

As the aforesaid information regarding the use of resources and release of residuals/effluents into the nature would be required for the supply and use tables of NRA, it would be imperative that the above data be maintained and monitored centrally and the entities mandated to fill the data online through input forms. This will ensure that the desired data are readily available centrally and can be used for the intended purposes.



CHAPTER - XVII

DISCLOSURE ON RECEIPTS AND EXPENDITURE RELATED TO NRA

17.1 Disclosures to Accounts - Role of GASAB

While preparation of Asset Accounts embedding the revenues earned through exploitation of resources as discussed in the Chapters X to XIV would largely suffice the requirements of the first among the four stages of NRA implementation as envisaged in SEEA (CF), the next stage i.e. preparation of supply and use tables would need some more information as to the expenditure incurred on management of resources but also those incurred on mitigation of environmental damage occurred due natural resources exploitation and usage.

GASAB is mandated to prepare and propose accounting standards and guidance notes to serve as disclosure to the Government Accounts. The disclosure statements are intended not only to enhance the accountability mechanism but proper accounting disclosures would lead to more clarity in the financial reports thereby assisting the Government to balance its assets and liabilities, calculate the fiscal parameters and enhance the quality of decision making.

17.2 Disclosure on natural resource related activities

Heads of accounts under which revenues are accrued through exploitation of natural resources have been discussed in Chapter - IX. However, it has also been discussed that not the entire amounts accrued under these heads relate to revenues but include other administrative and application fees as well. Similarly, expenditure from these heads are incurred on direction and administration, collection charges of resources besides expenses towards mitigation of environmental damages some of which are also incurred from other heads of expenditure accounts. Nevertheless, some expenditure incurred by the Pollution Control Boards. Municipal bodies or other similar autonomous bodies may not be specifically depicted in the Accounts. These would need to be brought under one head and disclosed through the financial statements to depict expenditure on resource related activities like pollution control, mitigation of degradation of environment, mine closures, river cleaning expenses, specific ailments rendered by exploitation of resources etc. in the long run.

Secondly, the Central as well as State Governments levy a number of taxes, royalties and cess for environment degradation from mining, deforestation, plying of diesel vehicles. For example, road tax collected on diesel vehicles are higher than petrol vehicles, net present value equal to cost of afforestation of double the area allowed for deforestation is collected and so on. The taxes/royalty/cess and other levies are meant to be utilised for restoration of environmental degradation. These collections are shown as revenues in the books of accounts of the respective entities/Governments and accordingly depicted in the financial statements of the Government(s). However, under the present system, there is no verifiable mechanism to regularly monitor their allocation for the desired causes as no specific head of accounts exist in the accounting framework for one to one analysis.

17.3 Preparing the disclosures

Availability of almost all revenues realised through exploitation of resources presently would be a definite advantage in initiating the disclosure statement. However, identifying all the potential sources of expenditure incurred on resource management as well as environmental damage mitigation activities will remain a challenge. Nevertheless, GASAB with its well laid out working mechanism can take this work forward. The expectation would be to map the revenues and all possible expenditure on resource management and related activities. Tentative outline of the proposed disclosure statement is given through the table below.

Table No. 29 Showing tentative outline of proposed disclosure statement on NRA

| Name of the natural resource : | | | | | | |
|--|---|---|------------------|---|---|--|
| Year : | | | | | | |
| Volume of natural resources extracted/abstracted during the year | Revenues collected on extraction/abstraction of resources | Expenditure incurred on management of resources | | | | Variation between receipts and total expenses (col 3 less col 6) |
| | | Direction and Administration | Collection costs | Mitigation of environmental degradation | Total expenditure incurred on management of resources and mitigation of environmental degradation | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (in cum/ tonnes) | | (₹ in crore) | | | | |
| Use in Govt sector | | | | | | |
| % of total proved reserve | | | | | | |
| Use by private sector | | | | | | |
| % of total proved reserve | | | | | | |

Notes :

- (i) Resources extracted/abstracted for Government sector use and private sector use (showing separately own consumption, exports in crude form or with some form of manufacturing) to be shown separately.
- (ii) As envisaged in SEEA (CF), total proved reserve of natural resources to be reckoned as resources available at the beginning of the year.

17.4 Summing up

The table is purely tentative and may be changed based on the need after detailed analysis of information available and those obtained from other sources. The benefits of floating a separate standard in the form of additional disclosure in the financial statements of the Government(s) has been discussed in some of the preceding paragraphs. Also, mapping the expenditure on reversal of degradation caused by resource exploitation would help the entities with valuable information required for preparation of supply and use tables in which the expenditure on mitigation of environmental degradation would have to be deducted from the economic gain accrued to the entities through resource exploitation. Besides, such information would be highly crucial for the authorities to decide on continuing resource exploitation, analysing the rates of royalties or other pricing methodologies and also decide on allocation of resources based on the sound database on actual expenses incurred in resource exploitation and environmental damage mitigation measures which is presently not available.

Annexure - A

**Members of Internal Working Group on NRA
(Reference : Write up on making of this Paper)**

| Sl. No. | Name | Designation |
|----------------|--------------------------------------|--|
| 1. | Ms Divya Malhotra/ Shri R M Johri | Director General (GA) & Member Secretary (GASAB) |
| 2. | Shri Manish Kumar | Director General, iCED, Jaipur |
| 3. | Shri S K Jha | Director General of Audit, Environment and Scientific Departments Audit |
| 4. | Shri Dinesh Bhargava | Director General, GASAB |
| 5. | Ms Asha Rani Rungta | Principal Director, GASAB |
| 6. | Ms Monika Verma | Accountant General (A&E)-II, U.P. |
| 7. | Shri Ashok Sinha/Shri K S Ramuwalia | Principal Director, GASAB |
| 8. | Ms P Bhanumati | Deputy Director General, Ministry of Statistics and Programme Implementation, Government of India |
| 9. | Professor Purnamita Dasgupta | Head of Environment and Resource Economics Unit, Institute of Economic Growth |
| 10. | Ms Aastha Dwivedi/Ms Anshu Singh | Assistant Director/Deputy Director General - Statistics, Ministry of Environment, Forest & Climate Change, Government of India |

Annexure - B
Sustainable Development Goals and associated targets
(Reference :Para 2.1)

| Goals | About the Goals | Associated targets |
|---|--|---------------------------|
| GOAL - 1 No Poverty | End poverty in all its forms everywhere | 7 |
| GOAL - 2 Zero Hunger | End hunger, achieve food security and improved nutrition and promote sustainable agriculture | 8 |
| GOAL - 3 Good health and well being | Ensure healthy lives and promote well being for all at all ages | 13 |
| GOAL - 4 Quality education | Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all | 10 |
| GOAL - 5 Gender equality | Achieve gender equality and empower all women and girls | 9 |
| GOAL - 6 Clean water and sanitation | Ensure availability and sustainable management of water and sanitation for all | 8 |
| GOAL - 7 Affordable and clean energy | Ensure access to affordable, reliable sustainable and modern energy for all | 5 |
| GOAL - 8 Decent work and economic growth | Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all | 12 |
| GOAL - 9 Industry, innovation and infrastructure | Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation | 8 |
| GOAL - 10 Reduced inequality | Reduce inequality within and among countries | 10 |

| | | |
|---|---|----|
| GOAL - 11 Sustainable cities and communities | Make cities and human settlements inclusive, safe, resilient and sustainable | 10 |
| GOAL - 12 Responsible consumption and production | Ensure sustainable consumption and production patterns | 11 |
| GOAL - 13 Climate action | Take urgent action to combat climate change and its impacts | 5 |
| GOAL - 14 Life below water | Conserve and sustainably use the oceans, seas and marine resources for sustainable development | 10 |
| GOAL - 15 Life on land | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt biodiversity loss | 12 |
| GOAL - 16 Peace and justice strong institution | Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels | 12 |
| GOAL - 17 Partnership to achieve goal | Strengthen the means of implementation and revitalise the global partnership for sustainable development | 19 |

Annexure - C

Statement showing approaches for managing the risks of climate change
(Reference :Para 3.2)

| Category | Examples |
|------------------------------|---|
| Human Development | Improved access to education, nutrition, health facilities, energy, safe housing and settlement structures and social support structures, reduced gender inequality and marginalisation in other forms. |
| Poverty alleviation | Improved access to & control of local resources; Land tenure; Disaster risk reduction; Social safety nets & social protection; Insurance schemes. |
| Livelihood security | Income, asset & livelihood diversification; Improved infrastructure; Access to technology & decision making fora; Increased decision-making power; Changed cropping, livestock & aquaculture practices; Reliance on social networks. |
| Disaster risk management | Early warning systems; Hazard & vulnerability mapping; Diversifying water resources; Improved drainage; Flood & cyclone shelters; Building codes & practices; Storm & wastewater management; Transport & road infrastructure improvements. |
| Ecosystem management | Maintaining wetlands & urban green spaces; Coastal afforestation; Watershed & reservoir management; Reduction of other stressors on ecosystems & of habitat fragmentation; Maintenance of genetic diversity; Manipulation of disturbance regimes; Community-based natural resource management. |
| Spatial or land use planning | Provisioning of adequate housing, infrastructure & services; Managing development in flood prone & other high risk areas; Urban planning & upgrading programs; Land zoning laws; Easements; Protected areas. |
| Structural/Physical | Engineered & built-environment options: Sea walls & coastal protection structures; Flood levees; Water storage; Improved drainage; Flood & cyclone shelters; Building codes & practices; Storm & wastewater management; Transport & road infrastructure improvements; Floating houses; Power plant & electricity grid adjustments. |
| | Technological options: New crop & animal varieties; Indigenous, traditional & local knowledge, technologies & methods; Efficient irrigation; Water-saving technologies; Desalinisation; Conservation agriculture; Food storage & preservation facilities; Hazard & vulnerability mapping & monitoring; Early warning systems; Building insulation; Mechanical & passive cooling; Technology development, transfer & diffusion. |
| | Ecosystem-based options: Ecological restoration; Soil conservation; Afforestation & reforestation; Mangrove conservation & replanting; Green infrastructure (e.g., shade trees, green roofs); Controlling overfishing; Fisheries co-management; Assisted species migration & dispersal; Ecological corridors; Seed |

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| | <p>banks, gene banks & other ex situ conservation; Community-based natural resource management.</p> <p>Services: Social safety nets & social protection; Food banks & distribution of food surplus; Municipal services including water & sanitation; Vaccination programs; Essential public health services; Enhanced emergency medical services.</p> |
| Institution | <p>Economic options: Financial incentives; Insurance; Catastrophe bonds; Payments for ecosystem services; Pricing water to encourage universal provision and careful use; Microfinance; Disaster contingency funds; Cash transfers; Public-private partnerships.</p> |
| | <p>Laws & regulations: Land zoning laws; Building standards & practices; Easements; Water regulations & agreements; Laws to support disaster risk reduction; Laws to encourage insurance purchasing; Defined property rights & land tenure security; Protected areas; Fishing quotas; Patent pools & technology transfer.</p> |
| | <p>National & government policies & programs: National & regional adaptation plans including mainstreaming; Sub-national & local adaptation plans; Economic diversification; Urban upgrading programs; Municipal water management programs; Disaster planning & preparedness; Integrated water resource management; Integrated coastal zone management; Ecosystem-based management; Community-based adaptation.</p> |
| Social | <p>Educational options: Awareness raising & integrating into education; Gender equity in education; Extension services; Sharing indigenous, traditional & local knowledge; Participatory action research & social learning; Knowledge-sharing & learning platforms.</p> |
| | <p>Informational options: Hazard & vulnerability mapping; Early warning & response systems; Systematic monitoring & remote sensing; Climate services; Use of indigenous climate observations; Participatory scenario development; Integrated assessments.</p> |
| | <p>Behavioural options: Household preparation & evacuation planning; Migration; Soil & water conservation; Storm drain clearance; Livelihood diversification; Changed cropping, livestock & aquaculture practices; Reliance on social networks.</p> |
| Sphere of changes | <p>Practical: Social & technical innovations, behavioural shifts, or institutional & managerial changes that produce substantial shifts in outcomes.</p> |
| | <p>Political: Political, social, cultural & ecological decisions & actions consistent with reducing vulnerability & risk & supporting adaptation, mitigation & sustainable development.</p> |
| | <p>Personal: Individual & collective assumptions, beliefs, values & worldviews influencing climate-change responses.</p> |

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