



Government of India
Ministry of Statistics and Programme Implementation

EnviStats India 2022

Vol:II Environment Accounts



Social Statistics Division
National Statistical Office

@ Government of India, 2022

Acknowledgement

The Division gratefully acknowledges the contribution of all the source agencies, without whom this multifarious collection of statistics could not have been possible.

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ACRONYMS AND ABBREVIATIONS

A	AGB	Above Ground Biomass
	APY	Area, Production and Yield
B	BCM	Billion Cubic Meters
	BGB	Below Ground Biomass
	bgl	Below Ground Level
	BSI	Botanical Survey of India
C	CACP	Commission for Agricultural Costs and Prices
	CBD	Convention on Biological Diversity
	CCA	Culturable Command Area
	CCS	Cost of Cultivation Studies
	CFS	Cubic Feet per Second
	CGWB	Central Ground Water Board
	CIFOR	Center for International Forestry Research
	CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
	CMFRI	Central Marine Fisheries Research Institute
	CMPDIL	Central Mine Planning and Design Institute Limited
	CMR	Coal Mines Regulation
	CO ₂	Carbon Dioxide
	COMAPS	Coastal Ocean Monitoring and Prediction System
	CPCB	Central Pollution Control Board
	CSCC	Country-level Social Cost of Carbon
	Cu M	Cubic Meter
	cumecs	Cubic Meter per Second
	CWC	Central Water Commission
	C&D Waste	Construction & Demolition Waste
	D	DDUGJY
DES		Directorate of Economics and Statistics
DIN		Dissolved Inorganic Nitrogen
DIP		Dissolved Inorganic Phosphorus
DISCOMs		Distribution Companies
DOD		Department of Ocean Development
DOS		Department of Space
E		EARAS
	EEA	Experimental Ecosystem Accounts
	EWSA	Effective Water Spread Area
F	FAME	Faster Adoption and Manufacturing of Electric Vehicles
	FAO	Food and Agriculture Organization
	FIDF	Fisheries and Aquaculture Infrastructure Development Fund
	FSI	Forest Survey of India
G	GDP	Gross Domestic Product
	GENCOS	Generation Company
	GHGs	Green House Gases

	GOI	Government of India
	GPG	Good Practice Guidance
	GSI	Geological Survey of India
	GVA	Gross Value Added
H	Ha	Hectare
I	IEA	International Energy Agency
	IMG	Inter-Ministerial Group
	IPBES	Intergovernmental Platform on Biodiversity & Ecosystem Services
	IPC	Irrigation Potential Created
	IPCC	Intergovernmental Panel on Climate Change
	IPDS	Integrated Power Development Scheme
	IPU	Irrigation Potential Utilized
	IRES	International Recommendation on energy Statistics
	ISFR	India State of Forest Report
	ISRO	Indian Space Research Organization
	IUCN	International Union for Conservation of Nature
IUSS	International Union of Soil Science	
K	KCC	Kisan Credit Card
	km	Kilometre
L	LC	Land Cover
	LNG	Liquefied Natural Gas
	LU	Land Use
	LULC	Land Use and Land Cover
	LULUCF	Land Use, Land-Use Change, and Forestry
M	M. ha.	Million Hectare
	MI	Micro Irrigation
	MIS Portal	Management Information System Portal
	mm	Millimetre
	MoC	Ministry of Coal
	MoEF&CC	Ministry of Environment, Forest and Climate Change
	MoES	Ministry of Earth Sciences
	MSPs	Minimum Support Prices
	MSUT	Monetary Supply and Use Tables
	MSW	Municipal Solid Waste
N	N.I	Nutrient index
	NBS	Nutrient-based Subsidy
	NCCR	National Centre for Coastal Research
	NCIWRD	National Commission on Integrated Water Resources Development
	NDC	Nationally Determined Contributions
	NEMMP	National Electric Mobility Mission Plan
	NEP	National Environment Policy
	NPV	Net Present Value
	NRC	Natural Resources Census
	NRR	Natural Resources Repository

	NRSA	National Remote Sensing Agency
	NRSC	National Remote Sensing Centre
	NSO	National Statistical Office
	NSS	National Sample Surveys
	NTCA	National Tiger Conservation Authority
	NTFP	Non-Timber Forest Products
O	OW	Observation Well
P	PACS	Primary Agricultural Credit Society
	PCC	Pollution Control Committee
	PM-AASHA	Pradhan Mantri Annadata Aay Sanrakshan Abhiyan
	PMMSY	Pradhan Mantri Matsya Sampada Yojana
	PSUT	Physical Supply and Use Tables
R	RDSS	Revamped Distribution sector scheme
	RFAs	Recorded Forest Areas
	RR	Resource Rent
	RRR	Reduce, Reuse and Recycle
	RWA	Resident Welfare Association
S	SAC	Space Applications Centre
	SCC	Social Cost of Carbon
	SDGs	Sustainable Development Goals
	SECR	Spatially Explicit Capture Recapture
	SEEA	System of Environmental Economic Accounting
	SEEA-CF	System of Environmental Economic Accounting - Central Framework
	SEEA-EA	SEEA-Ecosystem Accounting
	SFDs	State Forest Departments
	SHCs	Soil Health Cards
	SIEC	Standard International Energy Product Classification
	SNA	System of National Accounts
	SRU	Standard River Units
	STL	Soil Testing Labs
	T	TFCP
TOF		Trees Outside Forest
U	ULBs	Urban Local Bodies
	UNFC	United Nations Framework Classification
	UN-SIAP	United Nations - Statistical Institute for Asia and the Pacific
	UNWTO	UN World Tourism Organization
	UNWWAP	United Nations World Water Assessment Programme
	UPR	Usual Place of Residence
W	WII	Wildlife Institute of India
Z	ZSI	Zoological Survey of India

INTRODUCTION



Chapter 1

Introduction

One of the first conditions of happiness is that the link between man and nature shall not be broken

-Leo Tolstoy

Background

1.1 Since time immemorial living in harmony with nature has been ingrained in the cultural ethos of India. Realizing this, the environmental issues are embedded in India's Constitutional guidelines adopted in 1950. The Directive Principles of State Policy, given in the Constitution of India, contain provisions that reflect the State's commitment to protect the environment, including forests and wildlife, and which enjoin upon the citizens of India the responsibility to protect and improve the environment.

1.2 However, in the current times the harmony between people and nature is getting disrupted at an accelerated pace, essentially due to rapid industrialization and urbanization. These factors degrade and damage the environment causing the horrendous impacts of climate change. The impact of climate change can be easily seen on human health from frequent extreme weather events such as heatwaves, storms and floods, droughts, the disruption of food systems, increased zoonoses and vector-borne diseases and mental health issues. Apart from these, climate change undermines several determinants for good health such as livelihoods, equality and access to health care and social support structure.

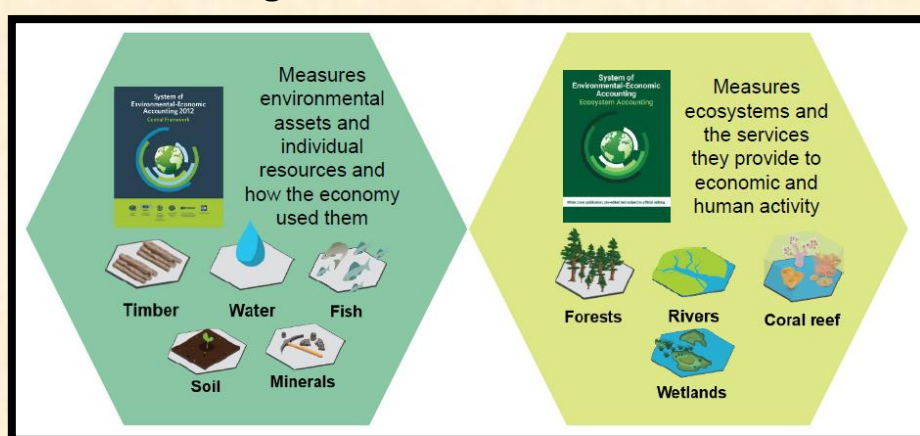
1.3 For a developing country like India with GDP of approximately ₹198 lakh crore for the year 2020-21 at current prices¹, it is important to maintain the economic growth rate, but at the same time due importance also needs to be given towards addressing the concerns of sustainability. The key is to ensure that the growth remains sustainable and the country is able to retain or rather enhance its natural wealth required for economic activity and well-being for future generations as well. Thus, the need of the hour is to move towards integrating the information on economic activities with those on environment and push the bars for adopting the 'go beyond GDP' approach while clinging on to the parameters of sustainability.

¹ National Accounts Statistics 2022, Ministry of Statistics and Programme Implementation

The System of Environmental-Economic Accounting (SEEA²)

1.4 The System of Environmental-Economic Accounting (SEEA) is an international statistical standard that uses a systems approach to bring together economic and environmental information to measure the contribution of the environment to the economy and the impact of the economy on the environment. The SEEA uses a structure and classifications consistent with the System of National Accounts (SNA) to facilitate the development of indicators and analysis of the economy-environment nexus. There are two sides of SEEA - SEEA-Central Framework (SEEA-CF) and the SEEA-Ecosystem Accounting (SEEA-EA) as illustrated in the **Figure-1.1** below.

Figure 1.1: SEEA-CF and SEEA-EA



Source: UN-SIAP

1.5 The SEEA – CF provides a framework for organizing and presenting statistics on the environment and its relationship with the economy. It brings together economic and environmental information in an internationally agreed set of standard concepts, definitions, classifications, accounting rules and tables to produce internationally comparable statistics. The SEEA-CF helps to account for the stocks of the environmental assets and flows between the environment and the economy. Environmental stocks and flows are considered holistically. From a stock perspective, the environment includes all living and non-living components that constitute the biophysical environment, including all types of natural resources and the ecosystems within which they are located. From the perspective of environment flows, the environment is the source of all-natural inputs for the economy, including natural resources inputs (minerals, energy, timber, fish, soil etc.) and other natural inputs absorbed by the economy, for example, energy from solar and wind resources and the air used in the combustion process.

² <https://seea.un.org/>

- 1.6 The SEEA-CF suggests compilation of mainly 3 types of accounts:
- (i) Physical Supply and Use Tables: to record the physical flows
 - (ii) Monetary Supply and Use Table: to record the flows of products in monetary terms
 - (iii) Asset Accounts (physical and monetary): to record the stocks and the changes in the stocks of environmental assets.

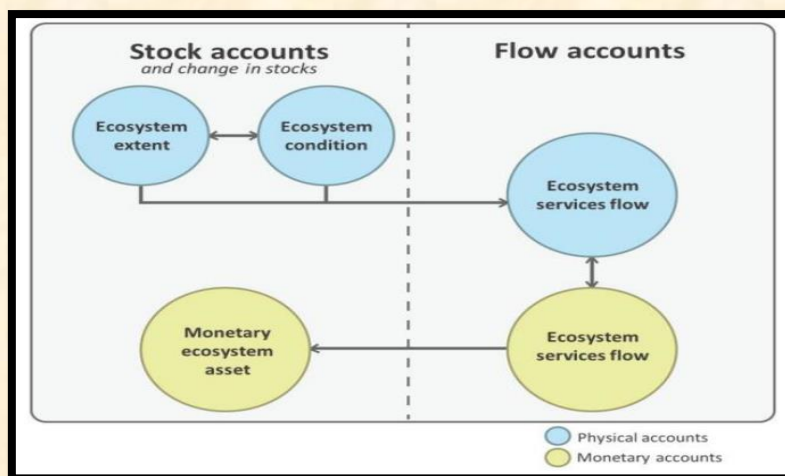
1.7 In the SEEA-CF, the focus is on the individual components of the environment that provide material and space to all economic activities. It, however, does not consider the non-material benefits from the indirect use of environmental assets (e.g. Benefits from ecosystem services such as water purification,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

1.8 SEEA-Ecosystem Accounting, a complementary framework of SEEA-CF describes the measurement of ecosystems in physical terms and the valuation of ecosystems in so far as it is consistent with the market valuation principles. This also encompasses the environmental assets but focuses on the interactions between individual environmental assets within ecosystems and on the broad set of material and non-material benefits that accrue to the economy and other human activity from flows of ecosystem services. Broadly the following accounts are prescribed in the SEEA-EA:

- (i) Extent Accounts: describes the size of the ecosystem assets (Ecosystem Assets are contiguous spaces of a specific ecosystem type characterized by a distinct set of biotic and abiotic components). For example- forests, wetlands, agricultural areas, marine areas.
- (ii) Condition Accounts: describes the quality of an ecosystem, measured in terms of its biotic and abiotic characteristics.
- (iii) Flows of Ecosystem Service: describes the contribution of the ecosystem to the benefits that are used in the economic and other human activity.
- (iv) Monetary Ecosystem Asset Account: describes the information on stocks and changes in stocks (additions and reductions) of assets and records this information in monetary terms for ecosystem assets based on the monetary valuation of ecosystem services and applying the net present value approach to obtain opening and closing values in monetary terms for ecosystem assets at the beginning and end of each accounting period.
- (v) Thematic Accounts: organizes the data on themes of specific policy relevance. For example - biodiversity, climate change, oceans and urban areas.

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

Figure 1.2: Set of Ecosystem Accounts

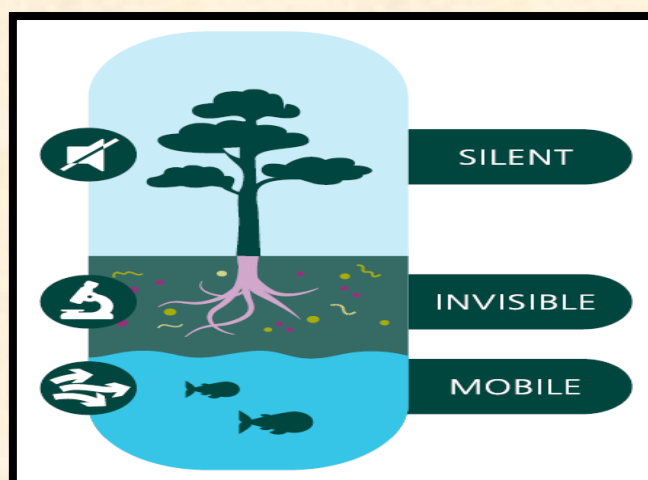


Source: UN-SIAP

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

1.11 It is a well-conceived fact that Nature provides several valuable services to mankind, but despite having immense value in the lives of humans they are often beyond the scope of valuation. The simple reason for this is the lack of available data and market value for nature's services. The three distinctive feature that makes it impossible for markets to record adequately the use human beings make of the Nature's goods and services are- mobility, silence and invisibility. This is shown in the **Figure-1.3** given below:

Figure 1.3: Nature's Property



Source: The Economics of Biodiversity: The Dasgupta Review

1.12 Uncovering the values of ecosystem contributions to people can bridge the gap between growth and well-being. The contribution of the environmental goods and services duly measured enables robust and sustainable decisions and policies.

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

- i. The products produced by economic units (e.g., food, water, clothing, shelter, recreation) are referred to as SNA benefits, since the measurement boundary is defined by the production boundary used to measure Gross Domestic Product (GDP) in the System of National Accounts (SNA). This includes goods produced by households for their own consumption.
- ii. The benefits that accrue to individuals that are not produced by economic units (e.g., clean air) are referred to as non-SNA benefits, reflecting the fact that the receipt of these benefits by individuals is not the result of an economic production process defined within the SNA. A distinguishing characteristic between these two types of benefits is that, in general, SNA benefits can be bought and sold on markets whereas non-SNA benefits cannot be.

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

Environment Accounts in India

1.15 The National Statistical Office (NSO) under the Ministry of Statistics and Programme Implementation (MoSPI) is mandated with “Development of Environment Statistics and Development of methodology, concepts and preparation of National Resource Accounts for India”. With this mandate, the Ministry constituted an Expert Group in 2011 under the chairmanship of Prof. Sir Partha Dasgupta, Frank Ramsey Professor Emeritus of Economics, University of Cambridge, U.K for advising on an implementation plan for compiling “Green National Accounts in India”. The Expert Group submitted its report in 2013 and recommended the compilation of the accounts following the SEEA Framework in a phased manner, i.e. starting with the asset accounts followed by the physical and the monetary flows. Based on the above recommendations, the first

layers of these accounts (i.e., asset accounts) were released in the year 2018, in the publication, EnviStats India 2018 – Supplement on Environment Accounts³, detailing the physical asset accounts of land cover, minerals, water and forests, at the state and national levels.

1.16 Since then, the Ministry has continuously strived to enhance the scope and coverage of environmental accounts, including those of extent and condition accounts. Further, in order to translate the physical values using an economic yardstick, the Ministry evaluated some ecosystem services-such as Crop Provisioning Services, Timber and Non-timber Forest Products Provisioning Services, Carbon Retention Services provided by Forests and Nature-Based Tourism services. These accounts, along with the extent and the condition accounts, present a systematic glimpse of the State of Environment in India in respect of various environmental assets and ecosystems. Several accounts have been released in the form of annual publications “EnviStats India: Vol.II-Environment Accounts” which are presented in the following **Table 1.1**:

Table 1.1: Topics covered in EnviStats India

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

³ <https://www.mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/6501?q=RPCAT>

Type of account	Topics covered (Year of publication given in parentheses)
	Nature-based tourism (monetary) (2019) Soil erosion prevention services provided by croplands (physical) (2020)
Thematic Accounts	Biodiversity - The extent of protected areas (2020) State-wise floral and faunal species accounts (2020) Species Richness of IUCN Red List species (2020, 2021)
Individual environmental asset accounts (SEEA CF)	Forests – Growing Stocks of Timber and Carbon (2018, 2020) Water (2018)

1.17 In order to expand the coverage of the Environmental Accounts in India, National Statistical Office of MoSPI released the five-year strategy for compiling Environment Accounts in India: 2022-2026 following the SEEA structure⁴. Some of the potential areas for work identified in line with the national priorities are listed below:

- (a) Energy Accounts
- (b) Material Flow Accounts
- (c) Ocean Accounts
- (d) Thematic accounts for Biodiversity and Urban Area Accounts

1.18 The current publication which is fifth in the series covers Energy Accounts, Solid Waste Accounts, Wetlands including Mangroves and Estuaries, Fish Provisioning Services, Forest Ecosystems Accounts and Species Richness of IUCN Red List Species. A brief description of the remaining chapters is provided in the subsequent paragraphs.

Chapter 2. Energy Accounts

1.19 As far as the energy sector of India is concerned, two recent monumental achievements have paved the way towards the well-being of a huge number of people of India. The first is India's success in bringing electricity connections to hundreds of millions of its citizens and the second is the accelerating rate at which India grasped the transformative potential of renewables and solar in particular. India⁵ is a major force in the global energy economy. While the country's rapid pace of industrialization and urbanization will create huge demands of the energy sector, policy makers ought to target for policies to bring about a secure and sustainable energy future. To aid the policy

⁴ Strategy for Environmental Economic Accounts in India: 2022- 2026
<https://www.mospi.gov.in/documents/213904/301563//Environment%20Accounting%20Strategy%202022-261638528460762.pdf/8da50af2-45ad-9569-d765-fa79b73ec6ae>

⁵ <https://www.iea.org/reports/india-energy-outlook-2021/energy-in-india-today>

makers with the appropriate information about the energy sector, the publication covers the compilation of the Energy Accounts.

1.20 Energy Accounts organizes the Energy related information in an internationally accepted framework. While the Energy Statistics are often developed to address specific policy questions and issues, Energy Accounts merge a wide range of Energy related statistics across sectors into one consistent framework. NSO, India has been regularly compiling Energy Statistics following the International Recommendation for Energy Statistics (IRES) framework. This year the publication covers Energy Accounts following the SEEA-Energy framework utilizing Energy Statistics as the base for the years 2015-16 onwards. Chapter 2 of the publication provides the Physical Asset Accounts for Energy and the Physical Supply and Use Tables utilizing the data provided by M/o Coal, M/o Petroleum & Natural Gas, Geological Survey of India and Central Electricity Authority of Ministry of Power.

Chapter 3: Solid Waste Accounts

1.21 As a subset of the Material Flow Accounts, NSO India has attempted to compile the accounts for the Solid Waste for the Union territory of Delhi. The Solid Waste Accounts provides organized information on the generation of solid waste and the management of flows of solid waste to recycling facilities, to controlled landfills or directly to the environment. The main idea behind the compilation of the solid wastes is to get a glimpse of the collection and management of solid waste in the area. The exercise has been undertaken on an experimental basis which can be expanded subsequently with the availability of information.

1.22 Chapter 3 of the publication provides estimates for the Solid Waste Accounts-Physical Supply and Use Table using the SEEA framework. The accounts contain seven components of solid waste comprising of Municipal Solid Waste, Bio-medical Waste, Hazardous Waste, Plastics, E-waste, Construction & Demolition Waste and Battery Waste. These accounts would provide a basis for identifying the amount of wastes that enter the environment, thus paving a pathway towards achieving a circular economy model wherein the wastes are reduced to minimum.

Chapter 4: Wetlands Accounts

1.23 Wetlands are amongst the most productive ecosystems on the Earth and provide many important services to human society. However, they are also ecologically sensitive and adaptive systems. Wetlands exhibit enormous diversity according to their genesis, geographical location, water regime and chemistry, dominant species, and soil and sediment characteristics. India supports unique geographical diversity and different climatic zones, which in turn supports diverse wetland habitats throughout the

subcontinent and covers nearly 15.98 million hectares⁶. Wetlands are considered to have unique ecological features which provide numerous products and services to humanity. Ecosystem goods provided by the wetlands mainly include: water for irrigation; groundwater recharge; fisheries; non-timber forest products; water supply; and recreation. Besides, more than one billion people depend on wetlands for their wellbeing. Wetland helps sustain the wide variety of life on our planet, protects our coastlines and biodiversity, acts as a natural sponge against river flooding, nutrient removal, toxics retention and stores carbon dioxide to regulate climate change. Furthermore, wetlands have also been providing a variety of ecological, biological and hydrological functions which offers economic, aesthetic, recreational, educational and other values to the society.

1.24 Chapter 4 on the wetlands provides the extent account for the Wetlands in India along with the decadal change matrix for the years 2006-07 and 2017-18. In addition, the chapter highlights the extent of the mangroves and the estuaries and the associated biodiversity in these wetlands.

Chapter 5: Fish Provisioning Services

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

1.26 With the use of the information provided by the States on the Rent/Lease of the rivers/ponds where the fishes thrive, estimates of the Fish Provisioning Services have been computed in Chapter 5 of the publication. The information has been compiled for Andhra Pradesh (2015-16 to 2021-22), Rajasthan (2015-16 to 2020-21) and Haryana (2015-16 to 2020-21).

Chapter 6: Forests Accounts

1.27 The rapid deterioration of the environment, which are the underlying causes for the climate change, biodiversity loss and the emergence of new diseases, has raised an alarm globally. Forests and trees have the potential to address these crises and move towards sustainable economies. Forests contain more carbon than half the global carbon stock in soils and vegetation. Apart from providing timber and non-timber forest products, forests ecosystems conserve soils and stabilize flows and runoff which in turn prevents land degradation and desertification, and diminishes the risks of disasters. In

⁶ Space based observation of Indian wetlands, Indian Space Research Organisation, Ahmedabad

essence, forests silently provide a multitude of services to humankind which are much beyond quantification.

1.28 Chapter 6 of the publication presents the Forests Extent and the Condition Accounts based on the data available in the India State of Forest Report published by the Forest Survey of India, Ministry of Environment, Forest and Climate Change (MoEFCC). In addition, the estimates for the Timber and Non-timber provisioning services (2011-12 to 2019-20) and the carbon retention services, a 'regulatory service' have been compiled at both current and constant prices. While the former two services can be linked to economic activity or SNA benefits, the 'carbon retention services' help understand the contribution of the forests in climate regulation and hence global wellbeing. In order to make the estimates comparable with the National Accounts, the base year has been chosen as 2011-12.

Chapter 7: Biodiversity

1.29 In recent decades humanity has been degrading our most precious asset, the natural environment, at rates far greater than ever before. As a result, the material standard of living of the average person in the world has gone up. But, in the process of achieving high 'growth numbers' humankind has degraded the biosphere to the point where the demands made of its goods and services far exceed its ability to meet them on a sustainable basis.

1.30 The Dasgupta report titled 'The Economics of Biodiversity'⁷ stressed on the fact that biodiversity is the key to the processes governing ecosystems. The decline of biodiversity disrupts biospheric processes, for example the processes governing the climate system. The sustainability of the humans' engagement with nature is thus ultimately about the functioning of the biosphere which includes both the living and the non-living part of it.

1.31 Chapter 7 of the publication presents the taxonomic faunal and floral diversity of India, the status and conservation efforts in respect of Leopard, and Species Richness of Red List species, by taxonomic groups, as compiled using Spatial Datasets sourced from the International Union for Conservation of Nature (IUCN). The IUCN Spatial Dataset is generally updated thrice a year. The publication, EnviStats India 2020, Vol. II Environment Accounts included the analysis of the IUCN Spatial Datasets of Red List species for three categories – Mammals, Amphibians and Reptiles using the 2020 Version 2. Subsequently, in 2021 the analysis of the Spatial Dataset for the two subsequent versions - 2020 Version 3 and 2021 Version 1 – and for three more categories – Plants, Mangroves and Freshwater group (consisting of both flora and fauna present in

⁷https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962785/The_Economics_of_Biodiversity_The_Dasgupta_Review_Full_Report.pdf

freshwater) were included. The current publication presents the results of state-wise assessment of IUCN Red List species using the spatial datasets of 2021 Version 2, 2021 Version 3 and 2022 Version 1.

Conclusion

1.32 NSO, India has been constantly striving to improve the coverage of environmental accounts in terms of time, domains and geographic coverage. However, it is expected that for a megadiverse country like India, the understanding of the data sources and methods used to compile accounts will evolve over time as a result of engagement with the data sources agencies and the users, especially the policy makers. Consequently, as with all statistical products, with the availability of updated data, the accounts presented so far do have a scope of further revision and refinement to depict better connection between environment and economic and human activity.

1.33 EnviStats India envisages to provide a panoramic view of the complex interactions involving the ecosystems of the country and intends to provide the right thrust towards the direction of mainstreaming environmental information into government decision making for a 'Better Environment, Better Tomorrow'.

ENERGY ACCOUNTS



Chapter 2

Energy Accounts

Energy Conservation is the foundation of energy independence

-Tom Allen

Introduction

2.1 Energy plays a significant role in human life and is also an important input in the production of goods and services, including food. Another major benefit of the energy sector is its usage in transportation and heating. In fact, energy has been a part of the humanity since the dawn of time. Before the industrial revolution, the energy needs were limited. Heat energy was derived from the sun and by burning wood, leaves and straw. Transportation was mainly through the muscle of the horses and the power of the wind. Water and wind drove the simple machines that helped grinding of the grains and pumping of the water.

2.2 With the low-cost automobiles and the spread of electricity there has been a radical change in the energy requirement patterns of the society. Energy penetrated not only deep into the economies facilitating services such as cooking, heating, cooling, lighting, operation of appliances, information and communication technology, functioning of machines to name just a few. In addition to this, energy addresses several social issues of well-being. Thus, in short, energy drives economies and is an enabler for development of the nation. But, the production and use of energy are a biggest contributor to global warming. The energy sector accounts for about two-thirds of global greenhouse gas emissions attributed to human activity. Knowing very well the adverse consequences of global warming and climate change, it is important to tread the path of sustainable energy which will open up avenues for transforming lives and economies while safeguarding the planet¹.

2.3 Realizing its importance in the power sector², in all the progressive countries of the world, power resources are considered as national assets and organizations are set up for the conservation, development and proper working of these resources.

India's Energy Scenario

2.4 Energy demand ³ in India is growing rapidly with major implications for the global energy market. India, with a population of 1.36 billion and a fast-growing economy, has seen its energy demand increasing rapidly as the country continues to urbanize and its

¹ <https://www.unep.org/explore-topics/energy/why-does-energy-matter>

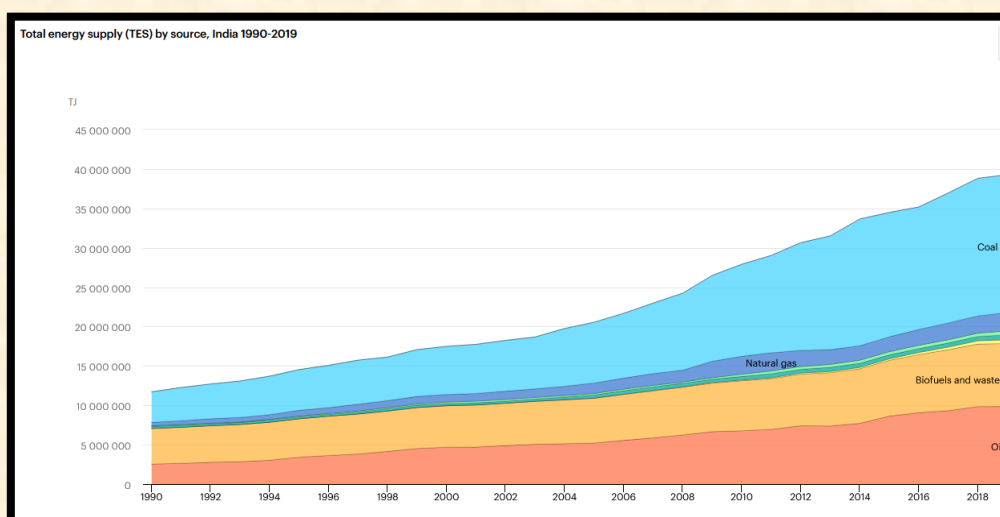
² http://lsi.gov.in:8081/jspui/bitstream/123456789/401/1/40059_1961_EIE.pdf

³ <https://www.iea.org/countries/india>

manufacturing sector develops. This growing demand is met through various energy sources, with coal being the largest source of energy supply. There is also a requirement to develop the institutional framework in order to attract the investment required to satisfy this growing energy need. Over 80% of India’s energy needs are met by three fuels: coal, oil and solid biomass. Coal has underpinned the expansion of electricity generation and industry, and remains the largest single fuel in the energy mix. Oil consumption and imports have grown rapidly on account of rising vehicle ownership and road transport use. Biomass, primarily fuelwood, makes up a declining share of the energy mix, but is still widely used as cooking fuel.

2.5 In 2014, thousands of villages and lakhs of hamlets did not have access to electricity. On 15th of August, 2015, the Hon’ble Prime Minister of India addressed this issue and aimed to provide electricity access to every inhabited village within 1000 days. The target was achieved in a span of 987 days, i.e. 13 days ahead of the target set. Applauding India’s efforts, the International Energy Agency (IEA) declared this as the most seminal development in the energy sector in the world in 2018. In addition, with the objective to achieve universal household electrification, the Hon’ble Prime Minister launched the “Pradhan Mantri Sahaj Bijli Har Ghar Yojana – SAUBHAGYA” in October 2017. Under the scheme till date, all willing households have been electrified in the country. Some of the hamlets and households which were unwilling earlier are currently willing to have electricity connections. A total of 2.817 crore households have been electrified since the launch of SAUBHAGYA. IEA mentioned this as the fastest expansion of access to electricity anywhere in the world in the history of the power sector.

Figure 2.1: Total Energy Supply by Source



Source: International Energy Agency

Energy and Climate Change

2.6 India has also been prioritizing access to electricity and clean cooking. The Government of India is continuing to focus on providing secure, affordable and

sustainable energy, while achieving its ambitious renewable energy targets and reducing local air pollution. India's⁴ announcement that it aims to reach net zero emissions by 2070 and to meet fifty percent of its electricity requirements from renewable energy sources by 2030 is a hugely significant moment for the global fight against climate change. In a pathway to net zero emissions by 2070, Hon'ble Prime Minister of India has announced more ambitious targets for 2030, including installing 500 gigawatts of non-fossil energy capacity, meeting 50% of the country's energy requirements from renewable energy, reducing the emissions intensity of its economy by 45%, and reducing carbon emissions by a billion tonne. India is pioneering a new model of economic development that could avoid the carbon-intensive approaches that many countries have pursued in the past – and provide a blueprint for other developing economies.

2.7 Several Government schemes⁵ have been launched to categorically address the issue of climate change. Since 2014, India imposed passenger vehicle fuel-efficiency standards. Once implemented in 2015, these standards mandated efficiency targets for new cars at the equivalent of 130 gCO₂/km in 2017 and 113 gCO₂/km in 2022. Fuel efficiency labeling for new vehicles has been made mandatory since 2011. As part of the National Electric Mobility Mission Plan (NEMMP) 2020, India developed the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme in 2015. FAME was designed to accelerate the uptake of hybrids and electric vehicles through providing subsidies that reduce the upfront purchase price of these vehicles. India's National Mission on Electric Mobility was launched in 2018. Subsequently, the National E-Mobility programme was launched to promote public procurement of electric vehicles and deployment of charging infrastructure. In 2019, Government of India adopted a scaled-up FAME II scheme, with an outlay of USD 1.4 billion to be used for upfront incentives and for supporting the deployment of charging infrastructure. While the scheme was scheduled to end in 2022, it has now been extended until 2024.

2.8 In order to strengthen the distribution system in rural and urban areas, Government of India launched⁶ Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) and Integrated Power Development Scheme (IPDS). Ministry of Power launched Revamped Distribution Sector Scheme (RDSS) to provide reform-based result linked financial assistance to the Distribution Companies (DISCOMs) to strengthen the supply infrastructure. Also, a Liquidity Infusion Scheme was launched to bridge the liquidity gaps. The Ministry launched a web-portal called PRAAPTI (Payment Ratification and Analysis in Power procurement for bringing Transparency in Invoicing of generators) for transparency in monitoring of dues to Generation Company (GENCOs) at the national

⁴ <https://www.mea.gov.in/Speeches-Statements.htm?dtl/34466/National+Statement+by+Prime+Minister+Shri+Narendra+Modi+at+COP26+Summit+in+Glasgow>

⁵ <https://www.iea.org/articles/fuel-economy-in-india>

⁶ https://powermin.gov.in/sites/default/files/uploads/MOP_Annual_Report_Eng_2021-22.pdf

level. Another milestone achievement is the development of the One Nation-One Grid which has transformed the country into one unified power market.

SEEA-Energy

2.9 With the enormous potential of India's energy sector, comes a sense of responsibility towards the nation and towards the globe at large. Tapping the energy resources ignoring the environmental concerns will serve good to none. Therefore, the effect of energy supply and use on the environment has emerged as a critical policy issue. Hence, it becomes pertinent to know the proper supply and usage of energy especially in the context of sustainable development. SEEA-Energy provides the framework for the compilation of the physical and monetary supply and use tables and also for having an idea about the stock of energy available in the country at a particular point of time.

2.10 For the purpose of compiling Energy Accounts for the country, the standard framework accepted internationally is the SEEA-Energy Framework. The System of Environmental Economic Accounting for Energy (SEEA-Energy⁷) is a multipurpose conceptual framework for organizing energy related statistical information. It supports analysis of both the role of energy within the economy and the relationship between energy-related activities and the environment. At the core of SEEA-Energy is an accounting approach that records the stocks and flows of energy within the territory of reference. The value added of SEEA-Energy lies in its ability to bring a broader and more structured perspective to bear on the Energy related information already available. Through their coherence with System of National Accounts (SNA), the data in the energy accounts can be easily linked with other information collected for national accounts, which allows for a more detailed and policy-relevant analysis of energy information.

2.11 The capacity of SEEA-Energy to link energy accounts with economic and other environmental accounts underlines its power. Essential to the formulation of a policy response to an environmental issue such as climate change, which is affected by energy-related emissions of carbon into the air, is understanding both human impacts on the physical environment (through determining, for example, which industry is generating the carbon emissions and the energy products involved); and energy needs and possible constraints and solutions (through determining, for example, ongoing energy requirements and what kind of low-carbon energy sources can be utilized). Indicators/statistics generated from SEEA-Energy accounts can also enhance the understanding of issues related to the effects of using economic instruments (such as tradable carbon emission permits) on both the economy and the environment. Those effects may include impacts on energy prices, household spending and business profitability and, crucially, on emissions of carbon generated by domestic producers and as embodied in imports.

⁷ https://seea.un.org/sites/seea.un.org/files/documents/seea-energy_final_web.pdf

2.12 SEEA- Energy has a close relationship with IRES (International Recommendation on Energy Statistics)⁸, which contributes valuable inputs into the production of the tables and accounts of SEEA-Energy. In particular IRES support the use of the harmonized definitions of energy products in accordance with the Standard International Energy Product Classification (SIEC)⁹ and offer guidance regarding data sources and data compilation.

2.13 The Energy Accounts as described in SEEA comprise three types of accounts, namely- Asset Accounts, Physical Supply and Use Tables (PSUT) and Monetary Supply and Use Tables (MSUT).

Asset Accounts for Energy

2.14 The purpose of an asset account is to record the opening and closing stock of the assets and the various types of changes in stock over an accounting period. The asset accounts in SEEA-Energy are compiled only for minerals and energy resources. These accounts provide valuable information to assess the fact whether the current patterns of economic activity are depleting and/or degrading the available mineral and energy resources. In addition, the information on the asset accounts can help in the management of mineral and energy resources.

2.15 Mineral and energy resources within SEEA-Energy include known deposits of oil resources, natural gas resources, coal and peat resources, and uranium and thorium resources, including those with no current economic value. Those resources are defined more broadly than in 2008 SNA, which includes only those inputs that meet the definition of an economic asset. In the SEEA Central Framework, mineral and energy resources include known deposits of oil resources, natural gas resources, coal and peat resources, non-metallic minerals and metallic minerals. In SEEA-Energy, mineral and energy resources are restricted to those resources that can become energy products.

2.16 Known deposits of minerals and energy resources are categorized into three classes, based on criteria from the United Nations Framework Classification (UNFC)-2009¹⁰:

- (a) ***Class A***: Commercially Recoverable Resources which includes on-production projects, projects approved for development and projects justified for development
- (b) ***Class B***: Potentially Commercially Recoverable Resources which includes economic and marginal development projects pending and development projects on hold.

⁸ <https://unstats.un.org/unsd/energystats/methodology/documents/IRES-web.pdf>

⁹ <https://unstats.un.org/unsd/classifications/Family/Detail/2007>

¹⁰ https://unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/unfc2009/UNFC2009_ES39_e.pdf

- (c) *Class C*: Non-Commercial and other known deposits which includes unclarified development projects, non-viable development projects and additional quantities in place.

2.17 The basic form of the Asset account is shown in Figure 2.2. It begins with the opening stock of resources and ends with the closing stock of resources. In physical terms, the changes between the beginning and the end of the accounting period are recorded either as additions to or as reductions in the stock. Wherever possible, the nature of the addition or reduction is recorded.

Figure 2.2: Basic Form of an Asset Account

Basic form of an asset account	
	Opening stock of resources
	Additions to the stock of resources
	Growth in stock
	Discoveries of new stock
	Upward reappraisals
	Reclassifications
	<i>Total additions to stock</i>
	Reductions in the stock of resources
	Extractions
	Normal loss of stock
	Catastrophic losses
	Downward reappraisals
	Reclassifications
	<i>Total reductions in stock</i>
	Revaluation of the stock of resources ^a
	Closing stock of resources

^a Applicable only for asset accounts in monetary terms.

Source: SEEA-Energy

2.18 According to SEEA-Energy, there are 3 types of additions to the stock of the Energy Assets:

- ***Discoveries***: Discoveries should incorporate estimates of the quantity of new deposits found during an accounting period. To be regarded as a discovery the new deposit must be a known deposit – i.e. in Class A, B or C. In situations in which a quantity of potential deposits becomes known to a higher degree of confidence, this increase should be treated as discoveries. Discoveries should be recorded by type of resource and by category of resource.
- ***Upward reappraisals***: Reappraisals should only pertain to known deposits. They will relate to additions in the estimated available stock of a specific deposit, or to changes in the categorization of specific deposits between Class A, B or C based on

EnviStats India 2022: Vol II Environment Accounts:

changes in geological information, technology, resource price or a combination of these factors.

- *Reclassifications:* Reclassifications may occur if certain deposits are opened or closed to mining operations due to a government decision concerning the access rights to a deposit. All other changes in the quantity of known deposits should be treated as reappraisals. Reclassifications may conceivably be recorded if asset accounts for energy resources are being compiled by institutional sector.

2.19 There are four types of reductions in the stock of energy assets:

- *Extraction:* Estimates of extraction should reflect the quantity of the resource physically removed from the deposit. It should exclude mining overburden, i.e. the quantity of soil and other material moved in order to extract the resource. The quantity should also be estimated before any refinement or processing of the resource is undertaken. Estimates of extraction should include estimates of illegal extraction, either by residents or non-residents, as these amounts reduce the availability of the resource.
- *Catastrophic losses.* Catastrophic losses are rare for most energy resources. Flooding and collapsing of mines do occur but the deposits continue to exist and can, in principle, be recovered. For example- oil wells that can be destroyed by fire or become unstable for other reasons leading to significant losses of oil resources. Losses of oil and related resources in this situation should be treated as catastrophic losses.
- *Downward reappraisals:* Reappraisals should only pertain to known deposits. They will relate to reductions in the estimated available stock of a specific deposit, or to changes in the categorization of specific deposits between Class A, B or C based on changes in geological information, technology, resource price or a combination of these factors.
- *Reclassifications:* Reclassifications may occur if certain deposits are opened or closed to mining operations due to a government decision concerning the access rights to a deposit. All other changes in the quantity of known deposits should be treated as reappraisals. Reclassifications may conceivably be recorded if asset accounts for energy resources are being compiled by institutional sector.

2.20 Monetary asset accounts for mineral and energy resources provide a market-based valuation of physical stock of mineral and energy resources and the changes in the value of these stocks over time. The same entries are made in monetary terms, although an additional entry recording revaluations of resource stocks is included. This entry accounts for changes in the value of assets over an accounting period due to movements in the price of the resources.

Physical Supply and Use Tables (PSUT)

2.21 SEEA-Energy records the physical flows, measured in physical units of energy content, through the compilation of supply and use tables. These tables are used to assess how an economy supplies and uses energy products, as well as to examine the changes in production and consumption patterns over time. These tables help in the presentation of how the energy flows into the economy, how they are used within and how they leave a country's national economy for a given period of time. The PSUT are expressed in a common energy unit such as joules and expresses the relationship between inputs to and outputs from energy transformation processes.

2.22 The general structure of the PSUT are shown in the Figure 2.3 below:

Figure 2.3: Basic Form of a Physical Supply and Use Table for Energy

Basic form of a physical supply and use table for energy (joules)						
Supply table						
	Industries	Households	Accumulation	Rest of the world	Environment	Total
Energy from natural inputs					A. Energy inputs from the environment	Total supply of energy from natural inputs
Energy products	C. Output			D. Imports		Total supply of energy products
Energy residuals	I. Energy residuals generated by industry	J. Energy residuals generated by household consumption	K. Energy residuals from accumulation	L. Energy residuals received from the rest of the world	M. Energy residuals recovered from the environment	Total supply of energy residuals
Use table						
	Industries	Households	Accumulation	Rest of the world	Environment	Total
Energy from natural inputs	B. Extraction of energy from natural inputs					Total use of energy from natural inputs
Energy products	E. Intermediate consumption	F. Household consumption	G. Changes in inventories	H. Exports		Total use of energy products
Energy residuals	N. Collection and treatment of energy residuals			P. Energy residuals sent to the rest of the world	Q. Energy residual flows direct to environment	Total use of energy residuals

Note: Dark grey cells are null by definition.

Source: SEEA-Energy

Monetary Supply and Use Tables (MSUT)

2.23 MSUT fully articulates in monetary terms the flows of energy products in an economy between different economic units. MSUT for energy provides information on the energy sector and the level of activity in this sector. They also provide detailed information on the industries within the economy that are using these energy products. Monetary supply and use tables for energy can readily be linked with PSUT for energy to create a powerful analytical tool.

2.24 Monetary supply and use tables have their roots in economic accounting and utilize the same organizational principles and display the same characteristics as physical supply and use tables. Nevertheless, while the physical supply and use table for energy contains three main types of flows, namely, energy from natural inputs, energy products

and energy residuals, the monetary supply and use table for energy records only those flows related to energy products.

2.25 The general structure of the MSUT is shown in the Figure 2.4 below:

Figure 2.4: Basic Form of a Monetary Supply and Use Table for Energy

	Industries	Households	Government	Accumulation	Rest of the world	Total
Supply table						
Products	Output				Imports	Total supply
Use table						
Products	Intermediate consumption	Household final consumption expenditure	Government final consumption expenditure	Gross capital formation (including changes in inventories)	Exports	Total use
	Value added					
Note: Dark grey cells are null by definition.						

Source: SEEA-Energy

Data Sources for Energy Accounts in India

2.26 Some of the major data-sources for the compilation of the Energy Accounts in India are given as follows:

- (i) **Energy Statistics:** Energy Statistics is a regular annual publication of the Economics Statistics Division (ESD) of National Statistical Office (NSO), Ministry of Statistics & Programme Implementation (MoSPI), using the IRES Framework. The data are primarily sourced from Ministry of Coal, Ministry of Petroleum & Natural Gas, Ministry of Mines, Ministry of Power, Ministry of New and Renewable Energy etc. The data pertaining to the energy sector of the economy provided in the publication are in respect of the reserves and potential for generation, installed capacity and capacity utilization, production of energy, foreign trade, availability of energy resources, consumption of energy resources, energy balance and sustainability.
- (ii) **Office of Coal Controller, Ministry of Coal:** The Ministry has the vision focused towards sustainable development of the coal and lignite industry with a view to satisfy its obligations towards economic prosperity of the country.
- (iii) **Central Mine Planning and Design Institute Limited (CMPDIL):** It is a Government of India enterprise having its corporate headquarters at Ranchi, Bihar. It is a fully owned subsidiary of Coal India Limited. CMPDIL's corporate responsibilities include assisting Ministry of Coal (MoC) for strategic decisions relating to coal-sector at the national level, eg, through maintaining inventories of coal deposits, coal mining potentials and operations, etc.
- (iv) **Geological Survey of India, Ministry of Mines:** Its main functions relate to creation and updation of national geoscientific information and mineral resource

assessment. These objectives are achieved through ground survey, air-borne and marine surveys, mineral prospecting and investigations, multi-disciplinary geoscientific, geo-technical, geo-environmental and natural hazards studies, glaciology, seismotectonic study, and carrying out fundamental research.

(v) **Ministry of Petroleum and Natural Gas:** It is concerned with exploration and production of Oil & Natural Gas, refining, distribution and marketing, import, export and conservation of petroleum products. Oil and Gas being the important import for our economy, many initiatives have been taken by the Ministry for increasing production and exploitation of all domestic petroleum resources to address the priorities like Energy Access, Energy Efficiency, Energy Sustainability and Energy Security.

(vi) **Central Electricity Authority, Ministry of Power:** This has the mission to achieve the vision by performing its statutory function by providing technical support base to all stakeholders in the power sector, to support Ministry of Power for forming policies in the power sector, to make technical standards & regulations, to carry out project monitoring, to disseminate power sector information, to upgrade skills of human resources in the power sector of the country.

2.27 SEEA recommends compilation of the accounts for all 3 types of energy resources (Class A, B and C), both in physical and monetary terms. Even though Class A is included in the core accounts countries are encouraged to compile information on Classes B and C.

Physical Asset Accounts for Energy for India

2.28 The Physical Asset Accounts for energy considering the crude oil, natural gas, coal and lignite has been compiled for India for the years 2015-16 to 2020-21 using data from M/o Coal, M/o Petroleum and NG and Geological Survey of India. The accounts for the atomic energy resources could not be compiled due to the non-disclosure policy regarding confidential information. For the assets such as Coal and Lignite, Geological Survey of India compiles estimates of these in 3 main categories of Proved, Indicated and Inferred.

2.29 Proved resources are Economically mineable part of Measured Mineral Resource. These resources are generally taken to be those quantities that geological and engineering information indicates with reasonable certainty and can be recovered in the future from known reservoirs under existing economic and operating conditions.¹¹ For Indicated mineral resources, tonnage, density, shape, physical characteristics grade and mineral content can be estimated with reasonable level of confidence based on exploration, sampling and testing information, location of borehole, pits, etc. For Inferred mineral resources, tonnage, grade and mineral content can be estimated with low level

¹¹ Coal Directory of India, 2020-21, Ministry of Coal

of confidence inferred from geological evidence.¹² However, majority of the extractions take place from the proved category of the resources with around 10% uncertainty. The other categories possess a higher degree of uncertainty. Thus, it would be more appropriate to subtract the extraction estimates from the proved category rather than from the total ('proved + indicated + inferred') while compiling the Asset Accounts. Also, according to a report of the Expert Committee on Road Map for Coal Sector Reforms under the chairmanship of Shri T.L. Sankar, released in December 2005 by Ministry of Coal, GoI¹³, a ratio of 1:4.7 is approximately suggested to know the proportion of the coal extracted and coal sterilized during the extraction process (1 unit of Coal extraction involves 3.7 units of sterilization loss). Similarly a ratio of 1 : 4.46 is approximately suggested to know the proportion of Lignite extracted and Lignite sterilized during the extraction process (1 unit of Lignite extraction involves 3.46 units of sterilization loss) as provided by Neyveli Lignite Corporation India Limited.

2.30 So, for assets such as coal and lignite, only the 'proved' category of resources has been used for compilation of the asset account as it has the lowest level of uncertainty amongst the other classes of resources and also because of the fact that most of the coal are extracted from 'proved' resources. The current publication is restricted to only the compilation of the Physical Asset Accounts and Physical Supply and Use Tables. Efforts will be made to compile Monetary Supply and Use Table (MSUT) in consultation with the stakeholders and would be included in the subsequent issues of the publication.

2.31 Year wise asset accounts for coal, lignite, crude oil and natural gas from the years 2015-16 to 2020-21 are provided in the Tables 2.1 (a) to (f). The Opening Stock (Inventory) data as given in the Coal Directory differs from what has been computed in the Asset Accounts. The reason for this is the deduction of the extraction and sterilization loss in the Asset accounts which is not considered in the geological resources by the GSI.

¹² National Mineral Inventory - An Overview

https://ibm.gov.in/writereaddata/files/07072014130440nmi%20overview%20142010_Chapter%2011.pdf

¹³ <http://www.indiaenvironmentportal.org.in/files/expertreport-1.pdf>

Table 2.1(a): Physical Asset Accounts for Energy: 2015-16

Type of Energy Resource				
	Coal (Proved Category)	Lignite (Proved Category)	Crude Oil	Natural Gas
	Million tonnes	Million tonnes	'000 Barrels	Million CuM
Opening Stock of Mineral and energy resources (Geological for last FY) as per National Inventory	69,818.0	2,159.0	46,58,874.7	12,51,990.0
Addition in stock:				
Discoveries	11.1		1,79,731.6	43,080.0
Upward Appraisal	6,462.0	359.0		
TOTAL ADDITION TO THE STOCK	6,473.1	359.0	1,79,731.6	43,080.0
Total Geological resource	76,291.1	2,518.0	48,38,606.3	12,95,070.0
Reduction in Stock:				
Extraction	638.0	44.0	2,70,916.8	32,249.2
Sterilization Loss	2,360.6	152.2		
Downward reappraisals			13,707.1	35,320.8
TOTAL REDUCTION IN STOCK	2,998.6	196.2	2,84,623.9	67,570.0
Closing stock of mineral and energy resources	73,292.5	2,321.8	45,53,982.4	12,27,500.0
<i>Coal and Lignite data are obtained from Geological Survey of India. Sterilization Loss for Coal = Extraction*3.7 Sterilization Loss for Lignite = Extraction*3.46</i>				

Table 2.1 (b): Physical Asset Accounts for Energy 2016-17

Type of Energy Resource				
	Coal (Proved Category)	Lignite (Proved Category)	Crude Oil	Natural Gas
	Million tonnes	Million tonnes	'000 Barrels	Million CuM
Opening Stock of Mineral and energy resources (Geological for last FY) as per National Inventory	73,292.5	2,321.8	45,53,982.4	12,27,500.0
Addition in stock:				
Discoveries	101.2		1,31,354.0	93,970.0
Upward Appraisal	4,869.3		6,662.0	130.0
TOTAL ADDITION TO THE STOCK	4,970.5		1,38,016.0	94,100.0
Total Geological resource	78,263.0	2,321.8	46,91,998.4	13,21,600.0
Reduction in Stock:				
Extraction	655.0	45.0	2,63,944.7	31,896.7
Sterilization Loss	2,423.5	155.7		
Downward reappraisals				
TOTAL REDUCTION IN STOCK	3,078.5	200.7	2,63,944.7	31,896.7
Closing stock of mineral and energy resources	75,184.5	2,121.1	44,28,053.7	12,89,703.3
<i>Coal and Lignite data are obtained from Geological Survey of India. Sterilization Loss for Coal = Extraction*3.7 Sterilization Loss for Lignite = Extraction*3.46</i>				

Table 2.1(c): Physical Asset Accounts for Energy 2017-18

Type of Energy Resource				
	Coal (Proved Category)	Lignite (Proved Category)	Crude Oil	Natural Gas
	Million tonnes	Million tonnes	'000 Barrels	Million CuM
Opening Stock of Mineral and energy resources (Geological for last FY) as per National Inventory	75,184.5	2,121.1	44,28,053.7	12,89,703.3
Addition in stock:				
Discoveries	167.6		1,86,841.7	83,740.0
Upward Appraisal	5,562.1		4,283.1	
TOTAL ADDITION TO THE STOCK	5,729.7		1,91,124.8	83,740.0
Total Geological resource	80,914.3	2,121.1	46,19,178.5	13,73,443.3
Reduction in Stock:				
Extraction	675.0	47.0	2,61,566.1	32,649.3
Sterilization Loss	2,497.5	162.6		
Downward reappraisals				1,220.7
TOTAL REDUCTION IN STOCK	3,172.5	209.6	2,61,566.1	33,870.0
Closing stock of mineral and energy resources	77,741.8	1,911.4	43,57,612.4	13,39,573.3
<i>Coal and Lignite data are obtained from Geological Survey of India. Sterilization Loss for Coal = Extraction*3.7 Sterilization Loss for Lignite = Extraction*3.46</i>				

Table 2.1(d): Physical Asset Accounts for Energy 2018-19

Type of Energy Resource				
	Coal (Proved Category)	Lignite (Proved Category)	Crude Oil	Natural Gas
	Million tonnes	Million tonnes	'000 Barrels	Million CuM
Opening Stock of Mineral and energy resources (Geological for last FY) as per National Inventory	77,741.8	1,911.4	43,57,612.4	13,39,573.3
Addition in stock:				
Discoveries	586.4		4,25,213.3	74,020.0
Upward Appraisal	6,240.6	246.8		
TOTAL ADDITION TO THE STOCK	6,826.9	246.8	4,25,213.3	74,020.0
Total Geological resource	84,568.7	2,158.3	47,82,825.7	14,13,593.3
Reduction in Stock:				
Extraction	729.0	44.0	2,50,709.9	32,873.4
Sterilization Loss	2,697.3	152.2		
Downward reappraisals			8,31,515.2	2,28,030.0
TOTAL REDUCTION IN STOCK	3,426.3	196.2	10,82,225.1	2,60,903.4
Closing stock of mineral and energy resources	81,142.4	1,962.0	37,00,600.5	11,52,689.9
<i>Coal and Lignite data are obtained from Geological Survey of India. Sterilization Loss for Coal = Extraction*3.7 Sterilization Loss for Lignite = Extraction*3.46</i>				

Table 2.1(e): Physical Asset Accounts for Energy 2019-20

Type of Energy Resource				
	Coal (Proved Category)	Lignite (Proved Category)	Crude Oil	Natural Gas
	Million tonnes	Million tonnes	'000 Barrels	Million CuM
Opening Stock of Mineral and energy resources (Geological for last FY) as per National Inventory	81,142.4	1,962.0	37,00,600.5	11,52,689.9
Addition in stock:				
Discoveries	2,595.4		2,47,094.3	40,300.0
Upward Appraisal	5,261.3	181.6		7,990.0
TOTAL ADDITION TO THE STOCK	7,856.7	181.6	2,47,094.3	48,290.0
Total Geological resource	88,999.1	2,143.6	39,47,694.8	12,00,979.9
Reduction in Stock:				
Extraction	731.0	42.0	2,35,800.7	31,184.2
Sterilization Loss	2,704.7	145.3		
Downward reappraisals			88,986.2	17,860.9
TOTAL REDUCTION IN STOCK	3,435.7	187.3	3,24,786.9	49,045.1
Closing stock of mineral and energy resources	85,563.4	1,956.3	36,22,907.9	11,51,934.8
<p><i>ONGC adopted PRMS system w.e.f. 01.04.2019, hence the above figures also include 2C figures from 2019-20 onwards.</i></p> <p><i>Coal and Lignite data are obtained from Geological Survey of India.</i></p> <p><i>Sterilization Loss for Coal = Extraction*3.7</i></p> <p><i>Sterilization Loss for Lignite = Extraction*3.46</i></p>				

Table 2.1(f): Physical Asset Accounts for Energy 2020-21

Type of Energy Resource				
	Coal (Proved Category)	Lignite (Proved Category)	Crude Oil	Natural Gas
	Million tonnes	Million tonnes	'000 Barrels	Million CuM
Opening Stock of Mineral and energy resources (Geological for last FY) as per National Inventory	85,563.4	1,956.3	36,22,907.9	11,51,934.8
Addition in stock:				
Discoveries	1,608.3		87,813.4	30,250.0
Upward Appraisal	12,099.5	405.0		740.0
TOTAL ADDITION TO THE STOCK	13,707.9	405.0	87,813.4	30,990.0
Total Geological resource	99,271.2	2,361.3	37,10,721.3	11,82,924.8
Reduction in Stock:				
Extraction	716.0	37.0	2,23,521.7	28,672.4
Sterilization Loss	2,649.2	128.0		
Downward reappraisals			3,225.2	12,945.0
TOTAL REDUCTION IN STOCK	3,365.2	165.0	2,26,746.9	41,617.4
Closing stock of mineral and energy resources	95,906.0	2,196.3	34,83,974.5	11,41,307.4

ONGC adopted PRMS system w.e.f. 01.04.2019, hence the above figures also include 2C figures from 2019-20 onwards.

Coal and Lignite data are obtained from Geological Survey of India.

*Sterilization Loss for Coal = Extraction*3.7*

*Sterilization Loss for Lignite = Extraction*3.46*

Physical Supply and Use Table for Energy

2.32 A key motivation for accounting for minerals and energy resources is to assess to what extent current patterns of economic activity are depleting the energy resources and how much sustainable the present economy is. Physical supply and use tables for energy aims at comprehensiveness that entails recording all energy flows both within the economy and between the economy and the environment. These accounts along with the

Asset accounts provides necessary granular level information to help identify the policy concern areas.

2.33 In the chapter, the PSUT for Energy has been compiled following the structure of SEEA-Energy. Following accounting identities have been adhered to while compiling the PSUT for Energy.

- (i) **Total Supply of Energy from Natural Inputs = Total Use of Energy from Natural Inputs**
- (ii) **Total Supply of Energy Products = Total Use of Energy Products (Transformation + End Use)**
- (iii) **Total Supply of Energy Residuals = Total Use of Energy Residuals**

Procedure for Compiling Physical Supply and Use Table

2.34 The Methodology for compiling the Physical supply and use tables are as given below:

- (i) Energy from Natural Inputs: In the Supply Table, most of the data (for Coal, Lignite, Crude Oil and Natural Gas) have been sourced from the Energy Statistics-2022 publication¹⁴ and the values are shown in the column 'Flows from Environment'. On the use side, industry-wise distribution of these 'Energy from Natural Inputs' have been made. The values in physical units are converted to Petajoules using the appropriate conversion factors. The conversion factors used have been provided in the **Annexure 2.1**.
- (ii) Energy Products: Both for the Supply side and the Use side the data has been primarily sourced from the Energy Statistics-2022 publication. Additional data such as Crude Oil Processed have been taken from the MoPNG press release¹⁵. Entries in the Supply Table and Use Table have been matched energy component wise. After converting all the entries into Energy units, the tables are balanced by making appropriate adjustments in the HH column (Electricity and Biofuels) and in the accumulation column (others).
- (iii) Energy Residuals: The distribution loss for Natural Gas and Electricity and the loss in petroleum (flare and other loss) has been taken from the Energy Statistics. Apart from this, loss due to coal reject has been received from M/o Coal.

2.35 In the current chapter, the Physical Supply and Use Tables for Energy for the years 2015-16 to 2019-20 have been compiled. The PSUT for energy for the year 2019-20 has

¹⁴ <https://mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/27201?q=RPCAT>

¹⁵ <https://pib.gov.in/PressReleaselframePage.aspx?PRID=1706564>

been presented in **Tables 2.2 (a)** and **2.2 (b)**. For the years 2015-16 to 2018-19, PSUT for energy is given in **Annexures 2.2 to 2.9**. The Energy Accounts compiled in the current publication is at the preliminary stage and have scopes of further improvement with the availability of granular information from the source agencies-especially NIC-wise disaggregated data, data of residuals and losses, data on the accumulations etc.

Figure 2.5 Total supply of Energy in Petajoules

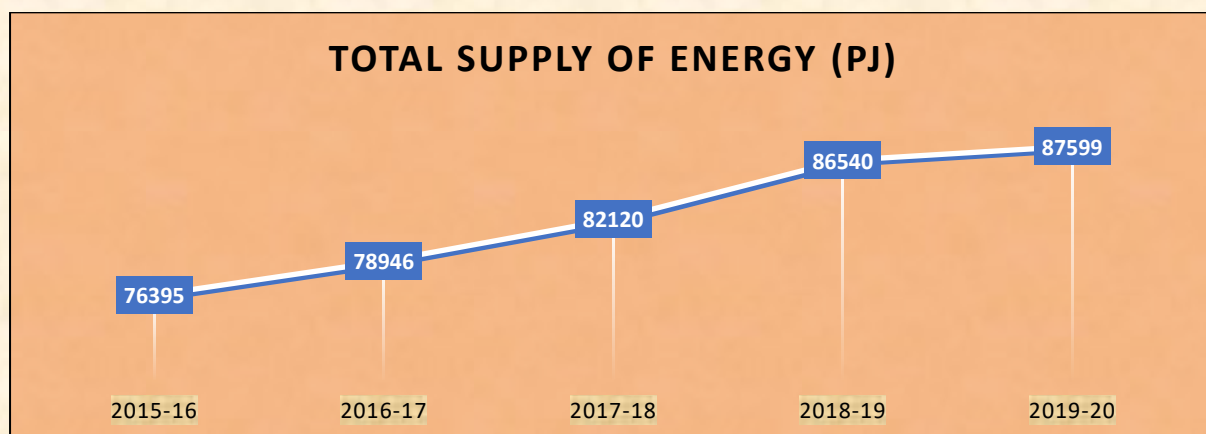
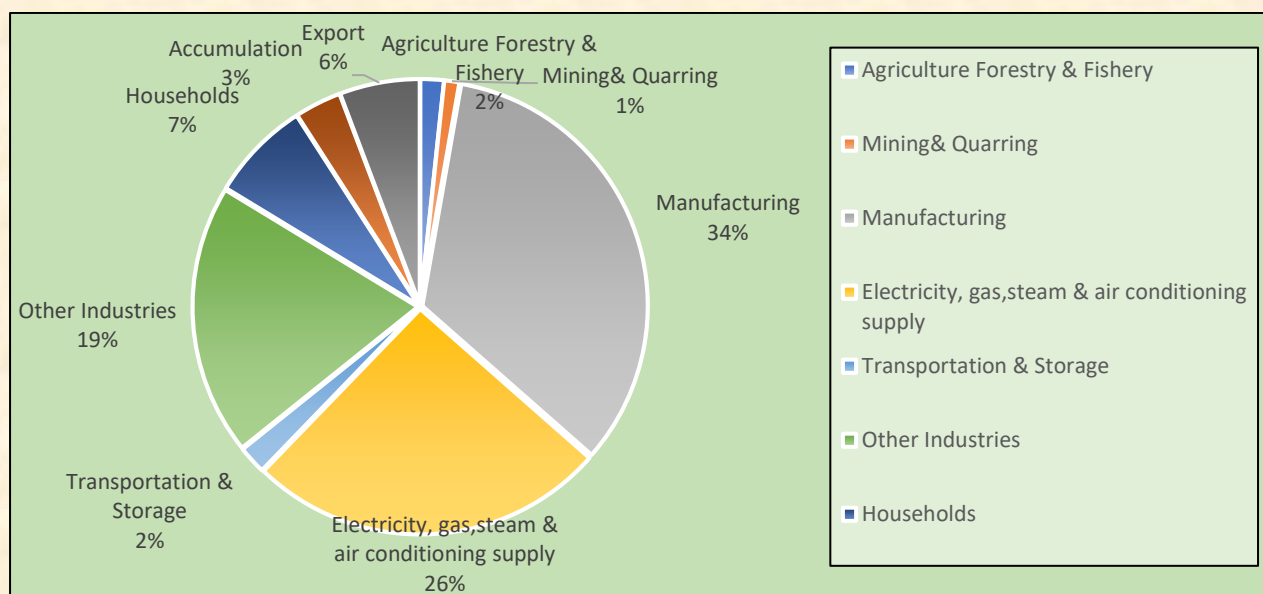


Figure 2.6: Industry-wise use (Transformation and End Use) of Energy for 2019-20



2.36 The Figure 2.5 shows the supply of Energy in Peta Joules over the years indicating an increasing trend. Figure 2.6 shows the industry-wise use of energy for the year 2019-20. The highest share of use can be seen in the Manufacturing and the Electricity sector for the year 2019-20.

Table 2.2 (a): Physical Supply Table for Energy: 2019-20

PHYSICAL SUPPLY TABLE (Unit: PJ)	Production (Incl. household own account) & generation of residuals							Accumulation	Flows from the rest of the world (Imports)	Flows from the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Energy from natural inputs:											
Natural resource inputs											
Crude Oil									1,347	1,347	
Natural Gas									1,201	1,201	
Coal									11,298	11,298	
Lignite									479	479	
Inputs of energy form renewable sources (Nuclear)-Electricity									1,250	1,250	
Other natural inputs (Biofuels)									54	54	
Total									15,628	15,628	
Energy Products:											
<i>Production of energy products by SIEC class:</i>											
Coal		11,058						3,760		14,818	
Natural gas		1,201						1,304		2,505	
Biofuels	105									105	
Electricity				5,843				23		5,866	
Nuclear fuels and other fuels				1,250						1,250	
Lignite		479						1		479	

PHYSICAL SUPPLY TABLE (Unit: PJ)	Production (Incl. household own account) & generation of residuals							Accumulation	Flows from the rest of the world (Imports)	Flows from the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Crude Oil		1,347						9,504		10,851	
Petroleum Products			11,011					1,834		12,844	
Total	105	14,085	11,011	7,093				16,425		48,720	
Energy Residuals:											
Distribution		4		975						978	
Extraction		35		84						119	
Other Losses (Coal Reject/other residuals)		240								240	
Other Energy Residuals	820	491	5,775	862	982	9,470	3,513			21,914	
Total energy residuals	820	769	5,775	1,920	982	9,470	3,513			23,251	
Other Residual Flows:											
Residuals from end-use for non-energy purposes											
Energy from solid waste											
TOTAL SUPPLY	925	14,855	16,786	9,013	982	9,470	3,513		16,425	15,628	87,599

Note: Grey cells are Nil by definition.

PJ: Petajoules

Total may not match due to rounding off.

Table 2.2(b): Physical Use Table for Energy: 2019-20

PHYSICAL USE TABLE (Unit: PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Energy from natural inputs:											
Natural resource inputs											
Crude Oil		1,347								1,347	
Natural Gas		1,201								1,201	
Coal		11,298								11,298	
Lignite		479								479	
Inputs of energy form renewable sources	52			1,198						1,250	
Other natural inputs	54									54	
Total	106	14,325		1,198						15,628	
Energy Products:											
<i>Transformation of energy products by SIEC class</i>											
Coal				9,474						9,474	
Natural gas				485						485	
Biofuels				52						52	
Electricity											
Nuclear fuels and other fuels				1,250						1,250	

PHYSICAL USE TABLE (Unit: PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Lignite				413						413	
Crude Oil			10,653							10,653	
Petroleum Products		37		8						44	
Total Transformed Energy		37	10,653	11,681						22,371	
<i>End-use of energy products by SIEC class:</i>											
Coal			1,302			3,688		340	16		5,345
Natural gas	9	378	916	23	428	184	48	34			2,020
Biofuels							54				54
Electricity	761		2,300	778	69	252	1,671		34		5,865
Nuclear fuels and other fuels											
Lignite			17			51		-2	1		66
Crude Oil			20					178			198
Petroleum Products	50	113	1,221	61	485	5,296	1,740	1,084	2,751		12,800
Total End Use for Energy purposes	820	491	5,775	862	982	9,470	3,513	1,634	2,801		26,349
<i>End-use of energy products for non-energy purposes</i>											
Energy Residuals:											
Distribution										978	978
Extraction										119	119

PHYSICAL USE TABLE (Unit: PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Other Losses (Coal Reject/other residuals)									240	240	
Other Energy Residuals									21,914	21,914	
Total energy residuals									23,251	23,251	
Other Residual Flows:											
Residuals from end-use for non-energy purposes											
Energy from solid waste											
TOTAL USE	925	14,853	16,428	13,741	982	9,470	3,513	1,634	2,801	23,251	87,599

Note: Grey cells are Nil by definition.

PJ: Petajoules

Total may not match due to rounding off.

Conclusion

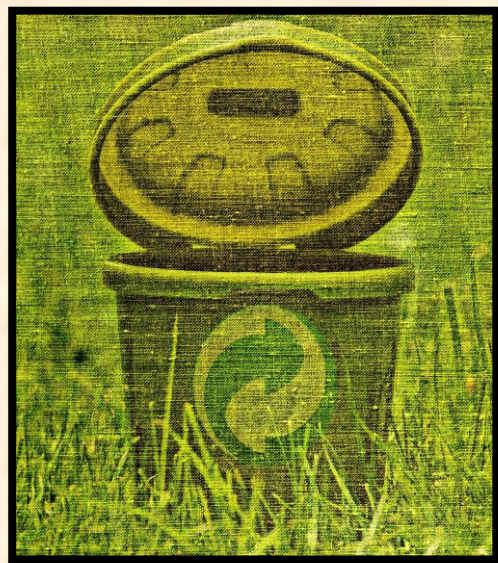
2.37 Several Energy indicators can be derived from the SEEA-Energy Accounts such as Energy Intensity for an industry (Energy intensity is a ratio of energy consumed per unit of economic output (GVA)), energy use per capita, energy use per GDP etc. Changes in the energy intensity can give a fair amount of idea about the efficiency and structural change in industry contribution. In addition, compilation of the Monetary Supply and Use Tables will help in providing additional information which might help in building linkages with the National Accounts.

2.38 SEEA-Energy also bears the direct linkages with the targets under Sustainable Development Goal 7 (“Ensure Access to affordable, reliable, sustainable and modern energy for all”). Besides this, the targets under SDG 12 (specially Target 12.2 which pertains to the material footprint and domestic material consumption and Target 12.c which focuses on rationalizing inefficient fossil-fuel subsidies that encourage wasteful consumption of fossil fuels) can also be compiled with the use of the Energy accounts. Energy accounts provides a myriad of information linked to the social, economic and environmental dimensions.

2.39 As the energy sector plays an integral role in the life of humans, how we use it becomes an essential consideration within the context of sustainable development. There are growing concerns about the impact of rising energy use and of related emissions on local and global environment. At the same time, it is recognized that continuing human welfare and development are dependent upon the benefits to be derived from energy use. Hence the need is to work towards fulfilment of the energy requirements of not only the current generations but to save enough for the future as well. The Energy accounts compiled in this chapter would help policy makers to have a better understanding of each energy component as also the major suppliers and users.

2.40 In this chapter, NSO, India has attempted compilation of the Energy Accounts with the best available information at hand. The Accounts do have a scope of further refinement based on the data availability and further understanding of the concepts and methodology.

SOLID WASTE ACCOUNTS



Chapter 3

Solid Waste Accounts

“Waste isn’t waste until we waste it.”

- Will. I. Am

Introduction

3.1 India, the second most populous country has showcased its advancement in all sectors of life, after independence. India is at its fastest phase of economic development, marching from ‘developing’ to ‘developed’. Many economic developments on social welfare, health, infrastructure, technology etc. take natural input for its processing and leaves residual to the environment. While looking at the progress in economic indicators, the country can’t ignore some of the glaring issues which pop up due to the residuals leaving behind as process of economic development.

3.2 The rapid urbanization and expansion of economic activity in the country has increased both consumption and imports and as a consequence is placing significant pressure on the management of all forms of residuals in India. These residuals are normally disposed in open dumps creating nuisance and environmental degradation which cause a major risk to public health and the environment. The long-term environmental strategy of the country, based on principles of sustainable development, may not be feasible to achieve without considering the problems of planning and resolving inadequate waste management. The importance of planning in municipal waste management is reflected in the fact that the management plans have to integrate the most appropriate option for the environment, considering economic, technical, social and environmental factors. Analysis of different waste management options allows decision makers to use different instruments to consider more acceptable options and make decisions about the optimal option to satisfy their specific needs. The basis for initiating the decision-making process depend upon waste generation and waste composition data (qualitative & quantitative) in a given territory within a certain time.

3.3 Champions of the Earth, the UN’s highest environmental honour, celebrates outstanding figures from the public and private sectors and from civil society whose actions have had a transformative positive impact on the environment, and was awarded to Hon’ble Prime Minister Shri Narendra Modi, in the year 2018. Recently India has taken another step for the fulfilment of its commitment to the protection of environment by banning single-use plastics in India with effect from July 2022. In order to monitor the progress made on the commitment, it is necessary to consolidate the information / statistics related to waste in terms of generation, treatment, recycle and reusable and also 4Rs principle (Reducing, reusing, recycling and recovering) to generate the waste accounts and indicators. The preparation of waste accounts and indicators are useful in

organizing information on the generation of waste and the management of flows of waste to recycling facilities, to controlled landfills or directly to the environment. Measures of the amount of waste in aggregate or of quantities of specific waste materials may be important indicator for assessing the environmental pressure and create demands for the policy marketers to take corrective measures for protective nature on sustainable basis.

3.4 As a beginning, NSO started with Solid Waste Accounts leaving apart effluents and air emissions, which are other two components of Residual Accounts. Central Pollution Control Board (CPCB), the nodal agency for developing standard and keeping a watch of residuals and its treatment, collects data related to all the three, i.e. solid waste, effluents and air emissions.

Solid Waste Accounts Framework

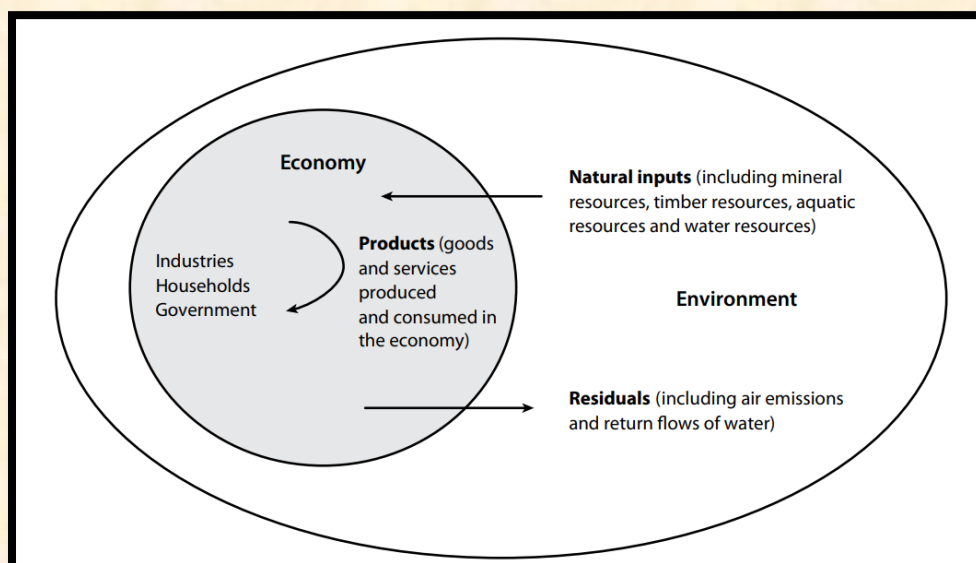
3.5 Solid waste accounts are useful in organising information on the generation of solid waste and the management of flows of solid waste to recycling facilities, to controlled landfills or directly to the environment. Measures of the amount of waste in aggregate or of quantities of specific waste materials may be important indicators of environmental pressure. The construction of solid waste accounts allows these indicators to be placed in a broader context with economic data in both physical and monetary terms.

3.6 Solid waste covers discarded materials that are no longer required by the owner or user. Where the unit discarding the materials receives no payment for the materials then the flow is considered a residual flow of solid waste. Where the unit discarding the materials receives a payment but the actual residual value of the material is small, for example in the case of scrap metal sold to a recycling firm, this flow is considered a product flow of solid waste. Discarded materials sold as second-hand products; for example the sale of a second-hand car or furniture will be treated as flows of products and will not be treated as solid waste. In the determination of whether a material is a second-hand product, consideration may be given of the extent to which the receiving unit can use the product again for the same purpose for which it was conceived. In practice, in many countries, statistics on solid waste is based on legal and administrative lists of materials determined to be solid waste. However, the principles above provide a basis for the measurement of solid waste in countries where legal or administrative processes concerning waste do not exist or are limited in scope.

3.7 “Physical flow Accounts” of System of Environmental Economic Accounting (SEEA) explains in detail the recording of different physical flows—Natural inputs, Products and Residuals and are placed within the structure of a physical supply and use table (PSUT).

3.8 The flows from the environment to the economy are recorded as natural inputs (e.g, flows of minerals, timber, fish and water), flows within the economy are recorded as product flows (including additions to the stock of fixed assets) and flows from the

economy to the environment are recorded as residuals. The following diagram shows the relationship between inputs, products and residuals within the environment.



3.9 The Central Framework organizes and integrates the information on the various stocks and flows of the economy and the environment in a series of tables and accounts: (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. The analysis of these data can also be extended by linking the tables and accounts to relevant employment, demographic and social information.

3.10 In Physical supply and use tables (PSUT), physical flows are recorded by compiling supply and use tables in physical units of measurement. These tables, which are commonly known as physical supply and use tables (PSUT), are used to assess how an economy supplies and uses energy, water and materials, as well as to examine changes in production and consumption patterns over time. In combination with data from monetary supply and use tables, changes in productivity and intensity in the use of natural inputs and the release of residuals can be examined. The PSUT structure is based on the monetary supply and use tables described above with extensions to incorporate a column for the environment, and rows for natural inputs and residuals.

3.11 Residuals are flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted to the environment (e.g., emission to air) by establishments and households through processes of production, consumption or accumulation but may also flow within the economy, as is the case when, for example, solid waste is collected as part of a waste collection scheme. The basic form of Physical

supply and use table for solid waste accounts is given in the Figure 3.1 and Figure 3.2 below:

Physical Supply Table for Solid Waste										
	Generation of Solid Waste							Rest of the world	Flows From the environment	Total supply
	Waste collection,treatment and disposal industry					other industries	Households			
	Landfill	Incineration		Recycling and reuse	Other treatment					
		Total	Of which: incineration to generate energy							
Generation of Solid Waste Residuals										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										
Generation of Solid Waste Products										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										

Dark Grey cells are null by definition

Figure 3.1: Basic form of Supply Table for Solid Waste Accounts

Physical Use Table for Solid Waste										
	Intermediate Consumption, collection of residuals							Final Consumption	Rest of the world	Total supply
	Waste collection,treatment and disposal industry					other industries	Households			
	Landfill	Incineration		Recycling and reuse	Other treatment					
		Total	Of which: incineration to generate energy							
Collection and disposal of solid waste residuals										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										
Use of Solid Waste Products										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										

Dark Grey cells are null by definition

Figure 3.2: Basic form of Use Table for Solid Waste Accounts

3.12 The first table is the physical supply table and the second table is the physical use table. The first part of the supply table, "Generation of solid waste residuals", shows the generation of solid waste by industries and households. It also shows the supply of solid waste from the rest of the world (recorded as imports) and also solid waste recovered

from the environment (for example, oil recovered following an off-shore oil spill, debris collected following a natural disaster, or the excavation of soil from locations at which hazardous chemicals were used).

3.13 Similarly, the first part of the use table, “Collection and disposal of solid waste residuals”, shows the collection and disposal of solid waste by various activities within the waste collection, treatment and disposal industry and by related activities in other industries. It also shows the flow of solid waste to the rest of the world as exports and the flow of solid waste direct to the environment. The columns of the table highlight the various activities of the waste collection, treatment and disposal industry. These are landfill operation, incineration of solid waste (of which incineration of solid waste to produce energy is separately identified), recycling and reuse activities, and other treatment of solid waste. More industry detail can be provided depending on analytical requirements and available information. It is noted that the accumulation of waste in landfill sites is not presented in a distinct accumulation column as in the general PSUT. This is done such that all information on the waste collection, treatment and disposal industry can be presented as a single group.

3.14 In the second part of the supply and use table, which talks about “Generation of solid waste products” and “Use of solid waste products” respectively, the flows of solid waste that are products rather than residuals are recorded, following the distinction described above. The flows recorded here relate to cases when a solid waste product is identified at the time of disposal by the discarding unit. The flow is recorded in the second part of the supply table matched by a use of solid waste products in the second part of the use table. Sales of scrap metal would be recorded in this way. Sales of products manufactured from solid waste, or simply obtained from waste collection, should not be included. For example, paper discarded by households that is collected by a charitable organisation and subsequently sold in bulk to a paper recycling firm, is only recorded in the solid waste account in respect of the initial flow of solid waste from households to the charitable organisation.

Solid Waste Accouts in India

3.15 In India, Solid Wastes are classified in to 6 components by Law namely (i) Municipal Solid Waste (ii) Hazardous Waste (iii) E-waste (iv) Bio-medical Waste (v) Plastic Waste and (vi) Construction and Demolition Waste. Due to non-availability of adequate data in the form in which it is required, NSO India prepared the PSUT of Delhi, the national Union capital territory of India on an experimental basis. Delhi has 5 Urban Local Bodies (ULB) and data was collected from Delhi Pollution Control Committee (DPCC) for the year 2020-2021. The basic deviation from SEEA-CF in preparation of PSUT for Delhi is on “products”. As per SEEA if any residual fetches any value while discarding an item, it will no longer be treated as ‘waste’ but will be treated as ‘product’ in the PSUT which cannot be followed in the Indian case as data on many items like batteries, e-waste, plastic waste etc has been given by the recycler who obtains these items by making nominal payments or at free of cost and no such segregated data is available.

3.16 It may also be noted that the data pertaining to different types of wastes are obtained by the authorised collectors of the same and so there may be an overlapping of data pertaining to a particular type of waste. For example, the data on plastic waste generated is obtained mainly from recyclers, which they might have received from ragpickers or segregators who did it from Municipal Solid Waste. Since no such segregated information is available, the data is placed as itself under the assumption that the volume of such waste may be negligible.

Municipal Solid Waste (MSW)

3.17 Municipal solid waste includes garbage (highly decomposable objects, such as food), trash (bulky items, such as tree branches or old appliances), and rubbish (slowly decomposable items, such as paper, glass, or metal objects) and plastic items. In accordance with the Provision 24 (4) of the Solid Wastes Management Rules, 2016, the Central Pollution Control Board (CPCB) is preparing a Consolidated Annual Report (CAR) based on the annual report submitted by SPCBs/PCCs in compliance of Solid Waste Management Rules, 2016.

3.18 Since data on waste generated disaggregated by households and other sources was not available with the municipal bodies of Delhi, NSO requested one of the municipal bodies to collect waste data disaggregated by sources for 15 days. It was found that about 85% of MSW is generated by households and only 15% are contributed by others. This ratio was applied on the total generation of MSW for the year 2020-2021 to get the figures under these two categories. The data was available in Tons Per Day (TPD), which was converted to Tons per annum as a common unit for all the solid wastes. The State level aggregated figures provide data on “land fill” and “processed” and further segregation of “processed” is not available.

3.19 In 2020-2021, the 5 ULBs in Delhi generated 10990 TPD (40,11,350 tonnes per annum) of Municipal Solid Waste out of which 5457 TPD (19,91,805 tonnes per annum) is processed/ treated. This is around 49.65% of the total solid waste generated and the rest 50.35 % of the MSW is sent for land filling i.e., 5533 TPD (20,19,545 tonnes). For processing the MSW, Delhi have 19 composters, 1 vermi-composting plant, 13 biogas plants and 3 RDF/Pelletization plants at various places with total capacity of 17,70,990.95 Tonnes per annum. In addition, there are 3 waste to energy plants with a capacity of 4550 TPD (1660750 tonnes per annum) with power generation of 59 MW per annum are also functioning. Further many composting plants are under set up and will be operational in limited time. There are 3 MSW dumpsites in Delhi and continuous monitoring of these dumpsites are in operation. Efforts are carried out to reduce the landfill as much as possible by creating new processing facilities with a total capacity of 7680 TPD (28,03,200 Tonnes per annum). This will be addressing the quantity of MSW sent for land fill and will take care of the future generation also.

Hazardous Waste

3.20 The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (HOWM Rules, 2016) stipulates that the occupier handling hazardous or other wastes and operator of the disposal facility shall submit the annual returns to the concerned State Pollution Control Board/ Pollution Control Committee (SPCB/PCC) by 30th June of every financial year. Based on reports submitted by SPCB/PCC, Central Pollution Control Board prepared a consolidated review report on management of hazardous and other wastes and submit the same to the Ministry of Environment, Forest and Climate Change before 30th December once in every year in accordance with the provisions stipulated under Rule 20 of the HOWM Rules,2016.

3.21 Only for hazardous waste CPCB has state-wise and district-wise data as per the SEEA-CF (Ref. to Figure 3.1). However, this kind of data is not available for other wastes. Further, in Delhi for which the accounts have been attempted in this publication, treatment or disposal facility is not available.

E-Waste

3.22 In Delhi, at state level, data on total waste collected in KGs is available and no recycling of e-waste is permitted in Delhi. Even though refurbishing and dismantling is permitted, no information on the quantity of waste recycled or exported by the units are available. Delhi PCC has granted permission to two refurbishers, 2 dismantlers and 110 bulk consumers. Of the total e-waste generated in 2020-21, refurbishers have collected 28606 KG (28.6 tonnes) of e-waste, where the bulk consumers collected 581,526.30 KG (581.5 Tonnes)

Bio Medical Waste

3.23 Bio-medical Waste has been regulated under Biomedical Waste Management Rules, 2016 as notified under Environment (Protection) Act, 1986 by the Ministry of Environment Forest & Climate Change. These Rules were first notified in the year 1998 and then revamped in the year 2016 to implement these rules more effectively and to improve the collection, segregation, processing, treatment and disposal of bio-medical wastes in an environmentally sound management thereby, reducing the bio- medical waste generation and its impact on the environment. These Rules has mandate of preparation of Annual Inventory of biomedical waste generation, its collection, treatment and disposal. Under Rule 13, every Occupier and Common Biomedical Waste Treatment Facility Operator is required to prepare annual inventory for biomedical waste management. Further, State Pollution Control Boards and Pollution Control Committees shall compile and submit the Annual Report to Central Pollution Control Board for the preceding year before 31st July of every year. Central Pollution Control Board shall compile, review and analyse the annual data submitted by SPCBs / PCCs and submit the same to Ministry of Environment Forests & Climate Change.

3.24 Much information is available in the annual report of Delhi PCC on bio medical waste as mostly the same is generated from hospitals/clinics or veterinary hospitals. The generation of Bio Medical waste in different category (yellow, Red blue and White) are available and regarding treatment also information on different processes is available. The quantity of waste treated under different methods are reported in different units.

Plastic Waste

3.25 As per rule “17(3)” of Plastic Waste Management Rule, 2016 (as amended) each State Pollution Control Board or Pollution Control Committee (SPCC or PCC) shall prepare and submit the Annual Report to Pollution Control Board on the implementation of these rules by the 31st July of each year. Also, as per provision “17(4)” of PWM Rules, 2016 (as amended), the Central Pollution Control Board shall prepare a consolidated report on use and management of plastic waste and forward it to the Central Government along with its recommendation by 31st August of each year. Information was collected from the returns submitted by 5 ULBs as it is having much disaggregated information. As mentioned earlier, a deviation from the definition of residual in SEEA, the data reported under plastic waste may or may not have fetched some value, but being treated as residual and the accounts are prepared. The data is reported in different units (other than the unit specified in the return) and much information on the “processing part’ is not available. In Delhi, there are total 840 Producers, plastic/ multilayer manufacturing/ recycling units in the UT. Door to Door waste collection system from households is done by Municipal Staff and the collected waste is sent to ‘Waste to Energy’ plants and recycling units. Data on Plastic waste generated as obtained through the returns filed by recyclers to the PCC has been shown separately as Plastic waste in the PSUT. Recyclers might have received the plastic waste from rag pickers. However, a part of this plastic waste is also included in the MSW since waste data of MSW is not disaggregated by type of waste.

Construction and Demolition Waste

3.26 Being one of the metropolitan cities, generation of C&D waste is much higher in comparison to others. The entire waste is getting processed and a considerable portion is re-used. No further information could be obtained from the annual return of C&D waste as required in the SEEA format. However, it is expected that in future such information can be obtained after taking up the matters with the concerned authorities.

Solid Waste Accounts- Delhi

3.27 The supply and use table of solid waste accounts for the year 2020-21 is presented in the **Table 3.1 and Table 3.2** below:

Table 3.1: Physical Supply Table – Solid Waste Account

In tonnes

Sl. No	Items	Households	Industry	Shops/ restaurants	Imports	Others	Total
Generation of Solid Waste Residuals							
1	Municipal Solid Waste	3432817		578533			4011350
2	Bio Medical Waste		11380				11380
3	Hazardous Waste		3239				3239
4	Construction and Demolition Waste		1354749				1354749
5	E Waste		610				610
6	Plastic Waste		546592				546592

Total may not match due to rounding off

Table 3.2: Physical Use Table – Solid Waste Account

In tonnes

Sl. No.	Items	Landfill	Incineration	Recycling & Reuse	To Environment	Exports	Waste to Energy	Others/ Inventory	Total
Collection and Disposal of Solid Waste Residuals									
1	Municipal Solid Waste	2019545		1991805					4011350
2	Bio Medical Waste	244@	3930	3557	389			3261	11380
3	Hazardous Waste*					366		2874	3239
4	Construction and Demolition Waste			1354749					1354749
5	E Waste *								
6	Plastic Waste	202751		135234	87600		121007		546592

*: No treatment and disposal facility available in Delhi.

@: Quantity of ash generated after incineration and sent for landfill is shown under landfill and excluded from incineration.

Total may not match due to rounding off

3.28 It can be observed that more than 99.5 % wastes out of total waste are generated as Municipal solid waste and out of which more than 85% is contributed by households. There is a need to develop such an ecosystem which can reduce the generation of MSW by various methods including awareness, reuse, recycle and encourage decentralised processing (may be at household level or at Resident Welfare Association (RWA) level

etc). From the use table, it can be observed that half of the MSW is used for land filling and half is getting processed. This issue can be addressed by increasing the waste treatment mechanism, segregation of wastes and other innovative methods. Further from the generation and processing of plastic waste, it can be inferred that more than 16 % of the generated waste are not being collected, which means that it has gone to the environment and there by polluting the environment. A PSUT of Solid Waste accounts will help in identifying this kind of issues as it is data driven.

Conclusion

3.29 Waste management is gaining paramount importance as it is a threat to civil society as well as for the environment. Better data will give better information on waste generation which will lead the policy makers to take decisions on RRRR (Reduce, Reuse, Recycle and Recover). As initiated by CPCB, an MIS portal for fetching the information from grassroot level will help to aggregate the information at any level and also to answer questions like who generate, what type and what treatment is being given. This will help in addressing some of the perineal problems in solid waste management and the Solid waste accounts will help in identifying methods to address these problems. A time series accounts on Solid Waste will be helpful in identifying the trend in 'generation & processing' of waste. This will further help in estimating the generation of solid waste in different types which in-turn will be helpful for the policy makers to take empirical decision on the number and capacity of treatment plants to be set up. Innovative methods and latest technology can be embraced to address the challenges which will ultimately lead to reducing the burden on environment and help in the preparation of Global/National level indicator(s) of SDG. However, residual accounts can be prepared only if data is available at the required level. This can be ensured by CPCB while developing the MIS portal for various types of solid wastes. Meantime, the Ministry will continue to make efforts in stabilizing the methodology and reducing the data gaps in consultation with stakeholders.

WETLANDS



Chapter 4

Wetlands Ecosystem

Look deep into nature and you will understand everything better

-Albert Einstein

Introduction

4.1 Life is sustained on planet Earth by various kinds of natural resources. With the growing or flourishing economy, the vital natural resources are excessively used which causes the depletion of natural resources. It is increasingly being realized that the planet Earth is facing grave environmental problems, with fast depleting natural resources threatening the very existence of many ecosystems. Wetlands is considered one of the most important threatened ecosystems.

4.2 Wetlands are considered the world's most productive ecosystem – they provide food, sequester carbon, help in flood control, recharge groundwater. Also, vegetation that grows in wetlands is consumed in various ways viz. to build mats, houses, as wildlife refuge, and as food. Wetlands are the areas of land that are either seasonally and permanently covered by water, or nearly saturated by water. Following are the definitions¹ of wetlands provided by the different agencies:

- (i) *Ramsar Convention, 1971, Article 1.1*: "Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".
- (ii) *International Union for the Conservation of Nature and Natural Resources (IUCN,1965)*: "Submerged or water saturated lands, both natural and man-made, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".
- (iii) *Ramsar Convention Modified Ramsar/IUCN Definition Amenable to Remote Sensing*: "All submerged or water saturated lands, natural or manmade, inland or coastal, permanent or temporary, static or dynamic, vegetated or non-vegetated, which necessarily has a land- water interface".
- (iv) As per the Ramsar Convention: 'In addition, to protect coherent sites especially waterflow habitat, Article 2.1 of the Convention provides that 'wetlands may include riparian and coastal zones adjacent to the wetlands, and islands or

¹ Wetlands Decadal Change Atlas

bodies of marine water deeper than six meters at low tide lying within the wetlands.’

4.3 There exist marine and coastal wetlands such as open coasts, coral reefs, estuaries, tidal flats, mangroves and coastal lagoons; Inland wetlands such as permanent and seasonal rivers, inland deltas and floodplains, permanent and seasonal lakes and ponds, marshes, freshwater swamps and peatlands as well as Human-made wetlands such as reservoirs, barrages and dams, aquaculture ponds, excavations and burrow pits, wastewater treatment ponds, irrigation canals, ditches, irrigation ponds and rice fields. Often these wetland types are interlinked hydrologically and ecologically, merging into one another and the larger landscapes. Wetlands should, therefore, be considered as part of the river basin or coastal zone.

4.4 Wetlands are central to meeting many of the United Nation’s 17 Sustainable Development Goals (SDGs) and 169 associated targets, focusing on poverty, hunger, health, energy, consumption and climate change. One of the difficulties most frequently faced for decision-making is lack of scientific data of our natural resources. Often the data are sparse or unconvincing, rarely in the form of geospatial database (map), thus open to challenges. Thus, the current thrust of every country is to have an appropriate geospatial database of natural resources that is based on unambiguous scientific methods². Regular updation of the status of the wetlands is more significant in view of accelerating pressure on the very existence of these resources due to developmental activities and population pressure being witnessed currently. Over a period of time, the database of wetlands has been widely used in developmental activities that require environmental clearances etc. Aquatic biodiversity is dependent on hydrologic regime; geological conditions and efforts are being made to conserve the biodiversity found in wetlands, streams and rivers. The goal of this irreplaceable biodiversity is to minimize its loss through sustainable management and conservation practices (Groombridge & Jenkins 1998)³. In India, lakes, rivers and other freshwaters support a large diversity of biota representing almost all taxonomic groups⁴. Algae in open waters represent the floristic diversity and macrophytes dominate the wetlands. Wetlands are also important as resting sites for migratory birds. Aquatic vegetation is a valuable source of food, especially for waterfowl. In the winter, migratory waterfowl search the sediment of wetlands for nutritious seeds, roots and tubers (Tiner, 1999)⁵.

² National Wetland Atlas: Jharkhand

³ Groombridge, B., & Jenkins, M. (1998). Freshwater biodiversity: a preliminary global assessment.

⁴ Ramachandra T.V. and Ahalya N., Conservation and Management Of Wetland Ecosystems In Karnataka

⁵ Tiner, R. W. 1999. Wetland Indicators: a Guide to Wetland Identification, Delineation, Classification, and Mapping. Lewis Publishers

Indian Wetlands

4.5 Indian land mass is characterised by highly diversified climate, landforms and landscapes spreading over high altitude mountain system, long coastline, surface and subsurface geological formations, forests types and various land cover systems. The interactive processes among these natural regions lead to formation of wetland ecosystems. Natural wetlands in India consists of the high-altitude Himalayan lakes, followed by wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries; mangrove swamps; coral reefs and marine wetlands etc.

4.6 India supports ⁶ unique geographical diversity and different climatic zones, which in turn supports diverse wetland habitats throughout the subcontinent and covers nearly 58.2 million hectares. India is one of the Contracting Parties to Ramsar Convention, signed in Ramsar, Iran, in 1971. India signed it on 1st Feb, 1982 and since then designated 75 Wetlands⁷ under the list of Wetlands of International Importance.

4.7 Wetlands of the Indian continent are unique due to their interaction with human populations for several millennia. Wetlands and their resources have been an integral part of the social and cultural ethos of human societies in this region.

Types of Wetlands

4.8 The first national level wetlands inventory was prepared in 2006-07. Since, almost a decade has already been passed, a need was felt to reassessing the current status of wetlands at national level in comparison with the database of 2006-07. Space Applications Centre, Indian Space Research Organization (ISRO), Ahmedabad has carried out project on “National Wetland inventory and Assessment-2nd Cycle”. The major objectives of the project are to generate a current status of existing (2006-07) wetlands and geo-database of National wetlands (1:50k scales and area \geq 2.25 ha) using Resourcesat-2/2A, LISS-III sensor data of 2017-18. The project has followed similar methodology as used in the case of earlier 2006-07 inventory. A wetland classification system based on IUCN/RAMSAR definition and amenability on remotely sensed data is used to categorize the wetlands. The wetland classification categorizes inland and coastal wetlands as level-I followed by natural and man-made wetlands as level-II, which were further categorized using a hierarchical system into 20 types of wetlands as level-III classes, excludes rice fields. Each wetland type also exhibits a wide diversity in terms of shape, size, distribution, water quality etc., which are well captured on the satellite imagery. The methodology to create the wetland database is adhered to NWIA technical

⁶ Invasive Alien Species: threat to inland wetlands of India: Centre for Biodiversity Policy and Law (CEBPOL)

⁷ <https://pib.gov.in/PressReleaselframePage.aspx?PRID=1851484>

guidelines manual (Garg and Patel, 2007)⁸. Wetlands inventory of 2006-07 (for wetlands area ≥ 2.25 ha) was updated for interpretational changes by using time series google images and ground information, after which updated figures of wetland number and area have been estimated. The details of National Wetlands Classification System are given in the **Table 4.1** and different wetlands types presented in the **Figure 4.1** below:

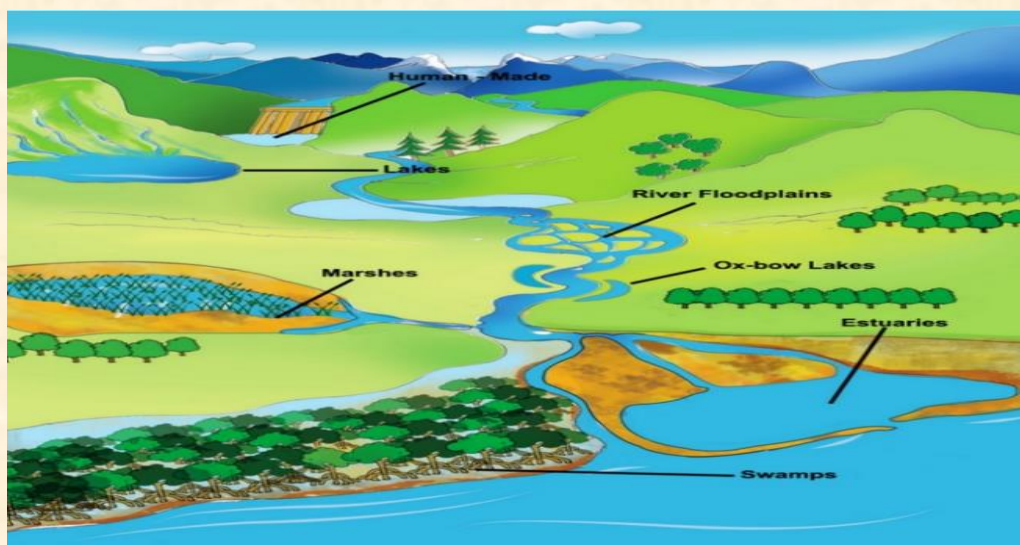
Table 4.1: Classification of India's Wetlands System

Level-I	Level-II Code	Level-III Code
Inland Wetlands	Natural (1100)	1101: Lakes
		1102: Ox-Bow Lakes/Cut-off Meanders
		1103: High altitude Wetlands
		1104: Riverine Wetlands
		1105: Waterlogged (natural)
		1106: River/Stream
	Man-made (1200)	1201: Reservoirs/Barrages
		1202: Tanks/Ponds
		1203: Waterlogged (man-made)
		1204: Salt Pans (inland)
1205: Aquaculture ponds (inland)		
Coastal Wetlands	Natural (2100)	2101: Lagoons/Backwaters
		2102: Creek
		2103: Sand/Beach
		2104: Intertidal mud flats
		2105: Salt marsh
		2106: Mangroves
		2107: Coral Reefs
	Man-made (2200)	2201: Salt Pans (Coastal)
		2202: Aquaculture ponds (coastal)

Source: Wetland Classification System (Ref: Garg J.K. and Patel J. G., 2007)

⁸ Garg J K and Patel J G, (2007). National Wetland Inventory and Assessment, Technical Guidelines and Procedure Manual, Technical Report, SAC/EOAM/AFEG/NWIA/TR/01/2007, June 2007, Space Applications Centre, hmedabad.

Figure 4.1: Wetland Types



Source: <https://indianwetlands.in/wetlands-overview/wetland-types/>

4.9 At level II, Indian wetlands are classified into two major groups namely Natural and Man-made and details are given below. According to the Wetland Decadal Change Atlas (2006-07 to 2017-18), the total natural wetlands area is 10.64 Mha (66.6%) whereas 5.34 Mha area (33.4%) is covered under man-made category. In comparison to the man-made wetlands area, natural wetlands area is approximately two times.

- i. **Natural Wetlands:** It consist of the high-altitude Himalayan lakes, wetlands in the flood plains of the major river, saline and temporary wetlands of the arid and semi-arid regions and coastal wetlands including lagoons, backwaters, estuaries, mangrove swamps and coral reefs.
- ii. **Man-made Wetlands:** These are wetlands built for a purpose, such as storing water for irrigation and drinking or for producing fish or for recreation. Reservoirs, aquaculture ponds, salt pans, dams, barrages, inland lakes and impoundments, traditional village ponds are some examples of human-made wetlands.

4.10 The definition and description of different types of wetlands at Level III are defined⁹ as follows:

- **1101-Lakes:** Larger bodies of standing water occupying distinct basin. These wetlands occur in natural depressions and normally fed by streams/rivers. On satellite images, lakes appear in different hues of blue interspersed with pink (aquatic vegetation), islands (white if unvegetated, red in case of terrestrial vegetation). Vegetation if scattered, make the image texture rough. Lakes and ponds (also known as the lentic systems) are a diverse set of inland fresh water

⁹ Space based observation of Indian Wetlands, Space Application Centre, ISRO, Ahmedabad, Gujarat

habitats that provide essential resources and habitats for both terrestrial and aquatic organisms.

- **1102-Ox-Bow Lakes/Cut-off Meanders:** A meandering stream may erode the outside shores of its broad bends and in time, the loops may cut-off, leaving basins. The resulting shallow crescent shaped lakes are called Ox-bow lakes. On the satellite image Ox-bow lakes occur near the rivers in plain areas. Some part of the lake normally has aquatic vegetation (red/pink in colour) during pre-monsoon season.
- **1103-High altitude Wetlands:** These lakes occur in the Himalayan region. Landscapes around high lakes are characterized by hilly topography. Otherwise they resemble lakes in the plain areas. The wetland is a distinct ecosystem that is flooded by water, either permanently (for years or decades) or seasonally (for weeks or months). For keeping uniformity in the delineation of these lakes, contour line of 3000 m above msl is taken as reference and all lakes above this contour line are classified as high-altitude lakes.
- **1104-Riverine Wetlands:** Along the major rivers, especially in plains, water accumulates leading to formation of marshes and swamp. Marshes are dominated by herbaceous plants and are sustained by water sources other than direct rainfall like surface runoff, groundwater or tidal flow. Swamps are 'Wetland dominated by trees or shrubs'. They have poor drainage and sufficient water supply to keep the ground waterlogged and level of minerals to stimulate decay of organism and prevent accumulation of organic materials.
- **1105-Waterlogged (natural):** An area in which water stands near, at, or above the land surface, so that the roots of all plants except hydrophytes are drowned and the plants die. Sometimes, man-made activities like canals cause waterlogging in adjacent areas due to seepage especially when canals are unlined. Floods or unlined canal seepage and other irrigation network may cause waterlogging. Spectrally, during the period when surface water exists, waterlogged areas appear more or less similar to lakes/ponds. However, during dry season large or all parts of such areas dry up and give the appearance of mud/salt flats (grey bluish).
- **1106-River/Stream:** Rivers are linear water features of the landscape. Rivers that are wider than the mapping unit will be mapped as polygons. Its importance arises from the fact that many stretches of the rivers in Indo-Gangetic Plains and peninsular India are declared important national and international wetlands (Ex. The river Ganga between Brajghat and Garh Mukteshwar, is a Ramsar site, Ranganthattu on the Cavery river is a bird sanctuary etc.). Wherever, rivers are wide and features like sand bars etc. are visible, they are mapped.
- **1201-Reservoirs:** A pond or lake built for the storage of water, usually by the construction of a dam across a river. On Remote Sensing images, reservoirs have irregular boundary behind a prominent dyke. Wetland boundary in case of reservoir incorporates water, aquatic vegetation and footprint of water as well. In the accompanying images aquatic vegetation in the reservoir is seen in bright pink tone. Tone is dark blue in deep reservoirs while it is ink blue in case of shallow

reservoirs or reservoirs with high silt load. These are annotated as Reservoirs/Dam.

- **1201-Barrages:** Dykes are constructed in the plain areas over rivers for creating Irrigation/water facilities. Such water storage areas develop into wetlands (Harike Barrage on Satluj – a Ramsar site, Okhla barrage on the Yamuna, a bird sanctuary etc.). Water appears in dark blue tone with a smooth texture. Aquatic vegetation appears in pink colour, which is scattered, or contiguous depending on the density. Reservoirs formed by barrages will be annotated as reservoir/barrage.
- **1202-Tanks/Ponds:** A term used in Ceylon and the drier parts of Peninsular India for an artificial pond, pool or lake formed by building a mud wall across the valley of a small stream to retain the monsoon. Ponds generally, suggest a small, quiet body of standing water, usually shallow enough to permit the growth of rooted plants from one shore to another. Tanks appear in light blue colour showing bottom reflectance. In this category, Industrial ponds/mining pools mainly comprising ‘Abandoned Quarries’ are also included. ‘Ash pond’ are the water body created for discharging effluents in industry, especially in thermal power plants and ‘Cooling pond’ is an artificial lake used for the natural cooling of condenser-cooling water serving a conventional power station. These ponds can be of any shape and size. Texture is rough and tonal appearance light (quarry) to blue shade (cooling pond).
- **1203-Waterlogged(man-made):** Man-made activities like canals cause waterlogging in adjacent areas due to seepage especially when canals are unlined. Such areas can be identified on the images along canal network. Tonal appearance is in various hues of blue. Sometimes, such waterlogged areas dry up and leave white scars on the land. Texture is smooth.
- **1204-Salt Pan (inland):** Salt Pans are shallow rectangular man-made depressions in which saline water is accumulated for drying in the sun for making salt.
- **1205-Aquaculture ponds:** Aquaculture is defined as "The breeding and rearing of fresh-water or marine fish in captivity, Fish farming or ranching". The water bodies used for the above are called aquaculture ponds. Aquaculture ponds are geometrical in shape usually square or rectangular. Tone is blue.
- **2101-Lagoons/Backwaters:** Such coastal bodies of water, partly separated from the sea by barrier beaches or bass of marine origin, are termed lagoons. As a rule, lagoons are elongated and lie parallel to the shoreline. They are usually characteristic of, but not restricted to, shores of emergence. Lagoons are generally shallower and more saline than typical estuaries. Backwater is an arm of the sea or series of connected lagoons, usually parallel to the coast, separated from the sea by a narrow strip of land but communicating with it through barred outlets.
- **2102-Creeks:** A notable physiographic feature of salt marshes, especially low marshes. These creeks develop as do rivers "with minor irregularities sooner or

later causing the water to be deflected into definite channels". Creeks will be delineated however their area will not be estimated.

- **2103-Sand/Beach:** Beach is an unvegetated part of the shoreline formed of loose material, usually sand that extends from the upper berm (a ridge or ridges on the backshore of the beach, formed by the deposit of material by wave action, that marks the upper limit of ordinary high tides and wave wash) to low water mark. Beach comprising rocky material is called rocky beach.
- **2104-Intertidal mud flats:** Most unvegetated areas that are alternately exposed and inundated by the falling and rising of the tide. They may be mudflats or sand flats depending on the coarseness of the material of which they are made.
- **2105-Salt Marshes:** Natural or semi-natural halophytic grassland and dwarf brushwood on the alluvial sediments bordering saline water bodies whose water level fluctuates either tidally or non- tidally. Salt marshes look in grey blue shade when wet.
- **2106-Mangroves:** The mangrove swamp is an association of halophytic trees, shrubs, and other plants growing in brackish to saline tidal waters of tropical and subtropical coastlines. They are the coastal swamps bordering major deltas of the country. On the satellite images mangroves occur in red colour if in contiguous patch. When mangrove associations are scattered or are degraded then instead of red colour, brick red colour may be seen.
- **2107-Coral Reefs:** Consolidated living colonies of microscopic organisms found in warm tropical waters. The term coral reef, or organic reef is applied to the rock-like reefs built-up of living things, principally corals. They consist of accumulations of calcareous deposits of corals and corraline algae with the intervening space connected with sand, which consists largely of shells of foraminefera. Present reefs are living associations growing on this accumulation of past. Reefs appear in light blue shade.
- **2201-Salt Pans (coastal):** An undrained usually small and shallow rectangular, man-made depression or hollow in which saline water accumulates and evaporates leaving a salt. Salt pans are square or rectangular in shape. When water is there appearance is blue, while when salt is formed, the tone is white.
- **2202-Aquaculture ponds (coastal):** FAO has defined Aquaculture as the farming of aquatic organism, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. The water bodies used for the above are called aquaculture ponds. Aquaculture ponds are geometrical in shape usually square or rectangular. The tone is blue.

Services provided by the Wetlands

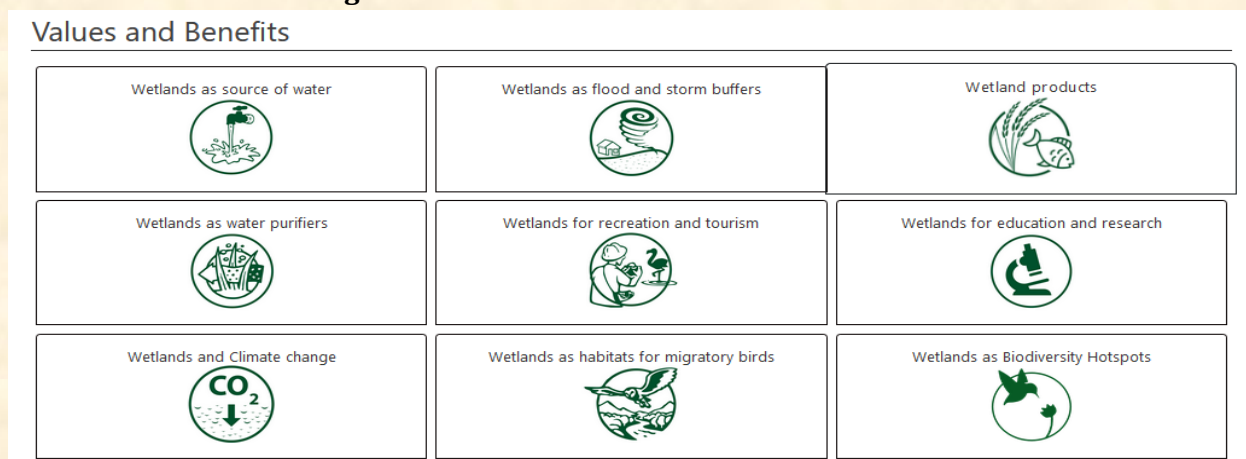
4.11 India has a large variety of freshwater, saline and marine wetlands. A vast majority of the inland wetlands are temporary and/or man-made. Not only have wetlands

influenced ways of human life, the people have traditionally depended on wetlands for millennia. Thus, even the most natural of the wetlands of the region, whether floodplains (e.g., those of the Brahmaputra basin) or marshes (e.g., Chauris of Bihar, lake Kolleru in Andhra Pradesh), swamps (e.g., in the foothills of Himalaya and in south India), coastal lagoons (like Chilika and Pulicat) or mangroves (including Sundarbans) have been influenced by human use and management. The continued interaction between wetlands and the humans in various ways keeps their characteristics always changing, often unpredictably.

4.12 The diverse eco-climatic regimes extent in the country resulted in a variety of wetland systems ranging from high altitude cold desert wetlands to hot and humid wetlands in coastal zones with its diverse flora and fauna. India, with its annual rainfall of over 115 cm, varied topography and climatic regimes support and sustain diverse and unique wetland habitats. Natural wetlands in India consists of the high-altitude Himalayan lakes, followed by wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries; mangrove swamps; coral reefs and marine wetlands, and soon. In fact, with the exception of bogs, fens and typical salt marshes, Indian wetlands cover the whole range of the ecosystem types found. In addition to the various types of natural wetlands, a large number of man-made wetlands also contribute to the faunal and floral diversity. These man-made wetlands, which have resulted from the needs of majority of the inland wetlands are directly or indirectly dependent on the major rivers like, Ganga, Brahmaputra, Narmada, Godavari, Krishna, Kaveri, Tapti. They occur in the hot arid regions of Gujarat and Rajasthan, the deltaic regions of the east and west coasts, highlands of central India, wet humid zones of south peninsular India and the Andaman and Nicobar & Lakshadweep islands. India has a wealth of wetland ecosystems that support diverse and unique habitats. These wetlands provide numerous ecological goods and services but are under tremendous stress due to rapid urbanization, industrialization and agricultural intensification, manifested by the decline in the hydrological, economic and ecological functions they perform.

4.13 Wetlands constitute a vital ecosystem among all the terrestrial ecosystems occurring on land. The enormous diversity of wetlands ecosystems plays a crucial role in regulating the hydrological process, carbon-fixation, flood control, nutrient cycling, water quality, stores carbon dioxide and helps in climate change etc. These wetlands facilitate the recharge of the ground-water and fulfils the dietary requirements such as food and fisheries. They act as a filter through storing, assimilating and transforming the contaminants washed away from the land before reaching natural river systems. Utility wise, wetlands directly and indirectly support millions of people in providing services such as food, fibre and raw materials, storm and flood control, clean water supply, scenic beauty and educational, aesthetic and recreational benefits.

Figure 4.2: Values and Benefits of Wetlands



Source: <https://indianwetlands.in/wetlands-overview/values-and-benefits/>

Threats to the Wetlands

4.14 Globally wetlands and its biodiversity are getting depleted due to habitat destruction, pollution, overexploitation of aquatic resources, tourism and the introduction of invasive exotic species along with alien pathogens and parasites. Some of the major causes that can be attributed for the acute and chronic wetland losses are as follows:

Acute wetlands losses	Chronic Wetland Losses
Agricultural conversions	Alteration of upper watershed
Direct deforestation in wetlands	Degradation of water quality
Hydrological Alterations	Ground water depletion
Inundation by dammed reservoirs	Introduced species and extinction of native biota

4.15. Recognizing the importance of protecting such waterbodies, the Government of India has taken up wetland conservation programme in 1985/86 and onwards in close collaboration with concerned State Governments. Several steps were taken to arrest further degradation and shrinkage of water bodies due to encroachment, siltation, weed infestation, catchment erosion, surface run-off carrying pesticides and fertilizers from agricultural fields, and discharge of domestic sewage and effluents, which resulted in deterioration of water quality, prolific weed growth, decline in biodiversity and other associated problems.

4.16 India is signatory to the Ramsar Convention for management of the wetlands, thus extending the scope of conserving the biodiversity and wise use to a wide variety of habitats including rivers and lakes, coastal lagoons, mangroves, peatlands, coral reefs as well as numerous human-made wetlands. The government has identified a number of wetlands for conservation and management under the National Wetlands Conservation Programme and helps the local government implement the Management Action Plan for these wetlands.

Extent of Wetlands in India

4.17 The extent of an ecosystem is the starting point for the compilation of the accounts. It records the total area of each ecosystem classified by type within the ecosystem accounting area. Ecosystem extent accounts are measured over time by ecosystem type, thus illustrating the changes in extent from one ecosystem type to another over the accounting period. During the past two decades, wetlands have received increasingly greater attention, from the view point of their hydrology, ecology as well as conservation. Large seasonal and year to year variations occur in the water level of rivers, lakes and reservoirs. In terms of wetland habitats, a large majority of wetlands in the region is therefore not only seasonally temporary but many of them often appear and disappear in successive years.

4.18 The concern for conservation and management of wetlands is increasing all over the globe including India, due to burgeoning population pressure and developmental activities. In order to manage wetlands effectively, information of its spatio-temporal variations is a pre-requisite, which can be generated over a period of time using images acquired by orbiting satellite. Earth observation from orbiting satellites has been highly effective for providing wealth of data and information over the earth surface with wide spatial coverage and temporal revisits. Systematic approaches involving judicious combination of conventional ground measurements and remote sensing techniques pave way for achieving optimum planning, conservation and sustainable exploitation of wetland systems. The first ever scientific database of 2006-07 on Indian wetlands was prepared by ISRO at the behest of Ministry of Environment, Forest and Climate Change (MoEF&CC) which is considered as benchmark in the wetland information of India. The digital database created under this mapping included the island territories. The objective of the project was to generate a current status of the existing wetlands and geo-database of National wetlands using remote sensing data.

4.19 Over the years it was realised to update the first wetlands inventory and therefore "National Wetland Inventory and Assessment- 2nd cycle" was undertaken by Space Applications Centre (SAC), Ahmedabad at the request of Ministry of Environment, Forests and Climate change in 2019. The summary of the results of this satellite-based mapping activities has been brought out in the form of an Atlas. This National Atlas highlights current status of wetlands along with decadal changes in terms of statistics, maps, satellite images, field photographs etc., for the entire country to provide useful

understanding the status and distribution of wetlands. The category-wise distribution of wetlands in India in 2006-07 and 2017-18 along with the change in the area during the period is given in the **Table 4.2** below:

Table 4.2: Area of Wetlands in India

(Area in Hectare)

Sr. No.	Wetland Type		2017-18		2006-07		Change
			Wetland Area	% of wetland area	Wetland Area	% of wetland area	Wetland Area
1	Inland	Natural	7015718	43.9	6931772	45.2	83946
2		Man-made	4834232	30.2	4311366	28.1	522866
3	Coastal	Natural	3620451	22.7	3694412	24.1	-73961
4		Man-made	511115	3.2	402284	2.6	108831
Total			15981516	100	15339834	100	641682

Source: Space based observation of Indian wetlands, SAC

4.20 The total wetland area estimated is 15.98 million hectare (Mha), which is around 4.86 percent of the total geographic area of the country. A total of 2,31,195 wetlands having area more than 2.25 hectare have been mapped at 1:50,000 scale during 2017-18. The extent of wetlands in India by type in 2017-18 and in 2006-07 are shown in **Table 4.3** along with the changes that occurred during the decade. The state-wise opening and closing extent of wetlands with changes therein between the years 2006-07 and 2017-18 are given in **Table 4.4**. **Table 4.5** shows decadal wetland inventory and change analysis in major river basins in India and the distribution is shown for the biogeographic zones in **Table 4.6**. State-wise and Class-wise details on extent of wetlands are given in **Annexure 4.1**. The total addition in wetland's area can be attributed to new wetlands added as well as the area expansion of existing wetlands.

Table 4.3 Extent of Wetlands and Decadal Changes

Wetland Type	2006-07 (Opening Stock)	New	Disappeared	Net Other Changes	2017-18 (Closing Stock)
Level -III	Area	Area	Area	Area	Area
	(ha)	(ha)	(ha)	(ha)	(ha)
INLAND Natural					
Lake/Pond	6,88,507	0	0	3,616	692,123
Ox-bow lake/ cut-off meander	1,10,812	1,448	158	1,327	113,429
High altitude lake	1,21,490	140	33	8,848	130,445
Riverine Wetlands	98,328	11,057	115	-9,870	99,400
Waterlogged	2,78,318	5,442	5,880	-6,119	271,761
River/Stream	56,34,317	0	0	74,243	5708,560
INLAND Natural: Total	69,31,772	18,087	6,186	72,045	7015,718
INLAND Man-made					
Reservoir/Barrage	24,25,119	1,86,006	0	1,24,244	27,35,369
Tank/Pond	16,69,134	85,155	4,334	64,247	18,14,202

Wetland Type	2006-07 (Opening Stock)	New	Disappeared	Net Other Changes	2017-18 (Closing Stock)
Waterlogged	95,240	5,428	4,558	96	96,206
Salt pan	13,105	1,683	0	4,769	19,557
Aquaculture Pond	1,08,768	43,099	5,276	22,308	1,68,899
INLAND Manmade Total	43,11,366	3,21,371	14,168	2,15,664	48,34,233
INLAND: TOTAL	1,12,43,138	3,39,458	20,354	2,87,709	1,18,49,951
COASTAL Natural					
Lagoon	2,15,827	0	0	113	2,15,940
Creek	2,28,039	0	0	26,929	2,54,968
Sand/Beach	44,726	171	73	-3	44,821
Intertidal mud flat	24,19,416	966	185	-1,17,678	23,02,519
Salt Marsh	1,53,835	1,462	473	-6,636	1,48,188
Mangrove	4,87,318	1,987	553	17,228	5,05,980
Coral Reef	1,45,251	0	0	2,784	1,48,035
COASTAL Natural Total	36,94,412	4,586	1284	-77,263	36,20,451
COASTAL Man-made					
Salt pan	1,60,672	2,483	207	90,863	2,53,811
Aquaculture pond	2,41,612	15,141	3,444	3,995	2,57,304
COASTAL Man-made Total					
	4,02,284	17,624	3,651	94,858	5,11,115
COASTAL Total	40,96,696	22,210	4,935	17,595	41,31,566
TOTAL	1,53,39,834	3,61,667	25,289	3,05,304	1,59,81,516

Source: Gupta, P K, J G Patel, R P Singh, I M Bahuguna, R Kumar et al. (2021). Satellite based observation of Indian wetlands, Space Applications Centre, ISRO, Ahmedabad. ISBN: 9789382760436. Available on VEDAS web portals (vedas.sac.gov.in)

It may be noted that the 'Net Other Changes' Include the changes in the wetland area occurring due to changes other than occurrence of a new wetland or disappearance of existing wetlands.

- (i) The positive changes explain that the spreading out of the existing wetlands is greater than the shrinkages and vice versa.
- (ii) Expansions may be due to conversion of one class of wetland to another, river changing its course, shift in precipitation patterns etc.
- (iii) The shrinkages of the wetlands may be attributed to conversion of one class of wetland to another, development activities etc.
- (iv) Further analysis can be attempted with the availability of the change matrix for these categories of wetlands.

Table: 4.4: Extent of wetlands and decadal change in different States

Sr. No.	State Name	2017-18			2006-07			Decadal Change
		Number	Area (ha)	Area (% of wetland)	Number	Area (ha)	Area (% of wetland)	Area (ha)
1	Andhra Pradesh	24,104	1141606	7.14	23,022	10,75,099	7.01	66,507
2	Arunachal Pradesh	1,182	1,51,104	0.95	1,164	1,47,914	0.96	3,190
3	Assam	5,902	8,49,078	5.31	5,596	7,89,217	5.14	59,861
4	Bihar	4,526	3,74,766	2.34	4,555	3,89,713	2.54	-14,947

Sr. No.	State Name	2017-18			2006-07			Decadal Change
		Number	Area (ha)	Area (% of wetland)	Number	Area (ha)	Area (% of wetland)	Area (ha)
5	Chhattisgarh	11,457	3,42,443	2.14	10,863	3,27,274	2.13	15,169
6	Goa	742	24,749	0.15	537	21,934	0.14	2,815
7	Gujarat	17,613	34,99,429	21.9	14,734	34,49,413	22.49	50,016
8	Haryana	1,905	33,649	0.21	1,546	29,710	0.19	3,939
9	Himachal Pradesh	215	94,011	0.59	204	93,383	0.61	628
10	Jharkhand	2,635	1,87,045	1.17	2,477	1,80,668	1.18	6,377
11	Karnataka	14,936	7,87,127	4.93	14,457	7,87,104	5.13	23
12	Kerala	1,399	1,58,336	0.99	1,396	1,54,453	1.01	3,883
13	Madhya Pradesh	13,947	8,61,736	5.39	10,570	7,59,016	4.95	1,02,720
14	Maharashtra	25,935	11,52,625	7.21	20,735	9,82,620	6.41	1,70,005
15	Manipur	132	67,408	0.42	139	62,657	0.41	4,751
16	Meghalaya	225	31,002	0.19	222	30,875	0.2	127
17	Mizoram	127	19,476	0.12	103	13,791	0.09	5,685
18	Nagaland	148	21,118	0.13	142	21,050	0.14	68
19	Odisha	13,331	7,19,942	4.5	12,003	6,92,027	4.51	27,915
20	Punjab	1,190	47,024	0.29	1,245	48,389	0.32	-1,365
21	Rajasthan	13,321	7,78,824	4.87	12,638	7,51,274	4.9	27,550
22	Sikkim	259	7,049	0.04	245	6,587	0.04	462
23	Tamil Nadu	26,883	9,25,712	5.79	27,011	9,24,848	6.03	864
24	Telangana	12,338	5,66,680	3.55	10,058	4,99,563	3.26	67,117
25	Tripura	416	18,438	0.12	402	14,196	0.09	4,242
26	Uttar Pradesh	18,555	11,04,562	6.91	19,069	10,94,024	7.13	10,538
27	Uttarakhand	172	1,12,882	0.71	173	1,01,771	0.66	11,111
28	West Bengal	12,955	11,30,127	7.07	12,830	11,14,729	7.27	15,398
29	Andaman&Nicobar	2,774	1,43,238	0.9	2,445	1,53,611	1	-10,373
30	Chandigarh	11	336	0	10	335	0	1
31	Dadra NagarHaveli	12	2,063	0.01	11	2,016	0.01	47
32	Daman and Diu	59	2,728	0.02	55	2,834	0.02	-106
33	Delhi	123	2,773	0.02	114	2,537	0.02	236
34	Jammu & Kashmir	404	1,64,110	1.03	403	1,64,230	1.07	-120
35	Lakshadweep	50	79,716	0.5	1,036	79,728	0.52	-12
36	Ladakh	1,073	3,73,049	2.33	50	3,65,294	2.38	7,755
37	Puducherry	139	5,555	0.03	125	5,950	0.04	-395
	Total	2,31,195	1,59,81,516	100	2,12,385	1,53,39,834	100	6,41,682

Source: Gupta, P K, J G Patel, R P Singh, I M Bahuguna, R Kumar et al. (2021). Satellite based observation of Indian wetlands, Space Applications Centre, ISRO, Ahmedabad

Table 4.5: Decadal wetland inventory and change analysis in different River basins

Sr. No.	Basin	2017-18			2006-07			Decadal Change		Disappeared		New	
		Number	Area (ha)	Area (% of wetland)	Number	Area (ha)	Area (% of wetland)	Numbers	Area (ha)	Number	Area (ha)	Number	Area (ha)
1	Indus	3,003	555631	3.48	2995	553106	3.61	8	2525	124	850	153	3602
2	Ganga	56,002	3751891	23.48	53460	3648472	23.78	2542	103419	478	10143	3263	86662
3	Luni and Rivers of Saurashtra	14,135	3178527	19.89	11824	3131167	20.41	2311	47360	27	1508	1047	16114
4	Sabarmati	3,489	172311	1.08	3067	168967	1.10	422	3344	12	212	410	3032
5	Mahi	4,113	171407	1.07	3660	165976	1.08	453	5431	0	0	440	4819
6	Narmada	3,892	448969	2.81	3055	425482	2.77	837	23487	10	115	854	18702
7	Tapi	3,900	263613	1.65	3230	240676	1.57	670	22937	23	98	466	12776
8	Godavari	24,029	1235931	7.73	20120	1110521	7.24	3909	125410	59	348	2592	93006
9	Krishna	31,688	1668866	10.44	27520	1530349	9.98	4168	138517	324	7190	2853	74132
10	Cauvery	8,457	305463	1.91	8351	304729	1.99	106	734	5	90	104	687
11	Rivers Between Krishna and Cauvery	15,426	563947	3.53	15513	565234	3.68	-87	-1287	126	2306	137	1883
12	Mahanadi	16,628	505512	3.16	15932	486482	3.17	696	19030	29	337	525	15957
13	West South Coast Rivers	21,168	975614	6.10	20119	936001	6.10	1049	39613	47	678	634	8511
14	Rivers Between Mahanadi and Godavari	8,873	318760	1.99	8226	303507	1.98	647	15253	6	123	474	5689
15	Brahmini-Baitrani	2,939	191934	1.20	2448	184528	1.20	491	7406	3	10	378	3234
16	Subernrekha	1,567	74420	0.47	1346	68473	0.45	221	5947	1	2	176	1331

Sr. No.	Basin	2017-18			2006-07			Decadal Change		Disappeared		New	
		Number	Area (ha)	Area (% of wetland)	Number	Area (ha)	Area (% of wetland)	Numbers	Area (ha)	Number	Area (ha)	Number	Area (ha)
17	Brahmaputra Barak & others	9,032	12,44,752	7.79	8925	1157773	7.55	107	86979	22	339	303	11436
18	Others	2,854	3,53,969	2.21	2594	358394	2.34	260	-4425	46	941	14	94
Total		2,31,195	1,59,81,516	100	212385	15339834	100	18810	641682	1342	25289	14823	361667

Source: Gupta, P K, J G Patel, R P Singh, I M Bahuguna, R Kumar et al. (2021). Satellite based observation of Indian wetlands, Space Applications Centre, ISRO, Ahmedabad (ISBN: 9789382760436)

Note: wetlands database of 2006-07 was updated by incorporating interpretational changes

Table 4.6: Decadal wetland inventory and change analysis in different Bio-Geographic zones

Sr. No.	Bio-Geographic zones	2017-18			2006-07			Decadal Change		Disappeared		New	
		Number	Area (ha)	Area (% of wetland)	Number	Area (ha)	Area (% of wetland)	Numbers	Area (ha)	Number	Area (ha)	Number	Area (ha)
1	Trans Himalaya	1,318	3,96,669	2.48	1,276	3,88,039	2.53	42	8,631	7	37	27	141
2	Himalaya	1,769	3,11,404	1.95	1,762	2,99,415	1.95	7	11,989	0	0	23	1,003
3	Desert	4,098	3,31,475	2.07	3,749	3,15,931	2.06	349	15,544	7	1,209	316	6,772

Sr. No.	Bio-Geographic zones	2017-18			2006-07			Decadal Change		Disappeared		New	
		Number	Area (ha)	Area (% of wetland)	Number	Area (ha)	Area (% of wetland)	Numbers	Area (ha)	Number	Area (ha)	Number	Area (ha)
4	Semi-arid	30,629	17,23,351	10.78	27,523	16,50,777	10.76	3,106	72,574	224	2,029	2,989	58,123
5	Western Ghats	4,829	4,16,887	2.61	4,134	3,81,330	2.49	695	35,557	12	95	519	7,802
6	Deccan Peninsula	1,30,940	52,81,133	33.05	1,19,637	49,32,452	32.15	11,303	3,48,681	396	6,215	8,347	2,09,416
7	Gangetic Plain	25,896	16,61,198	10.39	26,341	16,57,187	10.80	-445	4,012	359	8,860	419	15,988
8	Coasts	22,232	47,11,533	29.48	18,987	46,30,838	30.19	3,245	80,695	269	5,550	1,902	51,147
9	North-East	6,798	9,99,076	6.25	6,642	9,24,503	6.03	156	74,573	22	335	278	11,259
10	Islands	2,686	1,48,789	0.93	2,334	1,59,362	1.04	352	-10,573	46	959	3	14
Total		2,31,195	1,59,81,516	100	2,12,385	1,53,39,834	100	18,810	6,41,682	1,342	25,289	14,823	3,61,667

Source: Gupta, P K, J G Patel, R P Singh, I M Bahuguna, R Kumar et al. (2021). Satellite based observation of Indian wetlands, Space Applications Centre, ISRO, Ahmedabad (ISBN: 9789382760436)

Note: wetlands database of 2006-07 was updated by incorporating interpretational change

4.21 The decadal change in the extent of different wetlands types may be attributed to the anthropogenic activities and natural cycle processes. Some observations related to major changes in the area of different wetland classes are listed below:

Inland Wetlands: There is significant increase (approx. 5.4%) in inland wetlands category. This may be due to development of soil and water conservation structures such as reservoirs/Barrages, tank & ponds etc.

Inland Natural Wetlands: There is no significant change but slight increase (1.2%) in the extent of inland natural wetlands, and this may be due to spreading of existing wetlands, shift in precipitation pattern over land due to climate change etc.

- The area under Oxbow Lakes/Cut off meanders has increased and this may be due to shifting in the river course (mainly in major rivers such as Brahmaputra, Ganga, Godavari etc.) in last 10 years (2006-07 to 2017-18).
- The extent of High-Altitude wetlands area has increased by 7.8% probably due to the melting of Glacier & snow and change in precipitation pattern which might have contributed for the formation of fresh natural Lakes.
- Slight increase in the extent of riverine wetlands may be due to the spreading of existing wetlands in the major rivers flood plains for example river Ganga.
- Reduction in the waterlogged-natural and increase in waterlogged-man-made classes may be attributed to developmental activities such as canal network, mining works etc.

Inland Man-made Wetlands: significant increase in the area (Approx. 12%) of man-made wetlands are observed and this change may be due to new reservoirs/barrages, Tank & pond etc. which have come up in last 10 years.

- Under man-made category such as reservoirs/Barrages and Tank & Ponds, number as well as area have increased significantly. Tank & Pond is mainly constructed for irrigation purposes whereas reservoirs are for multi-purpose activities (Irrigation, drinking water supply etc.) including hydro-power.
- Significant increase in number as well as area of salt pans and aquaculture ponds is due to new salt pans nearby Sambhar Lake in Rajasthan and new aquaculture ponds nearby Loktak Lake in Manipur.

Coastal Wetlands

There is no overall significant change (< 1%) in the area of coastal wetlands. This is because of transition of one class to another in the coastal regions due to economic, local needs, natural processes etc.

Coastal Natural: There is a slight reduction in the area (approx. 2%) of wetlands under coastal natural category which may be due to conversion of natural wetlands to man-made categories for example intertidal mud flat converted to salt pans, aquaculture ponds in Gujarat coastal regions.

- More than 10% increase in the area of creeks may be attributed to merging of creeks between mangroves for example in Gujarat coast.
- Significant decrease in the area (Approx. 4.8%) of intertidal mudflats. This change is mainly due to conversion of large area of intertidal mudflats to mangroves, saltpan and aquaculture ponds classes.
- Reduction in the area (approx. 3.7%) of Salt marshes is primarily due to conversion to other wetland classes such as salt pans, aquaculture ponds, intertidal mudflats etc.
- Minor increase in the area (< 2%) of coral reefs. This may be due to consolidation of fragmented coral reefs. There is slight increase of coral area in Gujarat, slight decrease in A&N and stable in Gulf of Munnar in Tamil Nadu.
- Increase in mangrove areas (approx. 3.8%) is due to conversion of intertidal mud flats, salt marsh etc. to mangroves along with new mangrove plantation/rejuvenation.

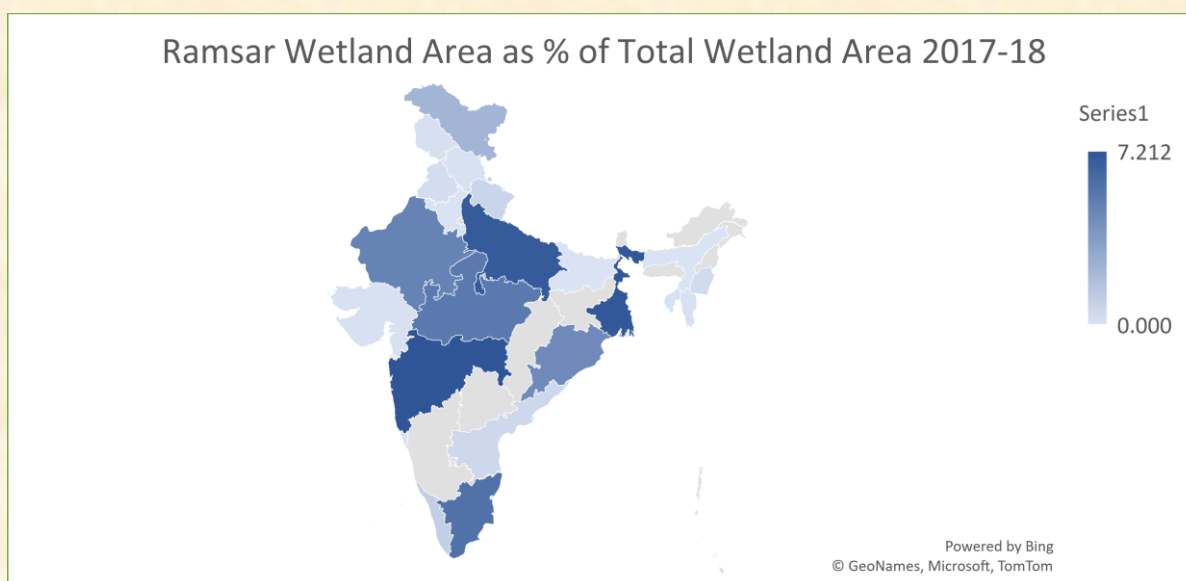
Coastal Man-made: significant increase in the area (Approx. 27%) of man-made wetlands is observed in coastal regions, the reason being conversion of some of the natural wetlands to man-made category.

- Most Significant increase in the area (approx. 58%) of salt pans (coastal) is observed and this may be due to conversion of intertidal mud flats and salt marsh into salt pans.
- There is an increase in the area (Approx. 6.5%) of aquaculture ponds in the coastal region. Major contribution in the area has come up through transition of Salt pans, Salt marsh, coastal agriculture regions etc. into aquaculture ponds.

Ramsar Sites (Wetlands) in India

4.22 The Ramsar Convention¹⁰ is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of the wetlands and their economic, cultural, scientific and recreational value. According to the Ramsar Convention wetlands ecosystem in India constitute most of the natural water bodies (such as river, lakes, coastal lagoons, mangroves, peat land, coral reefs) and man-made wetlands (such as ponds, farm ponds, irrigated fields, sacred groves, salt pans, reservoirs, gravel pits, sewage farms and canals). The Ramsar Convention, in line with its mission to conserve and promote wise use of all wetlands, designates suitable wetlands for the list of Wetlands of International Importance (the “Ramsar List”), so as to bring focus on their effective management. After India became a party to the Ramsar Convention on Wetlands of International Importance in 1982 as an endorsement of its resolution to conserve the wetlands of the country, it has designated 75 Ramsar sites of international importance covering an area of 13,26,678 hectares as on 6th September, 2022. State-wise details of these Ramsar sites of India which are being managed as per the Ramsar mandate are given in **Annexure 4.2**. **Figure 4.3** shows Ramsar wetland area of the state as percentage of total wetland area of the country for the year 2017-18.

Figure 4.3: State wise Ramsar wetland as percentage of Wetlands Area



4.23 Wetlands provide habitat and refuge for biodiversity, and help build resilience of species to protect them from population decline. While India’s National Biodiversity Action Plan (NBAP) acknowledges the importance of wetlands and aquatic systems for supporting biodiversity, it is important that the value of wetland ecosystems in helping to halt and reverse biodiversity decline is recognized more widely. The proper data on

¹⁰ Faunal diversity in Ramsar Wetlands of India

the current status especially with regard to the endangered species are very important. In the endeavour to have the baseline data on the current status, the Chilika Development Authority (CDA) in collaboration with the Fishing Cat Project (TFCP) and Indian wing of Fishing Cat Conservation Alliance (FCCA)) conducted the world's first population estimation of the fishing cat done outside the protected area network. The study revealed having 176 fishing cats which are the only wild cat species in India that is a wetland specialist¹¹ and which is one of the globally threatened species. The Fishing Cat is a Schedule I species according to the Wildlife (Protection) Act, 1972¹², generally indicates the health of wetlands and coastal ecosystems, which are considered one of the major safeguards against climate change. Fishing cats are the apex predator in coastal areas. If they survive, it means the area is climate resistant. Fishing cats deserve conservation measures of the highest accord in India like the Tiger and Elephant. Unfortunately, marshland and mangrove ecosystems, which are Fishing Cat habitat are in decline. In view of this, CDA prioritized the need to conserve the habitat and its population in future. These kinds of tracking provide an indication of what might be happening to these ecosystems, which are safeguards against climate change and droughts. In order to have further information about the condition of the wetlands, Biodiversity for the Wetlands especially for the Mangroves and Estuaries have been provided later in this chapter.

Mangroves

4.24 India has a rich coastline which spans across 7,500 kilometres distributed along 9 coastal areas, 2 groups of islands and 4 union territories. These regions support coastal and marine ecosystems that are rich in biodiversity¹³. Mangroves are an essential part of these ecosystems. These¹⁴ ecosystems occupy the boundary between land and sea. They consist of trees or large shrubs, including ferns and palms that normally grow in or adjacent to the intertidal zone. The Mangrove ecosystem is a distinct saline woodland habitat characterized by deposition of fine sediments on the coastal environment protected from high energy wave action. They are the woody halophytes growing in the boundary of land and the sea in the tropical and sub-tropical regions of the world¹⁵.

4.25 Mangroves, also known as the 'Tidal Forests', 'Coastal Woodlands', 'Walking Forests in the Sea', 'Root of the Sea', 'Only Blue Carbon Forests' and 'Oceanic Rain forest' are the symbiotic links between the land and the sea. Mangrove Ecosystem forms one of

¹¹ https://www.chilika.com/documents/newsevents_1609467056.pdf

¹² https://legislative.gov.in/sites/default/files/A1972-53_0.pdf

¹³ Conservation of Mangrove Forests- For fighting Coastal Disasters and Carbon Emissions; Terra Green, Volume 10, Issue 11, February 2018

¹⁴ <http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/specific-ecosystems/mangroves/#:~:text=Mangroves%20are%20rare%20but%20spectacular,in%20saline%20coastal%20sediment%20habitats.>

¹⁵ Faunal Diversity of Mangrove Ecosystem in India, ZSI

the ecological sensitive marine habitats at the niche between the fresh water and marine environment. Mangrove¹⁶ forests make up one of the most productive and biologically diverse ecosystems on the planet. They grow in a variety of depths of salt water, their roots sticking out of the mud, with fish crustaceans and a host of other species living between tree trunk.

4.26 Mangroves protect the coasts from ruinous effects of erosion and stabilize coastline thereby protecting the coastal population from cyclones and other natural calamities. They also serve as one of the most efficient carbon sequesters, and by sinking the carbon termed as 'Blue carbon', help in mitigating the impact of climate change¹⁷. They are the source of some highly valued commercial products and fisheries. They are also an attracting site for ecotourism. Their complex roots help in binding the soil and filter the pollutants reaching to the oceans.

4.27 According to the Forest Survey of India (FSI¹⁸), mangroves are salt tolerant plant communities found in tropical and sub-tropical intertidal regions of the world. Such areas are characterized by high rainfall (between 1000-3000 mm) and temperature (ranging between 26-35 degrees). Mangrove species exhibit a variety of adaptations in morphology, anatomy and physiology to survive in water logged solid, high salinity and frequent cyclonic storms. Succulent leaves, sunken stomata, aerial breathing roots called 'pneumatophores', vivipary, stilt roots, buttresses etc. are some of the adaptations exhibited by the mangroves.

4.28 Mangroves are important refuges of coastal bio-diversity and also act as bio-shields against extreme climatic conditions. Mangroves have the ability to absorb upto four times more carbon dioxide by area than upland terrestrial forests (Donato *et al.*, 2011)¹⁹. The remarkable traits of the mangrove ecosystem translate into a wide variety of goods and services that we benefit from. These play a critical role in supporting human well-being by delivering the necessities of life like food, shelter and livelihoods. At the same time mangroves reduce loss of property and vulnerability of local communities.

4.29 As per the Biennial Update Report²⁰ to UNFCCC, the incremental annual mitigation potential 2020 for the restoration of the mangroves and wetlands catchment (M/W) of area 0.2 million hectares is 1.6 MtCO₂. As regards the environment protection of India, the private parties have also joined hands together with the Government agencies. For

¹⁶ <https://www.iucn.org/theme/marine-and-polar/our-work/climate-change-and-ocean/mangroves-and-coastal-ecosystems>

¹⁷ <https://www.iucn.org/resources/issues-briefs/blue-carbon>

¹⁸ <https://fsi.nic.in/isfr-2021/chapter-3.pdf>

¹⁹ https://www.researchgate.net/profile/John-Kauffman-4/publication/285109220_Mangroves_among_the_most_carbon-rich_forest_in_the_tropics/links/569cf2f908ae2f0bdb8d48c8/Mangroves-among-the-most-carbon-rich-forest-in-the-tropics.pdf?origin=publication_detail

²⁰ Third Biennial Update Report to UNFCCC

instance, initiatives taken by the Tata Chemicals with respect to the mangroves planted in the areas of Sundarbans and Mithapur in 2018-19 is 60,000.

4.30 Bearing in mind the enormous benefits of mangroves, it is important to have a regular and timely assessment of the conditions and the quality of the mangroves. As far as the monitoring of the mangroves are concerned, Remote Sensing is an efficient method of assessing the spread of the mangroves especially in the inaccessible areas. Mangrove bearing States are implementing different measures for conservation and management of the mangroves. Some important techniques adopted in Gujarat for restoration of degraded mangrove habitats are the direct seeds sowing, raised bed plantation and the fishbone channel plantation. In Andhra Pradesh, Forest Department has formed Eco-Development Committees and Van Samrakshan Samithis for joint implementation of projects in mangrove areas. Regular trainings are also being conducted for sustainable mangrove conservation. In Maharashtra, steps have been taken to conserve ecology and biodiversity of mangroves by protection, restoration, regeneration and maintenance.

Extent Accounts

4.31 Considering the ecological and economic role of mangroves, the mangrove cover in India are monitored periodically by Forest Survey of India (FSI) since 1987 using remote sensing. The Mangrove Cover has been compiled by the FSI into following categories:

- (i) Very Dense (canopy density of 70% and above)
- (ii) Moderately Dense (canopy density of 40% and more but less than 70%)
- (iii) Open categories (canopy density of 10% and more but less than 40%)

4.32 The State wise extent of the Mangrove cover (in sq kms.) from 1987 to 2020-21 is presented in **Table 4.8**. The state-wise mangrove cover in different canopy classes has been shown in **Table 4.9**. The Mangroves cover in the country is 4992 sq. km which is 0.15% of the country's geographic area. West Bengal has the largest share in total mangrove cover followed by Gujrat and A & N Islands. The total mangrove cover has been increasing over the years.

Table 4.8: State wise Mangrove Cover

State/UT	1987	1989	1991	1993	1995	1997	1999	2001
Andhra Pradesh	495	405	399	378	383	383	397	333
Goa		3	3	3	3	5	5	5
Gujarat	427	412	397	419	689	901	1,031	911
Karnataka					2	3	3	2
Maharashtra	140	114	113	155	155	124	108	118

State/UT	1987	1989	1991	1993	1995	1997	1999	2001
Odisha	199	192	195	195	195	211	215	219
Tamil Nadu	23	47	47	21	21	21	21	23
West Bengal	2,076	2,109	2,119	2,119	2,119	2,123	2,125	2,081
A & N Islands	686	973	971	966	966	966	966	789
Puducherry								1
Total	4,046	4,255	4,244	4,256	4,533	4,737	4,871	4,482

Table 4.8: State wise Mangrove Cover (Contd.)

(Sq Km)

State/UT	2003	2005	2009	2011	2013	2015	2017	2019	2021
Andhra Pradesh	329	354	353	352	352	367	404	404	405
Goa	16	16	17	22	22	26	26	26	27
Gujarat	916	991	1,046	1,058	1,103	1,107	1,140	1,177	1,175
Karnataka	3	3	3	3	3	3	10	10	13
Kerala	8	5	5	6	6	9	9	9	9
Maharashtra	158	186	186	186	186	222	304	320	324
Odisha	203	217	221	222	213	231	243	251	259
Tamil Nadu	35	36	39	39	39	47	49	45	45
West Bengal	2,120	2,136	2,152	2,155	2,097	2,106	2,114	2,112	2,114
A & N Islands	658	635	615	617	604	617	617	616	616
Daman & Diu	1	1	1	2	2	3	3	3	3
Puducherry	1	1	1	1	1	2	2	2	2
Total	4,448	4,581	4,639	4,663	4,628	4,740	4,921	4,975	4,992

Table 4.9: State wise Mangrove Cover in Different Canopy Classes (Sq Km)

Very Dense Mangroves

State/UT	2003	2005	2009	2011	2013	2015	2017	2019	2021
Maharashtra	8								
Odisha			82	82	82	82	82	81	81
Tamil Nadu						1	1	1	1
West Bengal	892	892	1,038	1,038	993	990	999	996	994
A & N Islands	262	255	285	283	276	399	399	398	399
Total	1,162	1,147	1,405	1,403	1,351	1,472	1,481	1,476	1,475

Moderately Dense Mangroves

State/UT	2003	2005	2009	2011	2013	2015	2017	2019	2021
Andhra Pradesh	15	15	126	126	126	129	213	213	213
Goa	10	14	14	20	20	20	20	20	21
Gujarat	198	195	188	182	175	174	172	169	169
Karnataka	3	3	3	3	3	3	2	2	2
Kerala	3	3	3	3	3	5	5	5	5

Maharashtra	44	58	69	69	69	79	88	88	90
Odisha	160	156	97	97	88	95	94	94	94
Tamil Nadu	18	18	16	16	16	18	25	27	27
West Bengal	894	895	881	881	699	700	692	692	692
A & N Islands	312	272	262	261	258	168	169	169	168
Total	1,657	1,629	1,659	1,658	1,457	1,391	1,480	1,479	1,481

Open Mangroves

State/UT	2003	2005	2009	2011	2013	2015	2017	2019	2021
Andhra Pradesh	314	314	227	226	226	238	191	191	192
Goa		2	3	2	2	6	6	6	6
Gujarat	762	741	858	876	928	933	968	1,008	1,006
Karnataka							8	8	11
Kerala	5	5	2	3	3	4	4	4	4
Maharashtra	64	100	117	117	117	143	216	232	234
Odisha	47	47	42	43	43	54	67	76	84
Tamil Nadu	17	17	23	23	23	28	23	17	17
West Bengal	334	331	233	236	405	416	423	424	428
A & N Islands	97	110	68	73	70	50	49	49	49
D&N Haveli and Daman & Diu	1	1	1	1	1	3	3	3	3
Puducherry	1	1	1	1	1	2	2	2	2
Total	1,642	1,669	1,575	1,601	1,819	1,877	1,960	2,020	2,036

4.33 The district wise mangrove cover for the different categories of mangrove forests are as given in the **Annexure 4.3**.

Wetland Ecosystem Condition-Biodiversity

4.34 The ecosystem condition accounts record the condition of ecosystem assets in terms of selected characteristics at specific points in time. Over time, they record the changes to their condition and provide valuable information on the health of ecosystems. These accounts are part of System of Environmental Economic Accounts – Ecosystem Accounts (SEEA-EA). These accounts contain aggregated statistical information about the overall abiotic and biotic characteristics of an ecosystem over a spatial scale.

4.35 Mangroves are ecologically fragile ecosystems that are repositories of rich biodiversity. These forests provide habitat and refuge to a wide array of species, both aquatic and terrestrial. They also act as a nursery for fishes, shell fish and molluscs etc. Information on biodiversity is scattered in nature in Indian context, particularly in context of specific ecosystem. According to Champion & Seth Classification (1968)²¹, Mangroves are included in type Group-4 Littoral & Swamp Forests and are covered under

²¹ Champion H.G. and Seth S.K (1968): A revised survey of The Forest Types of India. Forest Research Institute, Dehradun

4A/L1 Littoral forest, 4B/TS1 Mangrove scrub, 4B/TS2 Mangrove Forest, 4B/TS3 Saltwater mixed forest (Hertiera) and 4B/TS4 Barckish water mixed forest (Heritiera) types. Some of the important species of mangrove ecosystems in India include *Avicennia officinalis*, *Rhizophora mucronate*, *Sonneratia alba*, *Avicennia alba*, *Bruguiera cylindrica*, *Heritiera littoralis*, *Phoenix paludosa*, *Morinda citrifolia* and *Ceriops tagal*.

Sundarbans-world's largest Mangrove Forests

4.36 Sundarbans, located in the northern Bay of Bengal is the world's largest single patch of Mangrove Forests. Spread over approximately 10,000 sq km, in Bangladesh and India, Sundarbans is the first Mangrove Forest in the world, which was brought under scientific management, as early as in 1892. Appreciating the importance of mangroves, the Government of India set up a National Mangrove Committee in 1976, to advise the Government about the issues related to conservation and development of mangroves in the country. Different states are carrying out practices for the conservation of mangrove cover with the active involvement of local communities. Recently, during a bilateral discussion with Bangladesh, the Hon'ble Prime Minister of India reaffirmed the support to cooperate on climate change and on preserving common heritage ²² like the Sundarbans.

Biodiversity of Mangroves

4.37 Mangroves are one of the most productive ecosystems of the world. They encompass a complex interacting function unit of planet, animal and microbial communities and their non-living environment. The tidal forest serve as a nursery ground for several organisms, protects from coastal erosion, sequestrates the carbon and provides livelihood to millions of people besides harbouring an array of faunal elements in its habitat. Information on biodiversity is scattered in nature in Indian context, particularly in context of specific ecosystem. Understanding mangrove biodiversity is of utmost important for the effective conservation and sustainable utilization of its services.

4.38 The total number of mangrove species in different regions of coastal India and floral diversity are given in the **Table 4.10 and Table 4.11**. **Annexure 4.4** provides the faunal diversity of mangroves of India. **Annexure 4.5** provides the State-wise distribution of faunal species of different taxa in mangrove ecosystems in India. **Annexure 4.6** provides IUCN Conservation Status of Fishes known from Mangroves in India. As per the Faunal Diversity of Mangrove Ecosystem in India, 2019 brought out by Zoological Survey of India, more than one lakh species exists in India as against the existing number of species (Protista and Animalia) in the world. Of which, 4822 number of species exist in the mangroves ecosystems. West Bengal has maximum number of species in mangroves ecosystems followed by Andaman & Nicobar Islands, Tamil Nadu and Odisha.

²² <https://mea.gov.in/Speeches-Statements.htm?dtl/35676/English+Translation+of+Press+Statement+by+Prime+Minister+Shri+Narendra+Modi+during+the+visit+of+Prime+Minister+of+Bangladesh+to+India>

Table 4.10: Faunal diversity of Mangrove Ecosystem of India

Kingdom	Number of Species				
	World	India	%	Indian Mangrove Ecosystem	%
Protista	50,012	3,557	7.1	349	9.8
Animalia	16,29,511	99,701	6.1	4,473	4.5
Total (Protista+Animalia)	16,79,523	1,03,258	6.1	4,822	4.7

Source: 1. Faunal Diversity of Mangrove Ecosystem in India, ZSI, 2019; 2. Animal Discoveries, 2021, ZSI

Table 4.11: Floral Diversity in mangrove ecosystem in India

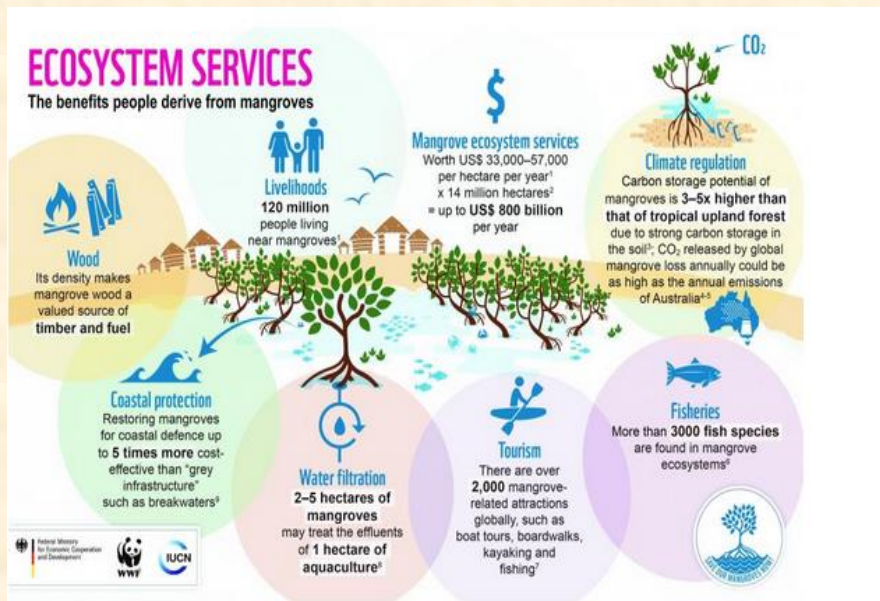
Sl. No.	Kingdom	Groups	No. of Species
1	Bacteria (Monera)	Actinomycetes	23
2		Other Bacteria	69
3	Fungi	Fungi	103
4		Lichens	32
5	Plantae	Marine algae (Phytoplankton and seaweeds)	557
6		Sea-grass	11
7		Mangrove associate plants	86
8		Mangrove plants	44
Total floral species			925

Source: Faunal Diversity of Mangrove Ecosystem in India, ZSI, 2019

Ecosystem Services

4.39 Mangroves Ecosystems provide a host of benefits to the human community through their natural functioning. These benefits in the form of goods and services accrued by the human community are called ecosystem services. Since the ecosystem services are freely available from nature, the significance of conservation of biodiversity and its role in provisioning these services has never been appropriately appreciated by human society. Valuation of the ecosystem services enables us to understand the role of the ecosystem in the livelihoods and sustenance of human community in the landscape.

4.40 Mangroves support coastal biodiversity, fishery resources and fisher livelihoods. A large number of globally endangered species ranging from plankton to



invertebrates; amphibians and reptiles to birds and mammals thrive in these mangroves. They are crucial for not only providing forest products such as fuel-wood, fodder, and honey but are also important for removing pollutants such as carbon and heavy metals.

Source: Intergovernmental Platform on Biodiversity & Ecosystem Services (IPBES)

Drivers and Pressures on the Mangroves

4.41 Biotic pressures and natural calamity play a major role in negatively impacting Mangroves ecosystems. Growing land reclamation for agriculture and industrialization along the coastlines and discharge of untreated domestic sewage and industrial effluents are damaging to these forests. Up-stream activities related to river training and natural erosion and accretion also have an effect on the health of Mangroves since an adequate ecological flow in the rivers is essential for flushing of the Mangroves of silt and other wastes. Mangrove forests continue to be stressed by various factors like conversion for urbanization, aquaculture, agriculture, salt farming and other developmental activities such as tourism, mining, refineries, oil pipeline passages, port/harbour, dam and road constructions; changes in hydrological regimes; increasing salinity; coastal pollution; siltation; exploitation of fishery resources; cattle grazing; private ownership and ineffective institutional regimes. Specific stressors are: (i) agriculture and prawn seed collection in the Sundarbans, West Bengal, (ii) prawn farming and encroachment in Andhra Pradesh and Odisha, (iii) cattle feed in Tamil Nadu and Gujarat, (iv) industrial developments in Gujarat, (v) cyclone and floods along east coast, (vi) mangrove areas under private lands in Kerala, Maharashtra and Karnataka; and (iv) urbanization in Mumbai. The most significant threats to mangroves are human pressures and sea-level rise.

4.42 The Ministry of Environment Forest and Climate Change is implementing a Central Sector Scheme on conservation and management of Mangroves and Coral Reefs in Coastal States/UTs of India. Under the scheme, 38 mangroves and 4 coral reef sites have been identified for on-ground intervention. The objective of the scheme is to essentially ensure

conservation and management of mangroves and coral reefs. The 38 Mangrove sites identified in the States/UTs are given in the **Table 4.12** below²³:

Table 4.12: State-wise Conservation and Management of Mangroves Sites

State/UT	Mangrove Area
West Bengal	Sundarbans
Odisha	Bhaitarkanika, Mahanadi, Subernarekha, Devi, Dharma, Mangrove Genetic Resources Centre, Chilka
Andhra Pradesh	Coringa, East Godavari, Krishna
Tamil Nadu	Pichavaram, Muthupet, Ramnad, Pulicat, Kazhuveli
Andaman and Nicobar	North Andaman, Nicobar
Kerala	Vembanad, Kannur (Northern Kerala)
Karnataka	Coondapur, Dakshin Kannada/Honnavar, Karwar, Mangalore Forest Division
Goa	Goa
Maharashtra	Achra-Ratangiri, Devgarh-vijay Durg, Veldur, Kundalika Revdanda, Mumbra-Diva, Vikroli, Shreevardhan, Vaitarna, Vasai-Manori, Malvan
Gujarat	Gulf of Kutch, Gulf of Khambhat, Dumas-Ubhrat

Source: Press Information Bureau, Ministry of Environment, Forest and Climate Change

Estuaries in India

4.43 Estuaries are semi enclosed waterbodies where freshwater from coastal streams and rivers runs into and mixes with seawater²⁴ .(Pritchard, 1967). ²⁵Estuaries and their surrounding lands are the transition zones between the land and the sea. These are found around the global coastal zone, wherever rivers, large or small, enter the sea. Estuaries with their surrounding lands are places of transition from land to sea²⁶. The water level and salinity of estuaries are affected by the tide. Tide provides the flow of seawater and river mouth provide the flow of fresh water. The salinity of the estuaries ranges from 0% to 35% at the river end to the sea mouth respectively.

4.44 India has long coastline of 7516.6 km with an Exclusive Economic Zone of 2.02 million sq km. A total of 14 major, 44 medium and 162 minor rivers drains into the sea through various estuaries. Most of the major estuaries of India are situated in the east coast and join Bay of Bengal. The estuaries on the west coast are usually smaller.

²³ <https://pib.gov.in/newsite/PrintRelease.aspx?relid=67525>

²⁴ Pritchard, D.W.,1967. What is an estuary: physical viewpoint. In: G.H. Lauff (Editor), Estuaries. AAAS Washington, DC. Pub. 83, pp. 3-5.

²⁵ <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/estuary>

²⁶ Chandra, K., Raghunathan, C. and Swetapadma Dash, 2018. *Current Status of Estuarine Biodiversity in India*, 1-576, Zoological Survey of India

4.45 Most of the major estuaries of India are situated in the east coast and joining with Bay of Bengal. The important estuaries of east coast are Hoogly-Malta, Subarnarekha, Brahmani-Baitarani complex, Mahanadi, Rushikulya, Bahuda, Vamsadhara, Nagavali, Godavari, Krishna, Pennar, Ennore, Adyar, Vellar and Cauvery while the Western coast represents Cochin, Zuari, Mandovi, Tapi and Narmada are the major estuaries connecting with Arabian Sea. The map below shows the major estuaries of India.

Figure: 4.4: Estuaries in India



Source: Current Status of Estuarine Biodiversity in India, Zoological Survey of India, 2018

4.46 Estuaries are one of the promising and self-sustaining ecosystems supporting all forms of aquatic flora and fauna. They are a home to a wide variety of organism which impacts the biotic and abiotic features of estuaries. These are reliable productive ecosystem caused by nutrient trap which shows eutrophication as a result of nutrient rich riverine waters combining with warmer, light imparted shallow coastal waters which enriches the primary production. Among all the estuaries, Hoogly-Matla estuary is highly diversified in faunal and floral components. Floral and Faunal diversity of major Estuaries in India is provided in the **Annexure 4.7**.

Conclusion

4.47 Wetlands are the areas of critical ecological importance that are cradles of biodiversity and nurture a wide variety of flora and fauna. They are one of the most productive ecosystems and their significance has increased considerably in the 21st Century. Their complexity, which make them difficult to be assessed with reference to any scale or levels, along with the importance of the many ecosystem services they provide, highlights the need for development programmes to take more cognizance of these rich and invaluable ecosystems. A well designed and timely wetland monitoring

and assessment activities are critical for better management and protection of wetland resources.

4.48 The Mangroves and the Estuaries are an essential part of the ecosystem providing innumerable services to the humanity. The proper management²⁷ of these can be effectively concretized only by involving local communities and by creating awareness amongst the people. Thousands of species of birds, mammals, fish and other wildlife depend on mangroves and estuarine habitats as places to live, feed and reproduce. Understanding the biodiversity of estuaries is important for their conservation and sustainable utilization.

4.49 The SEEA framework defines a coherent system to help integrate these concerns, which in turn, is envisaged to provide a tool for enhanced decision-making capabilities. The current publication provides data that would facilitate efficient monitoring of the wetlands of India. Also, stock taking of the biodiversity in the two most important wetlands- mangroves and estuaries provides insights into the health of these wetlands.

²⁷ Conservation and Management of mangroves in India, with special reference to the State of Goa and the middle Andaman Island

FISH PROVISIONING SERVICES



Chapter 5

Fish Provisioning Services

When the last tree has been cut down, the last fish caught, the last river poisoned, only then will we realize that one cannot eat money.

-Anonymous

Introduction-Fisheries Sector

5.1 Fishing¹ is the capture of aquatic organisms in marine, coastal and inland areas. Marine and inland fisheries, together with aquaculture provide food, nutrition and a source of income to around 820 million people around the world, from harvesting, processing, marketing and distribution. For many, it forms the part of their cultural identity. Currently, the Global fisheries and aquaculture production is at a record high and the sector plays a significant role in providing food and nutrition in the future.

5.2 According to the latest edition of FAO's 'The State of World Fisheries and Aquaculture'², global fisheries and aquaculture production totalled 178 million tons (with capture fishing amounting to nearly 90 million tonnes) in 2020, making fish and seafood amongst the most traded food commodities and around 86 percent of the total fish production (157 million out of 178 million tonnes) was for direct human consumption. This share, which was 67 percent in the 1960s, has increased significantly in recent decades. In fact, annual growth rate of food fish consumption has surpassed that of meat consumption from all terrestrial animals, combined. Fishing – both in capture fisheries (at sea) and in aquaculture (fish farming) – if sustainably managed, has an important role to play in providing jobs and feeding the world. Aquaculture growth has the potential to feed and nourish the world population but ensuring sustainability is utmost required.

5.3 According to FAO's report, per capita fish consumption has soared from 10 kg in the 1960s to more than 20.5 kg in 2019 and projected to reach 21.5 kg in 2030 with the growing trend in the world's consumption of aquatic food and this poses tremendous pressure on the aquatic resources. In addition, other factors such as overfishing, pollution, poor management are causing a continuous decrease in the fishery resources. Under such circumstances, it is important to maintain the stock of fish reserves and address the concerns of sustainability.

¹ <https://www.fao.org/fisheries/en/>

² <https://www.fao.org/3/cc0461en/cc0461en.pdf>

5.4 Over the last two decades, the fisheries and aquaculture sectors have been increasingly recognized³ for their essential contribution to global food security and nutrition. Expanding this role requires scaling up transformative changes in policy, management, innovation, and investment to achieve sustainable, inclusive and equitable global fisheries and aquaculture. One of the greatest threats to the sustainability of global fishery resources is illegal, unreported and unregulated fishing.

Fisheries Sector in India

5.5 Fishery sector occupies an important place in the socio-economic development of the country as far as India is concerned. The importance and the role of fisheries sector⁴ was officially recognized in India, through the enactment of the 'Indian Fisheries Act' in 1897⁵. This Act laid the foundation of the development of the fisheries sector in India and delineated the responsibility of the provinces, towards the development and conservation of fisheries in the country. Through this Act, the provinces were empowered to formulate Rules/Laws for the conservation of the fish and fisheries resources. As Fisheries is a State Subject, so historically investments in the sector, particularly in the fishing villages/coastal fishing villages, fishing harbours and ports have been made by the states 'for the welfare and support of the fishermen community'. However, with the growing requirements for resources, technological transfer/ advice and policy orientation the efforts of State Governments/UT Administrations are supplemented by the Government of India towards the development of the fisheries sector.

5.6 Fisheries has emerged as a sunrise sector and has been an important sector that provides food, nutrition, employment, income and livelihood in India. The fisheries sector plays an important role in the national economy and the sector has been one of the major contributors of foreign exchange earnings, with India being one of the leading seafood exporting nations in the world. According to FAO's 'The State of World Fisheries and Aquaculture 2022' report, India ranked in first in Inland water capture production and ranked sixth in Marine water capture.

5.7 The fisheries sector has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a relatively non-expensive source of nutritious food. At the same time, it is an instrument of livelihood for a large section of economically backward population of the country providing income and employment to more than 28 million people. Fisheries sector has been recognized as a 'Sunrise Sector' and has demonstrated a double-digit average annual

³ <https://www.fao.org/3/cc0461en/online/sofia/2022/executive-summary.html>

⁴ Depart of Fisheries, Annual Report 2021-22

⁵ <http://nbaindia.org/uploaded/Biodiversityindia/1.%20Fisheries%20Act.pdf>

growth of **10.87%** since 2014-15⁶. The sector has reached record fish production of 147.3 lakh tons in FY 2020-21 and has immense potential for growth.

5.8 India is the third largest ⁷ fish producing country in the world accounting for 7.96% of global production and contributing about 1.3% to the country's Gross Value Added (GVA) in 2020-21 and around 6.4% to the Agricultural, Forestry and Fishing GVA⁸. Export of marine products stood at 11.5 lakh tons and valued at Rs. 43,717.26 Crores during 2020-21 despite the market uncertainties raised by the Covid-19 pandemic outbreak.

5.9 Fish being an affordable and rich source of animal protein, is one of the healthiest options to mitigate hunger and nutrient deficiency. The Government of India has initiated several schemes to promote the fisheries sector. They include:

- **Pradhan Mantri Matsya Sampada Yojana (PMMSY):** The scheme aims to enhance fish production through expansion, intensification, diversification & productive utilization of land and water which will result in doubling fisher's and fish farmer's incomes and generation of employment. The scheme envisages to bring about Blue Revolution⁹ through sustainable and responsible development of fisheries sector in India.
- **Fisheries and Aquaculture Infrastructure Development Fund (FIDF):** In order to address the infrastructure requirement for fisheries sector, the Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying during 2018-19 has created dedicated fund namely FIDF with a total funds size of Rs 7522.48 crore¹⁰. FIDF provides concessional finance / loan to the Eligible Entities (EEs), including State Governments/UT Administrations and State entities for development of identified fisheries infrastructure facilities.
- **Kisan Credit Card (KCC):** The Government of India announced Rs.2 lakh crore concessional credit boost to Rs.2.5 crore farmers including fishers and fish farmers under Kisan Credit Card (KCC) Scheme as a part of Atmanirbhar Bharat Package. KCC aims to help animal husbandry and fisheries farmers for meeting their working capital requirements.

Ecosystem Services

5.10 The Ecosystem Services are central in the ecosystem accounting framework since they provide the link between ecosystem assets on the one hand, and the benefits used and enjoyed by people on the other hand. A fundamental aspect of ecosystem accounting

⁶ <https://pib.gov.in/PressReleasePage.aspx?PRID=1786303>

⁷ Department of Fisheries, Annual Report 2021-22, <https://pib.gov.in/PressReleasePage.aspx?PRID=1786303>

⁸ <https://mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/27503?q=RPCAT>

⁹ https://dof.gov.in/sites/default/files/2020-07/PressReleasebyPIBonPMMSY_0.pdf

¹⁰ <https://dof.gov.in/index.php/related-links/fidf>

is recognising the fact that a single ecosystem will generate a range of ecosystem services thus contributing to the generation of a number of benefits. For accounting purposes, it is most useful to consider ecosystem services in the context of a chain of flows that connect ecosystems with well-being. Starting at the individual and societal well-being, the chained approach recognises that well-being is influenced by the receipts of benefits. In the context of ecosystem accounting, benefits comprise of SNA and Non-SNA benefits. (Refer to Chapter 1 para 13).

5.11 SEEA- Ecosystem Accounting classifies the Ecosystem services into three broadly agreed categories:

- (i) Provisioning Services: those ecosystem services representing the contribution to benefits that are extracted or harvested from ecosystems, for example a fish or a plant with pharmaceutical properties.
- (ii) Regulating and maintenance Services: those ecosystem services resulting from the ability of ecosystems to regulate biological processes and to influence climate, hydrological and biochemical cycles, and thereby maintain environmental conditions beneficial to individuals and society. These services often have an important spatial aspect. For instance, the flood control service of an upper watershed forest is only relevant in the flood zone downstream of the forest.
- (iii) Cultural Services are generated from the physical settings, locations or situations which give rise to intellectual and symbolic benefits that people obtain from ecosystems through recreation, knowledge development, relaxation, and spiritual reflection. This may involve actual visits to an area, indirectly enjoying the ecosystem (e.g. through nature movies), or gaining satisfaction from the knowledge that an ecosystem containing important biodiversity or cultural monuments will be preserved.

5.12 In the publication, an attempt has been made to estimate the Fish Provisioning Services of some of the States of India. One of the approaches suggested in the SEEA for the calculation of the Fish provisioning service is the resource rent method. In the current publication, the resource rent method has been calculated using the rental price approach for the States of Andhra Pradesh, Rajasthan and Haryana. The estimates compiled in the publication are limited to tanks, ponds, lakes, reservoirs etc. that are provided for lease/rent. The information on the marine areas has not been considered due to paucity of information on the coastal boundaries and the availability of rent structure for coastal fishing. Data were collected from State Fisheries Department.

Andhra Pradesh

5.13 Andhra Pradesh state is endowed with a long coastline of 974 Kms with a continental shelf area of 33,227 Sq. kms. As per Central Marine Fisheries Research Institute (CMFRI) census, 2016, the marine fishermen population in 9 coastal districts of Andhra Pradesh is estimated at 5.17 lakh with 1.55 lakh fishermen families and 1.52 lakh traditional fishermen families. There are 533 marine fishing villages situated along the coast and 349 fish landing centers scattered in 9 coastal districts of Andhra Pradesh.

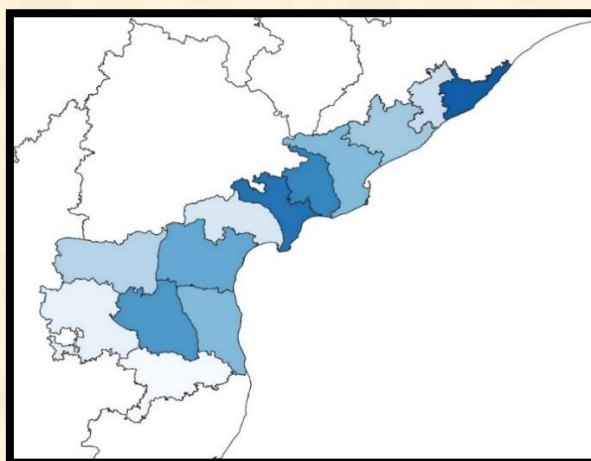


5.14 As far as the inland fisheries¹¹ are concerned, Andhra Pradesh is a major producer of fish in India with production of 36.1 lakh tones in 2019-20¹². Total number of reservoirs in Andhra Pradesh is 116 with effective water spread area (EWSA) as 1.66 lakh hectares and 3.87 lakh hectares of Tanks & Ponds and Brackish water. Average production of the State is 150 kg/ha.

5.15 On the basis of the rent/lease amount provided by the State, district wise Fish provisioning services for the year 2015-16 to 2021-22 have been

computed for the State and is given in **Annexure 5.1 to 5.7**. The District wise Rent per hectare for 2021-22 is shown in Figure 5.1.

Figure 5.1: District wise Fish Provisioning Services for Andhra Pradesh 2021-22



Note: Darker shade represent higher value.

¹¹ Department of Fisheries, Handbook of Fisheries Statistics 2020.

¹² Handbook on Fisheries Statistics: 2020

5.16 The details of the district-wise lakes, ponds, reservoirs etc. along with area present in the state for the year 2015-16 to 2021-22 are also provided in the **Annexure-5.1 to 5.7**. Year-wise estimates of Fish Provisioning Services for the years 2015-16 to 2021-22 are presented in the **Table-5.1** below.

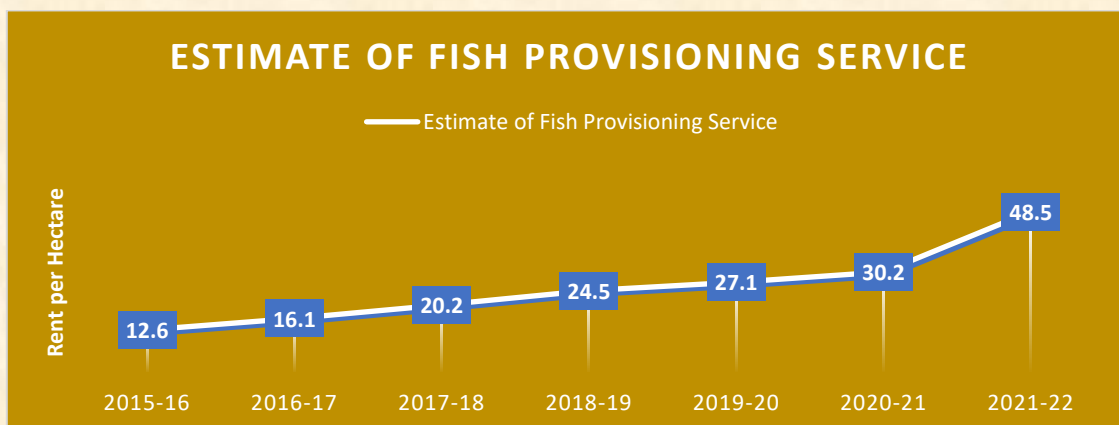
Table-5.1: Year-wise Fish Provisioning Services- Andhra Pradesh

Sr. No.	Year	Total Resource Area		Rent/Lease Amount	Rent per Hectare
		No of Resources	Area (Hectare)	(Rs.)	(Rs. / Hectare)
1	2015-16	3,397	3,89,262	49,04,343	13
2	2016-17	3,398	3,89,803	62,89,835	16
3	2017-18	3,398	3,89,803	78,71,066	20
4	2018-19	3,405	3,80,170	93,00,601	24
5	2019-20	3,428	3,80,345	1,02,94,244	27
6	2020-21	3,401	3,23,965	97,92,914	30
7	2021-22	3,317	2,91,399	1,41,28,320	48

Resources include Tanks, Ponds, Lake, Reservoirs

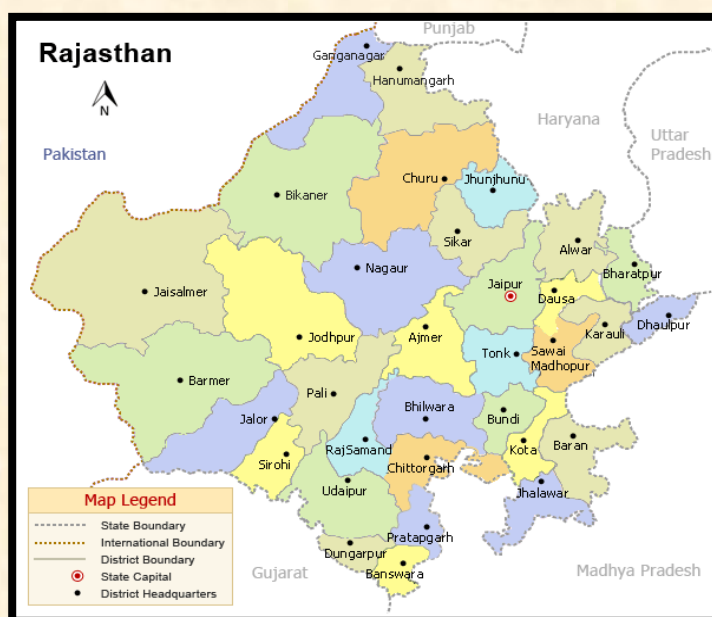
5.17 It can be observed that there has been reduction in the rent/lease amount in 2020-21. The reasons for the same may be primarily attributed to the reduction in the number of the major reservoirs. According to the information received from the State Fisheries Department, 2 reservoirs in the SPSR district has been identified for open auction vide GO Rt No217/2021 of Department of AHDD7 Fisheries, Government of AP in 2020-21. Therefore, these two reservoirs were not considered under rent/lease of 2020-21, thus decreasing the rent amount. However, there is an increase in the overall trend of the Fish Provisioning Services (Rent/hectare) over the years as depicted in the following graph:

Figure-5.2: Estimates of Fish Provisioning Services for Andhra Pradesh



Rajasthan

5.18 The State of Rajasthan¹³ is endowed with four major river basins viz. Chambal river basins, Mahi river basin, Luni river basin and Ghaghghar river basin. About seventy rivers connect these major river systems with large number of tanks, ponds and reservoirs during monsoon season regulating the natural recruitment of fish and other aquatic fauna throughout the State. The state has fresh water as well as saline water resources. It has 4.23 lakh ha. fresh water area covering 15,561 water bodies besides 30,000 ha. area as river and canals, 80,000 ha. waterlogged and 1.80 lakh ha. salt affected areas at full tank level. Average production of the State is 200 kg/ha. About 16500 farmers and fishers are engaged in fisheries related activities but with the targeted fish production.



5.19 Rajasthan has good aquatic resources¹⁴ to become a leading fish producer in the country. As per the study conducted by the Central Institute of Fisheries Education, Mumbai (2010) the fish production potential of Rajasthan is more than 80,000 metric tonnes annually.

5.20 The Rajasthan Department of Fisheries is providing assistance for different welfare schemes as per the guideline of state and Government of India to promote fish culture in the State in order to uplift the socio-economic conditions of the fishermen. Some of the schemes related to the Fisheries sector in Rajasthan are (i) Scheme on 'livelihood model', which is a 'zero revenue' model for the upliftment of tribal fishermen in three reservoirs- Jaisamnad (Udaipur), Mahi Bajaj Sagar (Banswara) and Kadana Backwater (Dungarpur) (ii) National Mission for Protein supplement (iii) Rashtriya Krishi Vikas Yojana.

5.21 The district-wise lakes, ponds, reservoirs etc. along with area and estimates of the Fish Provisioning Services have been estimated for the years 2015-16 to 2020-21 using data received from Department of Fisheries, Rajasthan. These estimates are provided in the **Annexure-5.8 to 5.13**. Fish Provisioning Services at the State level estimates for the years 2015-16 to 2020-21 are presented in the **Table-5.2** below:

¹³ <https://fisheries.rajasthan.gov.in/>

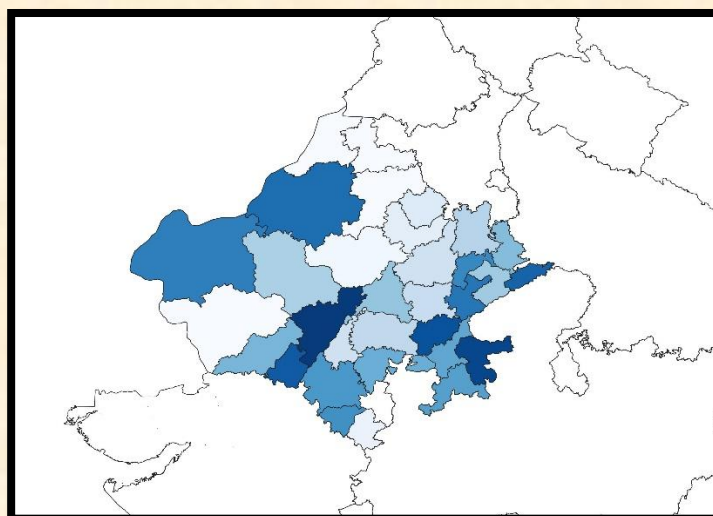
¹⁴ <https://www.rajras.in/rajasthan/economy/fisheries/>

Table-5.2: Year-wise Fish Provisioning Services- Rajasthan

Sr. No.	Year	Total Resource Area		Rent/Lease Amount	Rent per Hectare
		No	Area (Hectare)	(Rs.)	(Rs. /Hectare)
1	2015-16	15,561	4,30,784	45,19,36,462	1,049
2	2016-17	15,561	4,30,784	57,92,38,409	1,345
3	2017-18	15,561	4,30,784	72,03,68,982	1,672
4	2018-19	15,561	4,30,784	57,85,25,703	1,343
5	2019-20	15,561	4,30,784	63,41,01,651	1,472
6	2020-21	15,561	4,30,784	64,87,09,990	1,506

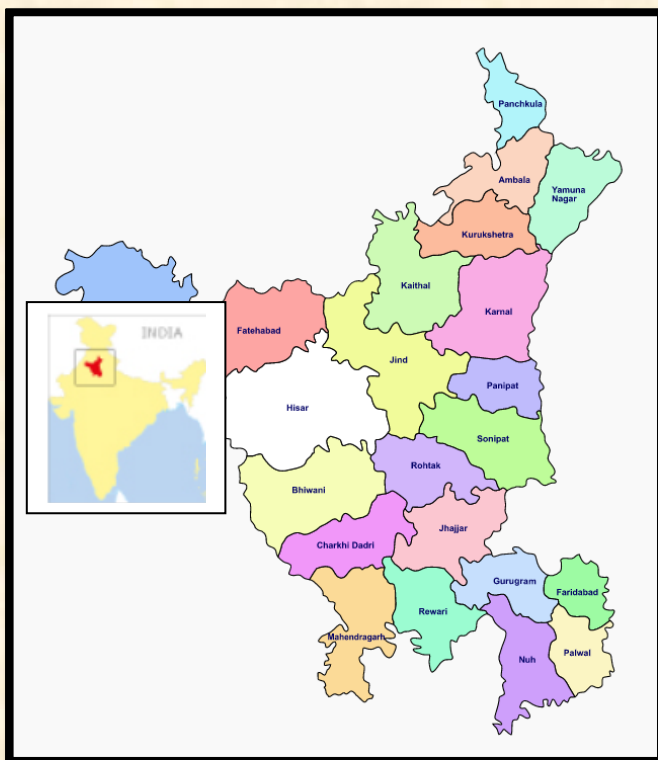
5.22 The fluctuation in the rent amount in the State can be attributed to the water availability of reservoirs which in turn depends on the rainfall patterns in the State. The district wise estimates of the Fish Provisioning Services for 2020-21 have been depicted in the map given below:

Figure 5.3: District wise Fish Provisioning Services for Rajasthan for 2020-21



Note: Darker shade represent higher value.

Haryana



5.23 The State of Haryana¹⁵ has good water resources in the shape of rivers, canals, drains, natural and man-made lakes/reservoirs / micro-water sheds, and village ponds to enable the promotion of fisheries. Fish culture in Haryana is little difficult due to the non-availability of the fishermen community and the prevalence of mostly vegetarian population. In the year 1966-67, only a 58-hectare pond water area was under fish culture by stocking of 1.5 lakh fish seeds and the total annual fish production was only 600 tonnes, which has been increased by covering 18207.06-hectare area under fish culture by stocking 6346.50 Lakh fish seed raising

209033.32 MT of fish during the year

2021-22¹⁵. It is proposed to stock 4400 lakh Fish Fingerling to produce 220000.00 MT fish during the years 2021-22 by covering a 22000.00-hectare water area. It is envisaged to provide technical and financial assistance to 2500-3000 families in the fisheries sector during the year 2021-22.

5.24 The Fish farming has increased manifold in the State in recent years. More than 80% of the village ponds available in the State are under fish culture. Village Panchayats are earning more than Rs. 125 Crores ¹⁶every year from leasing the village ponds for fish farming. In addition to this more than 2,500 pond units have been constructed by the fish farmers in their own land. The average productivity of fish is 7000 Kg per hectare as against the national level of 2,900 Kg. Haryana ranks 2nd in the Country for per hectare fish production.

5.25 Under the Centrally sponsored scheme, Strengthening of Post-Harvest Infrastructure, Govt. of India provides assistance to the Govt. undertakings, NGO's/Cooperatives/Joint Sector/Assisted Sector/Private Sector for establishing marketing infrastructure in the State. The state gets assistance for development of Fisheries Sector through some other Centre Sector Scheme and Centrally Sponsored schemes and Blue Revolution Scheme. Providing skill training to fish farmers & other

¹⁵ <http://harfish.gov.in/about-us>

¹⁶ <http://harfish.gov.in/fish-marketing>

stakeholders and providing assistance to bring area under aquaculture are some of the initiatives taken by the state for the development of fisheries.

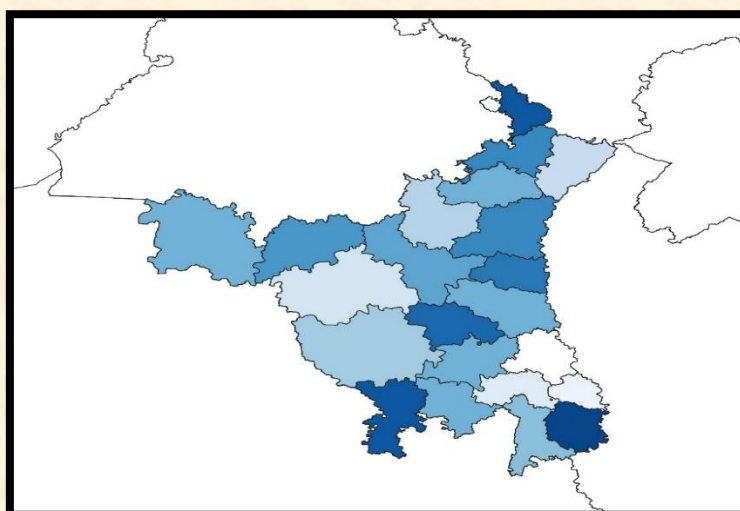
5.26 The district-wise lakes, ponds, reservoirs etc. along with area and estimates of the Fish Provisioning Services for the years 2015-16 to 2020-21 compiled using data received from Department of Fisheries, Haryana are provided in the **Annexure-5.14 to 5.19**. Fish Provisioning Services at the State level estimates for the years 2015-16 to 2020-21 are presented in the **Table-5.4** below:

Table-5.4: Year-wise Fish Provisioning Services- Haryana

Sr. No.	Year	Total Resource Area		Rent/Lease Amount	Rent per Hectare
		No	Area(Hectare)	(Rs.)	(Rs. /Hectare)
1	2015-16	6,004	11,282	4,60,800	50,132
2	2016-17	6,652	12,197	4,66,200	49,734
3	2017-18	6,862	12,531	4,64,400	48,257
4	2018-19	6,890	12,381	5,73,900	59,626
5	2019-20	5,924	11,379	5,85,200	60,001
6	2020-21	6,010	11,999	6,50,300	66,898

5.27 In Haryana, the rent or lease amount for a pond is estimated by the State Fisheries Department. This estimated rent amount is considered to be the base amount for the Panchayats for starting their bidding process of water bodies for fish culture. The actual rent depends upon several factors such as water availability and other condition such as presence of fence etc. Due to this reason, the rent amounts in the state is very high and are subject to inherent fluctuations. The district-wise estimates of the Fish Provisioning Services for 2020-21 have been depicted in the map given below:

Figure 5.4: District-wise Fish Provisioning Services for Haryana for 2020-21



Note: Darker shade represent higher value.

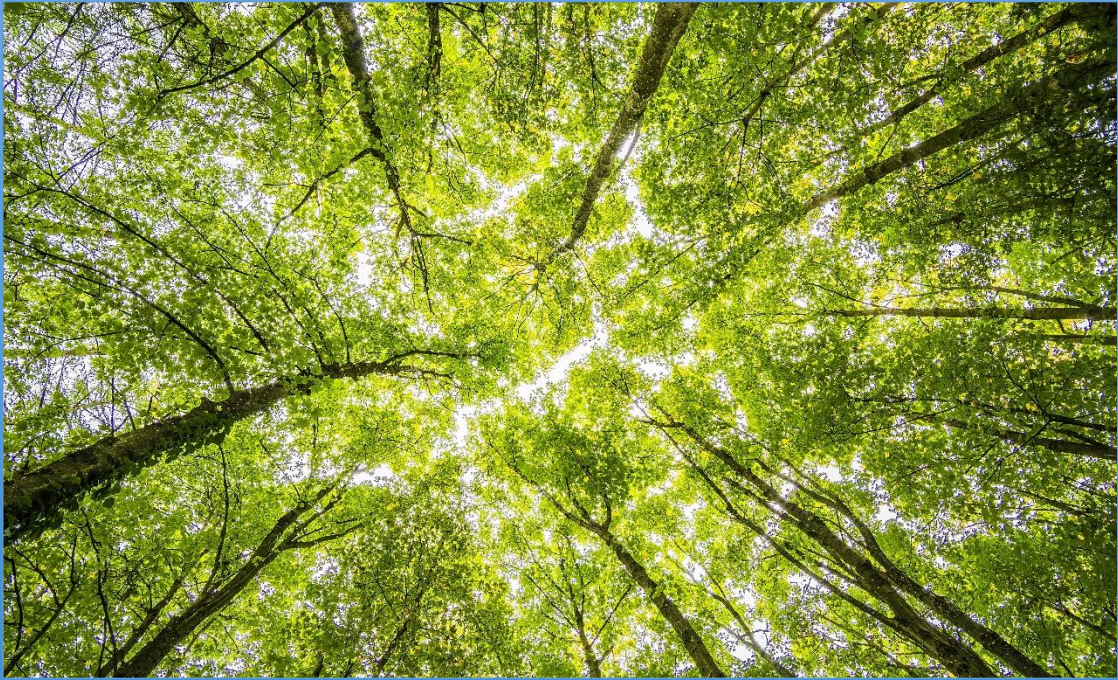
Challenges and Way Forward

5.28 The Fisheries sector in India has immense potential to expand and this will be possible only when waterbodies are in good and healthy conditions. It is essential to have focused attention to the fisheries sector through policy and financial support in order to accelerate its development in a sustainable, responsible, inclusive and equitable manner.

5.29 The estimation of the Fish Provisioning Service is an attempt to measure the value of the waterbodies where the fishes thrive. It is thus the contribution of the water bodies which helps mankind in the generation of huge amount of economic benefit as well as providing employment to people for better livelihood. The valuation of this service will open up avenues for more granular level policy framing to ensure improvement in the health of the water ecosystems which will help in turn to attain progress towards the achievement of sustainability.

5.30 The estimates in the current publication has been confined to three states for a limited number of years. The subject being covered for the first time, has scopes of further improvement and expansion over time. With the availability of more information from other states the estimates can be compiled on a pan-India basis.

FOREST ECOSYSTEM



Chapter 6

Forest Ecosystem

What we are doing to the forests of the world is but a mirror reflection of what we are doing to ourselves and to one another

-Mahatma Gandhi

Introduction- Forests

6.1 Forests are one of the multifunctional ecosystems which provide several services on all spatial and temporal levels. Today, the entire world has recognized the importance of forests and trees, not just as a resource base, but also as the key to survival of life on earth. The United Nations Organization has proclaimed its theme for 2021 as “**Forest Restoration: a path to recovery and well-being.**” The services provided by forests cover a wide spectrum of ecological, economic, social and cultural considerations and processes providing a multitude of benefits at local, national and global levels.

6.2 The relevance of the forest in the human lives cannot be undermined with forests playing a lead role in not just for timber and but also in myriad of other services such as carbon sequestration, preserving biodiversity, watershed services, soil conservation, recreational and cultural values, social and economic benefits for communities, stabilizes flows and runoffs which in turn prevents land degradation and desertification diminishing the risks of the natural disasters such as droughts, floods and landslides. Forests are important since they help in maintaining and upgrading the environment quality which is beyond quantification. But with more and more fragmentation in the forests, there is deterioration in the quality of the services provided by the forests. Owing to the importance of the forestry sector, the agreement on the first-ever United Nations Strategic Plan for Forests¹ (2017-2030) was forged at a special session of the UN Forum on Forests in January 2017 and the Plan was adopted by the UN General Assembly on 27 April 2017. The Strategic Plan features a set of six Global Forest Goals and 26 associated targets to be reached by 2030, which are voluntary and universal.

- **Global Forest Goal 1:** Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and contribute to the global effort of addressing climate change.
- **Global Forest Goal 2:** Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people.

¹ United Nation Strategic Plan for Forest 2030-https://www.un.org/esa/forests/wp-content/uploads/2017/09/UNSPF-Briefing_Note.pdf

- **Global Forest Goal 3:** Increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, as well as the proportion of forest products from sustainably managed forests.
- **Global Forest Goal 4:** Mobilize significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management and strengthen scientific and technical cooperation and partnerships.
- **Global Forest Goal 5:** Promote governance frameworks to implement sustainable forest management, including through the UN Forest Instrument, and enhance the contribution of forests to the 2030 Agenda.
- **Global Forest Goal 6:** Enhance cooperation, coordination, coherence and synergies on forest-related issues at all levels, including within the UN System and across Collaborative Partnership on Forests member organizations, as well as across sectors and relevant stakeholders.

6.3 Forests presently cover 30 percent of the Earth’s land area, or nearly 4 billion hectares. The Strategic Plan features targets to increase global forest area by 3% by 2030, signifying an increase of 120 million hectares, an area over twice the size of France and to eradicate extreme poverty for all forest-dependent people by 2030. Global Forests Goals and targets contribute to 2030 Agenda for Sustainable Development because forests and trees provide help to millions of people living in poverty by way of food, fuel for cooking and heating, water, medicine, shelter and clothing and function as safety nets in crises. The six Global Forest Goals and 26 associated targets support the objectives of the International Arrangement on Forests and aim to contribute to progress on the Sustainable Development Goals, the Rio conventions and other international forest-related instruments, and processes. The vision statement of the UN Strategic Plan for Forests 2030 calls for a world where forests are “sustainably managed, contribute to sustainable development and provide economic, social, environmental and cultural benefits for present and future generations.” When sustainably managed, forests are healthy, productive, resilient and renewable ecosystems which provide essential goods and services to people worldwide. An estimated 1.6 billion people – 25% of the global population – depend on forests for subsistence, livelihood, employment and income generation.

Forests in India

6.4 Trees and forests have held an important place in India since ancient times. These resources are vital for the existence of life on earth. As far as the definition of the forest cover is concerned, there exists different definitions from different sources. A detailed note on the conceptual differences in the definition of the Forest Cover is provided in the **Annexure 6.1**.

6.5 Evaluating the nature of the forests and monitoring their status are important from the perspective of national wealth, prosperity and economic well-being. In the Indian context, the evaluation of forest cover is undertaken by Forest Survey of India (FSI), Ministry of Environment, Forest & Climate Change (MoEF&CC), with a national assessment starting in the year 1987 using remote sensing techniques. The assessment is a biennial cycle at the National level which is published as the India State of Forest Report (ISFR). According to the India State of Forest Report 2021, the total forest cover of the country is 7,13,789 sq. km which is 21.71% of the geographical area of the country. The tree cover of the country is estimated as 95,748 sq. km which is 2.91% of the geographical area. Thus, the total forest and tree cover of the country is 8,09,537 sq. km which is 24.62% of the geographical area of the country.

6.6 In India, forest cover has been classified by the Forest Survey of India in terms of the tree canopy. The description of different forest cover classes is given in the **Table 6.1** below:

Table 6.1: Description of Forest Cover Class

Class	Description
Very Dense Forest (VDF)	All lands with tree canopy density of 70% and above
Moderately Dense Forest (MDF)	All lands with tree canopy density of 40% and more but less than 70%
Open Forest (OF)	All lands with tree canopy density of 10% and more but less than 40%
Scrub	Forest lands with canopy density less than 10%
Non-Forest	Lands not included in any of the above classes (includes water)

SEEA Extent and Condition Accounts for Forests

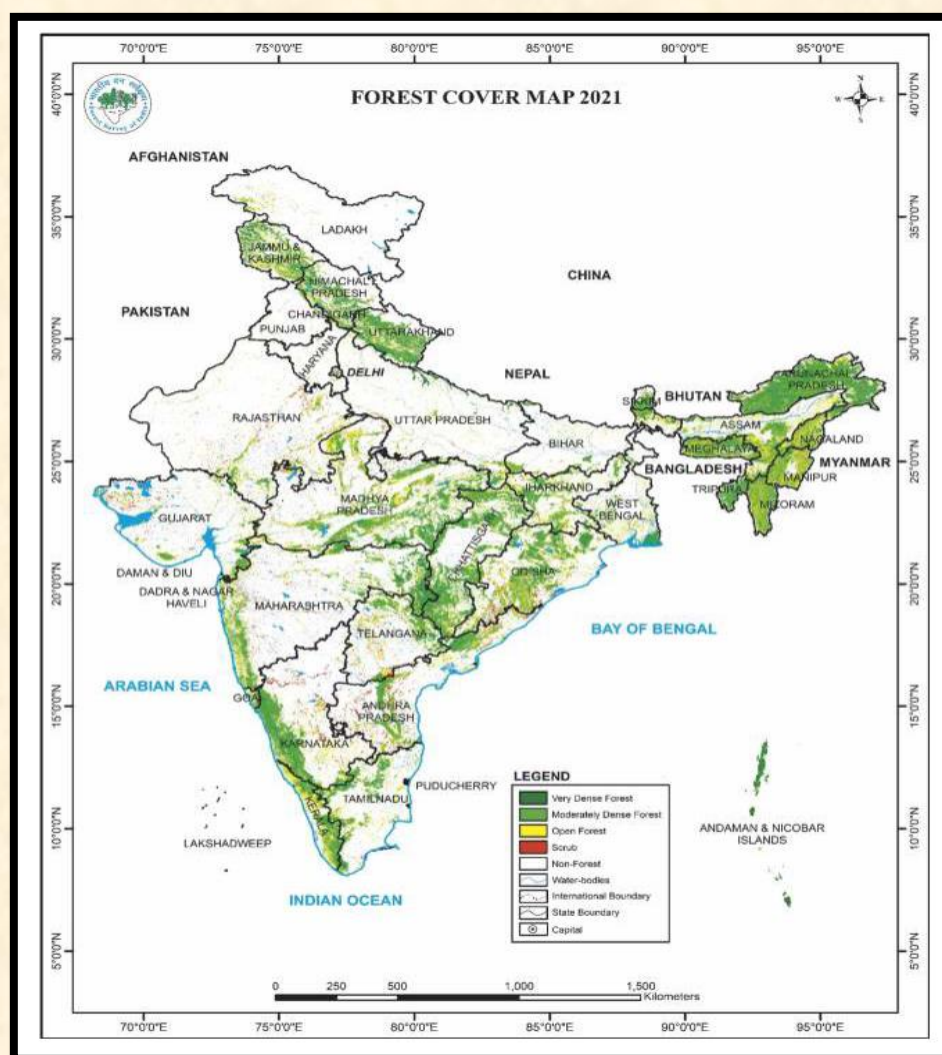
6.7 The System of Environmental-Economic Accounting (SEEA) prescribes the framework for compilation of the extent and the condition accounts to understand the quality and the quantity of the forest with 'ecosystem condition' representing both quality and biophysical state measures that are required to understand the capacity of the ecosystem to generate various services which are useful to human being as well as economic well-being. Thus, SEEA helps to link the forest assets and the services provided by the forests with the economy.

6.8 The forest cover in India is categorized into different types of Forests sourced from the India State of Forest Report (ISFR), 2021 is presented in the **Table 6.2** and also depicted in the **Figure 6.1** below:

Table 6.2: Forest Cover in India, 2021

Class	Area (in sq km)	Percentage of Geographical Area
Very Dense Forest (VDF)	99,779	3.04
Moderately Dense Forest (MDF)	3,06,890	9.33
Open Forest (OF)	3,07,120	9.34
Scrub	46,539	1.42
Non-Forest	25,27,141	76.87

Figure 6.1: India Forest Cover Map 2021



Source: India State of Forest Report – 2021, FSI, MoEFCC

6.9 The Forest Asset Accounts for the period 2015-16, 2017-18 and 2019-20 assessments have been given in the **Table 6.3** below. The State wise Forest Cover assessments for the years 2019 and 2021 are provided in the **Annexure 6.2**.

Table 6.3: Forest Asset Accounts - 2015-16, 2017-18 and 2019-20

2019-20				
(Area in sq. km)				
Type of Forest	Opening	Addition	Reduction	Closing
Very Dense Forest	99,278	2,009	1,508	99,779
Moderately Dense Forest	3,08,472	4,674	6,256	3,06,890
Open Forest	3,04,499	12,920	10,299	3,07,120
Scrub	46,297	5,562	5,320	46,539
Non-Forest	25,28,923	9,267	11,049	25,27,141
2017-18				
Type of Forest	Opening	Addition	Reduction	Closing
Very Dense Forest	98,158	1,969	849	99,278
Moderately Dense Forest	3,08,318	4,691	4,537	3,08,472
Open Forest	3,01,797	15,141	12,439	3,04,499
Scrub	45,979	4,466	4,148	46,297
Non-Forest	25,33,217	13,510	17,804	25,28,923
2015-16				
Type of Forest	Opening	Addition	Reduction	Closing
Very Dense Forest	88,633	13,673	4,148	98,158
Moderately Dense Forest	3,12,739	25,282	29,703	3,08,318
Open Forest	3,00,123	37,975	36,301	3,01,797
Scrub	42,302	14,542	10,865	45,979
Non-Forest	25,43,672	25,559	36,014	25,33,217

6.10 As per the ISFR, 2021, the total tree cover of the country has been estimated as 95,748 sq. km, while the extent of the trees outside forest has been found to be 29.29 million hectares which is about 36.18% of the total forest and tree cover of the country. The tree cover of the country has shown an increasing trend. The tree cover has risen from 90,844 sq. km in 2011 showing a decadal increase of 4,904 sq. km. The state wise extent of forest in India and their type of protection along with volume and density of growing stock is given in **Annexure 6.3**.

6.11 **Growing Stock** is the volume of all living trees in a forested area. Periodic estimation of the growing stock of wood is essential for developing national policies and strategies for sustainable use of forest resources. It is an important, quantifiable parameter and is used to calculate the tangible economic value of forests. It is an indicator of the sustainability and productivity of forests and forms the basis for calculating the biomass and carbon stock. Assessment of growing stock inside the forests provides information on the volume of wood available inside the forests. Similarly, the estimation of growing stock outside the forests is essential for the assessment of the volume of timber available outside the forests which can be used for economic development. At

present, Trees Outside Forest (TOF), in India has become the major source of wood for different uses.

6.12 According to IPCC², good Practice Guidance for LULUCF 2003³, **Forest Biomass** is an organic product of photosynthesis which is broadly classified into two components:

- (i) **Above Ground Biomass (AGB)** contain the part of vegetation above the ground e.g. stumps, tree, deadwood, litter and foliage.
- (ii) **Below Ground Biomass (BGB)** which includes the parts of the tree (roots) which are situated under the ground.

Globally, AGB is a commonly estimated parameter because of its utility in the estimation of forest atmospheric carbon and the GHGs. A higher value of AGB (>150 tonnes/ha) is indicative of a healthy and very dense forest.

6.13 The condition parameters for the forest Ecosystems is shown in the **Table 6.4** below. The State wise extent and the condition parameters (bamboo bearing area and the number of estimated culms by soundness of culms in Recorded Forest Area and volume of growing stock) have been listed in the **Annexure 6.4 and Annexure 6.5**.

Table 6.4: Condition Parameters of Forest Ecosystem

Parameter	Unit	Values (ISFR 2021)
Volume of growing stock in Forests	(m cum)	4,388.15
Volume of growing stock in TOF	(m cum)	1,779.35
Growing stock in Forests	(cum/ha)	56.6
Growing stock in TOF	(cum/ha)	8.4
Total number of culms of Bamboo	(in million)	53,336
Bamboo bearing Area	(in sq. km)	1,49,443
Carbon Stock in different carbon pools	(million tonnes)	7204

Forest Ecosystem Services

6.14 The forest ecosystems provide critical and diverse values and services to human society. As primary habitats for a wide range of species, forests support biodiversity maintenance and conservation. Forest growth sequesters and stores carbon from the atmosphere, contributing to the regulation of the global carbon cycle and climate change mitigation. Healthy forest ecosystems produce and conserve soil and stabilize stream flows and water runoff—preventing land degradation and desertification, and reducing the risks of natural disasters such as droughts, floods, and landslides. Forests also serve as sites of aesthetic, recreational, and spiritual value in many cultural and societal contexts, and contribute to poverty eradication and economic development by providing food, fibre, timber, and other forest products for subsistence and income generation.

² <https://www.ipcc.ch/>

³ <https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html>

6.15 In the current publication, estimates of following services from forests have been compiled.

- Timber Provisioning Services
- Non-timber Forest Products Provisioning Services
- Carbon Retention Services

Timber and Non-timber Forest Products (NTPF) Provisioning Services

6.16 The Forests Products are broadly classified into two categories- Timber and Non-timber Forest Products. Timber includes rose wood, teak wood, jungle wood etc. The source of production of timber is either from forests or from trees outside forests (TOF). FAO⁴ has defined TOF as “Trees on land not defined as forests and other wooded lands”. In India, FSI has defined TOF as “all trees growing outside government Recorded Forest Areas (RFAs)” irrespective of patch size. TOF resources play a vital role in the socio-economic life of rural India and generate valuable ecosystem services in urban and rural parts of the country.

6.17 Non-Timber Forest Products (NTFP) refers to all biological materials other than timber which are extracted from the forests for human use. They constitute an important source of livelihood for millions of people from forest fringe communities. NTFPs include plants used for food, beverages, forage, fuel, medicine, fibers and biochemical; animals, birds and fish for food, fur and feathers; as well as their products such as honey, lac and silk. As per FAO, there are at least 150 NTFPs that contribute substantially to international trade, including honey, gum arabic, rattan and bamboo shoots, cork, forest nuts and mushrooms, oleoresins, essential oils, and plant or animal parts for pharmaceutical products. NTFP extractions has a multiplier effect in the economy by generating employment not only for the inhabitants of these Forest Fringe Villages, but also for others involved in downstream processing and trading activities.

Monetary Value of Timber and Non-timber Forest Products (NTPF) Provisioning Services

6.18 In the National Accounts, the Gross Value Added (GVA) from the Forestry sector is compiled in two broad groups:

- (i) Major products comprising **Industrial Wood** (timber, round wood, match and pulpwood) and fuel wood (firewood and charcoal wood), and
- (ii) **Non-Timber Forest Products** (NTFPs) comprising a large number of wild growing forest material such as bamboo, fodder, lac, sandalwood, honey, resin, gum, tendu leaves (*Diospyros Melanoxylon*), cork, balsams, eelgrass, acorns, horse chestnuts, mosses, lichens etc.

6.19 The estimation of Gross Value Added from the “Forestry and Logging” sector in India is carried out by the production approach. It aims at estimating the value of output

⁴ <https://www.fao.org/3/cb9360en/online/cb9360en.html>

at factor cost in the first instance and then deducting the value of various inputs at purchaser's prices. The state-wise estimates of value of timber provisioning service are based on these exchange values that are adopted in compilation of National Accounts Statistics.

6.20 The data on production and prices of industrial wood/timber are supplied by State Forest Departments (SFDs). Estimates of value of output at current prices are compiled by multiplying the category-wise production figures with their respective average annual prices, both of which are supplied by the SFDs. In addition to the production of industrial wood from these Government forests, there would be

- (i) authorized (but unrecorded) removals of timber from forests; and
- (ii) unrecorded production of industrial wood from private owned forests and non-traditional forest areas (e.g. trees in village common fields, ridges, canal sides, road sides, fruit trees no longer productive etc.).

6.21 The value of unrecorded, but authorized, production from forests is taken as 10% of the value of recorded production. The estimates of industrial wood from trees outside forests (TOF) (i.e. private owned forests and non-traditional forest areas like village commons, field ridges, canal sides, road sides, fruit trees no longer productive etc.) are provided by the Forest Survey of India. Prices for the same are also provided by the SFDs.

6.22 Valuation of NTFP Provisioning Services are also based on the concept of exchange value. The state wise estimates of value of output of non-timber forest products, and separate estimates of fuelwood are available in India's National Accounts Statistics⁵. The items of NTFP vary from state to state. Information is built up on the basis of royalty received (in value terms) from those authorized to extract these from the forests. Value of Fodder from forest, as estimated using the 'per animal consumption' norms, is also a component of the estimate of NTFPs, as available in the National Accounts Statistics. Forest Rent as a percentage of GDP is taken from the World Bank's database⁶. According to the Metadata Glossary of the World Bank, Forest rents ⁷are roundwood harvest times the product of regional prices and a regional rental rate.

6.23 Forest rent as a percentage of the gross value of output of Timber/NTFP can then be estimated using GVO-Forestry, GVA-Forestry and GDP. This value can be said to approximate the share of 'rent' and thus can be used to estimate the value of timber and NTFP provisioning services. The detailed methodology of estimation of the value of Timber and NTFP provisioning services is presented in the **Table 6.5** below:

⁵ State-wise and Item-wise Value of Output from Agriculture, Forestry and Fishing, National Accounts Division, NSO, MoSPI,

⁶ <https://data.worldbank.org/indicator/NY.GDP.FRST.RT.ZS>

⁷ <https://databank.worldbank.org/metadataglossary/world-development-indicators/series/NY.GDP.FRST.RT.ZS>

Table 6.5: Method of estimation of value of Timber & NTFP provisioning services

Step	Item	Method of estimation (at current prices)
1	Value of output of Industrial wood and Non-Timber Forest Products (NTFP)	Estimates taken from the National Accounts
2	Forest rent / GVO of forestry	Estimated using the following factors: $(\text{Forest rent}/\text{GDP}) * (\text{GDP}/\text{GVA of Forestry}) * (\text{GVA} / \text{GVO of forestry})$.
3	Value of timber and NTFP provisioning service	Value of service = (Forest Rent/GVO of Forestry) * Value of output of timber and NTFP

6.24 The estimates of both timber and NTFP provisioning service in India during the period 2011-12 to 2019-20 has been compiled at current and constant prices. The constant prices estimates have been compiled using the estimates of GDP, GVA and GVO at constant prices compiled in the National Accounts Statistics. In order to maintain consistency with National Accounts, the year 2011-12 has been taken as the base year. The values of Timber and Non-timber Provisioning Services at current and constant prices for the years 2011-12 to 2019-20 are shown in the **Figure 6.2** and **Figure 6.3** below.

Figure 6.2: Value of Timber Provisioning Services at Current and Constant Prices

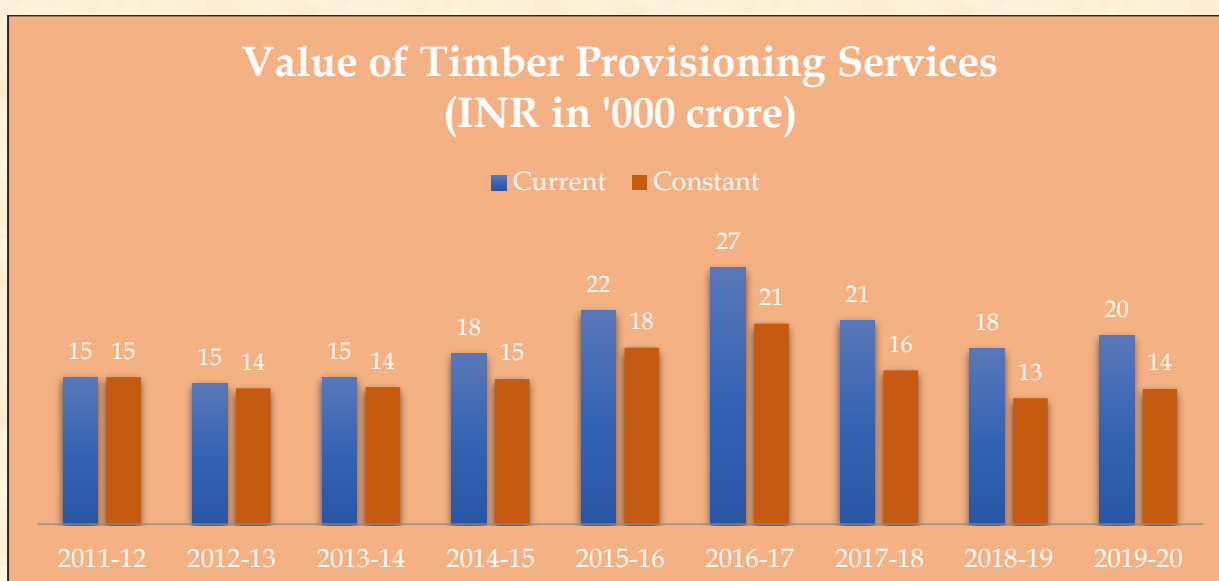
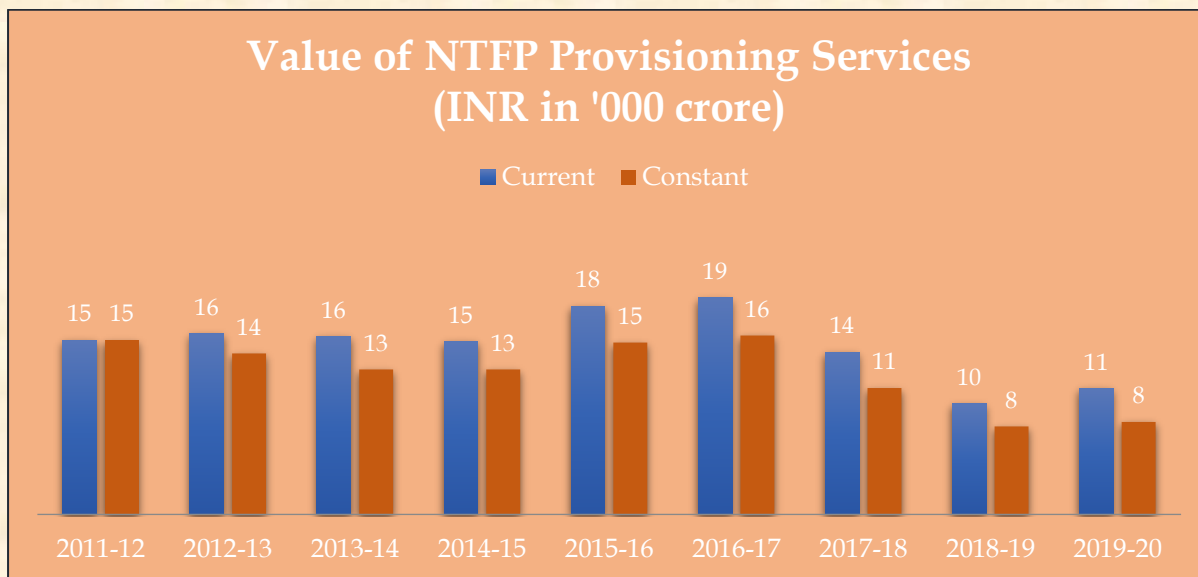


Figure 6.3: Value of NTFP Provisioning Services at Current and Constant Prices



6.25 The State-wise estimates of Value of Timber and NTFP Provisioning Services and services per hectare at current and constant prices for the year 2011-12 to 2019-20 are provided in the **Annexure 6.6**. The geographical area as provided in the ISFR, 2021 has been used to compile per hectare values. Figure 6.4 and 6.5 depicts the state wise value of timber and NTFP per hectare respectively for the year 2019-20.

Figure 6.4: State-wise Value of Timber Provisioning Services per hectare (at Current Price)- 2019-20

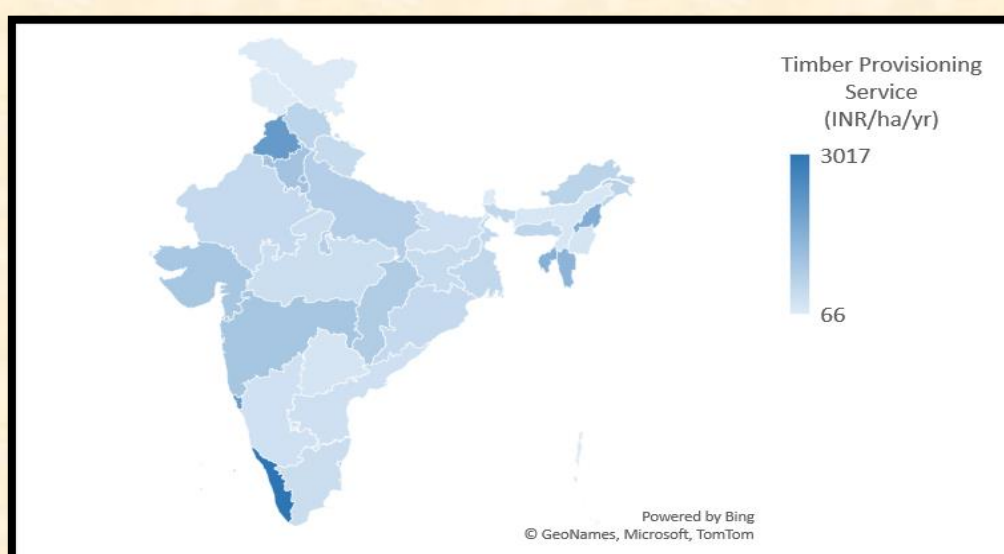
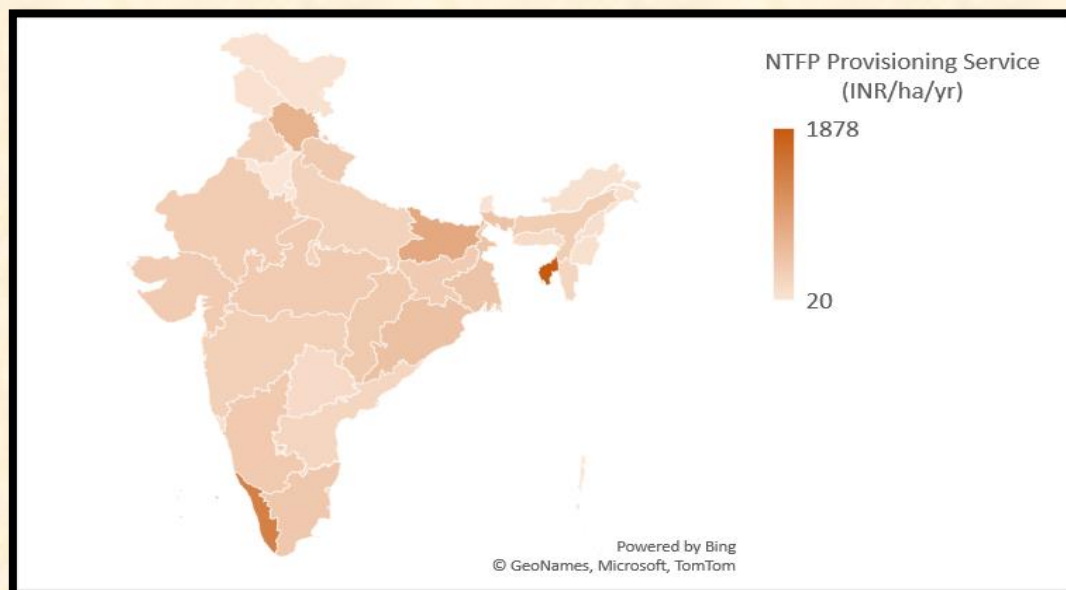


Figure 6.5: State-wise Value of NTFP Provisioning Services per hectare (at Current Price)- 2019-20



6.26 The state-wise analysis for 2019-20 shows that while the timber provisioning services per hectare at current price is highest for Kerala followed by Goa and Punjab, the higher value for NTFP provisioning services per hectare are observed for Tripura, Kerala and Bihar.

Carbon Retention Service

6.27 Forests play a key role within the global carbon cycle and adaptation to climate change, removing carbon dioxide (CO₂) from the atmosphere and converting it to wood as they grow, and releasing carbon dioxide back into the atmosphere when trees are burned or decay. The forest and land-use sector are thus unique in that it can act as either a source or a sink for carbon, with the potential to sequester carbon and thus reduce net CO₂ emissions. If not for forests, much of this carbon would remain in the atmosphere in the form of carbon dioxide (CO₂), the most important greenhouse gas driving climate change. The diversity of forests in India makes it resilient to climate change and an efficient sink of carbon. State wise Carbon stock and carbon stock per hectare for ISFR 2021 is given in **Annexure 6.7**.

6.28 India is committed at the highest level to meet its commitments under the Nationally Determined Contributions (NDC) made to the international community under the Paris Agreement (2015). As one of the three NDCs, India has committed to create additional carbon sink of 2.5 to 3.0 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.

6.29 The Social Cost of Carbon (SCC) represents the economic cost associated with climate damage (or benefit) resulting from the emission of an additional ton of CO₂⁸. Hence the social cost of carbon is often used as carbon price estimate. India's country-level social cost of a tonne of CO₂ is US\$ 86 as per Nature Climate Change article for the year 2017-18. India's country-level social cost of a tonne of CO₂ for the year 2019-20 has been estimated at US\$91 using the GDP deflator.

6.30 Analysis of trend of carbon in India's forest and tree cover vis-à-vis NDC target helps in understanding implications of increasing carbon sink through forest and tree cover by 2030. With a view to understand the carbon retention services provided by the forests of India which also contribute to the global climate regulation, estimates for economic value of carbon retention during the assessment year 2019-20 have been compiled for current prices using Social Cost of Carbon (SCC) approach. Also, estimates at constant prices have been compiled for the year 2011-12 onwards for the ISFR years. The base year has been considered as 2011-12 keeping the estimates consistent with National Accounts. ISFR-2013 estimates have been considered as the base year values which corresponds to the period October 2010 to Jan 2012.

6.31 Step wise methodology used for valuation of carbon retention service has been explained in the **Table 6.6** below.

Table 6.6: Method of estimation of economic value of Carbon Retention Service

Steps	Method of Estimation	Data Sources/Assumptions
1	Total Carbon Stock= Above ground biomass + Below ground biomass + Dead wood + Litter + Soil Organic Carbon	India State of Forest Report, Forest Survey of India
2	Carbon stock (CO ₂ eq.) = Carbon content * 3.67	Based on default IPCC conventions ⁹
3	Value of carbon stock (CO ₂ eq.) in US\$ = Carbon dioxide * Social Cost of tonne of CO ₂	Using India's country-level social cost of a tonne of CO ₂ (CSCC) emission as mentioned in Ricke et al article ¹² which is US\$86 for the year 2017-18. For the other years, CSCC has been estimated using the GDP deflator growth rate.
4	Value of carbon stock (CO ₂ eq.) in INR = Value of carbon stock in US\$ * Exchange rate	Using the exchange rate of Indian Rupee vis-à-vis the US Dollar (in Financial Year-Annual Average) ¹⁰ . For estimating at constant prices, exchange rate for the year 2011-12 has been used.

⁸ Ricke, K., Drouet, L., Caldeira, K., & Tavoni, M. (2018). Country-level social cost of carbon. *Nature Climate Change*, 8(10), 895-900 https://www.nature.com/articles/s41558-018-0282-y.epdf?author_access_token=XLBRLEGdT_Kv0n8_OnvpdRgN0jAjWel9jnR3ZoTv0Ms70oz073vBeHQkQjXs|bey6vjdAHHSPxkHEN8nflPeQI6U86-MxWO1T1uUiSvN2A-srp5G9s7YwGWt6-cuKn2e83mvZEpXG3r-j0nv0gYuA%3D%3D

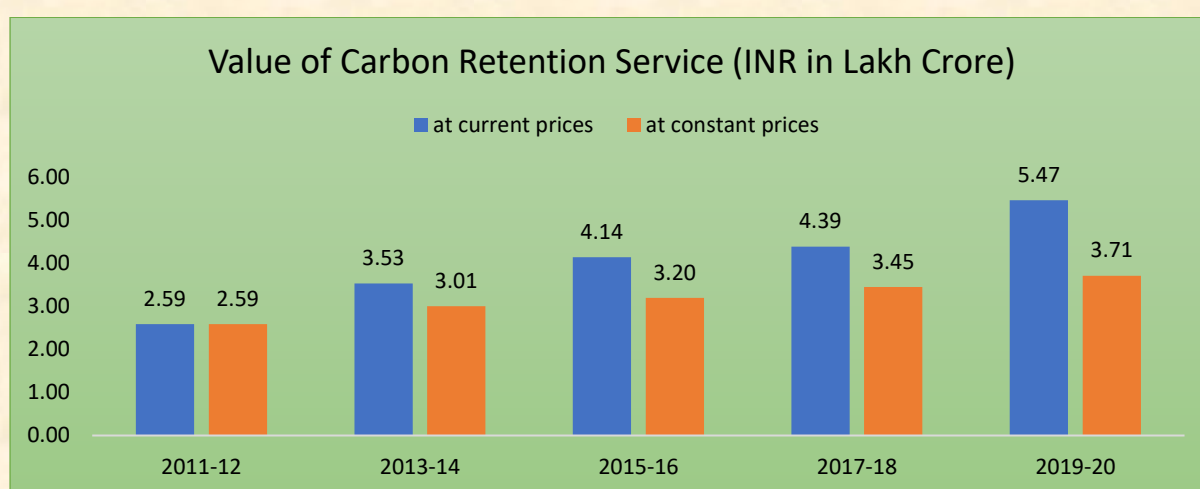
⁹ Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, et al. 2003. Good practice guidance for land use, land-use change and forestry. Institute for Global Environmental Strategies, Hayama, Japan

¹⁰ Handbook of Statistics on Indian Economy, Reserve Bank of India available at <https://www.rbi.org.in/Scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy>

Steps	Method of Estimation	Data Sources/Assumptions
5	Value of Carbon Retention service = Value of carbon stock (CO2 eq.) (as obtained in step 4) * Rate of return	A 3% rate of return has been assumed, which is equivalent to the discount rate taken for calculating SCC ¹¹ .

6.32 The value of carbon retention service in India computed using Social Cost of Carbon (SCC) approach has shown an increasing trend during the period 2011-12 to 2019-20. This is caused by the overall increase in carbon stocks. The value of carbon retention service using the current price as well as constant price during the period 2011-12 to 2019-20 is presented in the **Figure 6.6** below:

Figure 6.6: Value of Carbon Retention from forests in India



6.33 The value of carbon retention service at current price computed for the year 2019-20 is estimated as INR 546.95 thousand crore as compared to the value computed for the year 2017-18, which is INR 438.79 thousand crore. The detailed calculations of state wise estimates of value of carbon retention service and services per hectare for the year 2015-16 to 2019-20 are given in the **Annexure 6.8**.

Summary of Forest Ecosystem Services

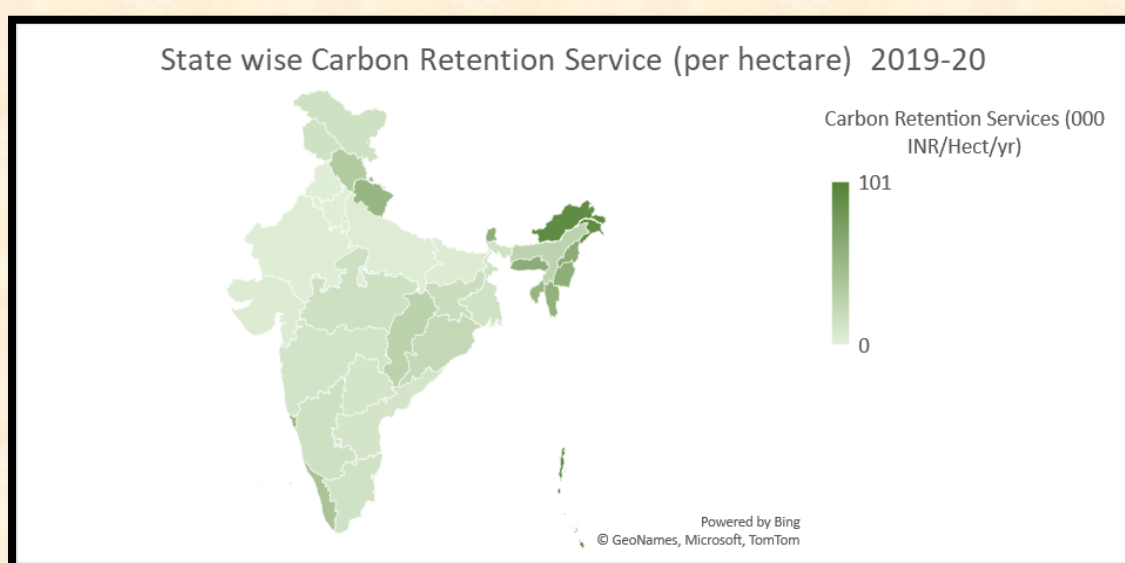
6.34 During the year 2019-20, it has been observed that value of timber provisioning services is about 0.13% of India's GDP, while that of NTFP provisioning service is 0.08% of India's GDP. Value of carbon retention service obtained using social cost of carbon approach during the year 2019-20 is equivalent to 3.75% of India's GDP. The national level estimates of economic value of these ecosystem services obtained have been summarised in **Table 6.7** below. **Figure 6.7** provides the economic values per hectare of these three ecosystem services for the States of India.

¹¹ Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017): <https://www.nap.edu/read/24651/chapter/9>

Table 6.7: Summary of selected ecosystem services from forests in India

Ecosystem services	Assessment period	Values (in '000 crore INR)	% of GDP
Timber provisioning	2019-20	19.63	0.13
Non-timber forest resources	2019-20	11.11	0.08
Carbon retention	2019-20	546.95	3.75

Figure 6.7: State-wise Value of Carbon Retention Services per hectare (at Current Price)- 2019-20



6.35 The Carbon Retention Services per hectare shows that in 2019-20 Andaman & Nicobar Islands has the highest value followed by Arunachal Pradesh and Meghalaya.

Conclusion

6.36 According to the State of World's Forest 2022, trees, forests and sustainable forestry can help the world recover from the COVID-19 pandemic and combat looming environmental crises such as climate change and biodiversity loss. The three pathways involving forests and trees offer means by which societies, communities and individual landowners, users and managers can derive more tangible value from forests and trees while addressing environmental degradation, recovering from crises, preventing future pandemics, increasing resilience and transforming economies. These pathways if pursued simultaneously, could help address the crises facing the planet while also generating sustainable economic benefits. The pathways are (i) halting deforestation and forest degradation as a crucial element for reversing the drivers of climate change, biodiversity loss, land degradation, desertification and threats to human health (**“halting**

deforestation and maintaining forests” – also “halting deforestation”); (ii) restoring degraded forests and landscapes and putting more trees into agricultural settings as cost-effective means for improving natural assets and generating economic, social and environmental benefits (**“restoring degraded lands and expanding agroforestry” – also “restoration”**); and (iii) increasing sustainable forest use and building green value chains to help meet future demand for materials and ecosystem services and support greener and circular economies, particularly at the local level (**“sustainably using forests and building green value chains” – also “sustainable use”**). These pathways are mutually reinforcing. When synergies are maximized, the pathways can provide some of the highest returns in the form of climate and environmental benefits while also enhancing local sustainable development potential, adaptive capacity and resilience.

6.37 In this chapter, ecosystem extent and condition accounts based on the SEEA framework, as well as estimates of flows of forest ecosystem services, have been presented for India. Values of only three selected ecosystem services: timber provisioning, non-timber forest resources and carbon retention provided by the forests of India have been compiled using various data sources and appropriate valuation approaches that are conceptually valid and that produce values consistent with the System of National Accounts to facilitate the integration of environmental and economic statistics. But there are still several other important indicators of condition and ecosystem services provided by forests that have not been included in this assessment, but are nevertheless, very important.

6.38 The accounts on forests provide a snapshot of the forest sector in India and an estimate of the valuation of its services. These are essentially to facilitate the policy makers for making efficient policies taking into consideration actual ground reality. Proper sustainable management of forests is possible only when a holistic assessment is made to understand the real worth of the forests.

BIODIVERSITY



Chapter 7

Biodiversity

Biodiversity starts in the distant past and it points towards the future

-Frans Lanting

Introduction

7.1 Biodiversity means the 'diversity' of life on Earth at all levels, from genes to ecosystems. It includes diversity within species, between species and of ecosystems. Biodiversity includes all ecosystems- manmade (plantations, farms, croplands, aquaculture sites, urban parks) and natural (forests, nature preserves or national parks) and represents the wealth of biological resources available to human beings. The diversity of life on earth is essential for the healthy functioning of ecosystems and it is biodiversity that boosts ecosystem productivity. It is high time the mankind realizes the fact that economies are embedded in nature and are not external to it.

7.2 Today there are 8-20 million species¹ of organisms, may be more, with cells containing a distinct nucleus that houses genetic material in the form of chromosomes (such organisms are called eukaryotes). Only about 2 million eukaryotes have been recognized and named so far. There are in addition unknown and much larger numbers of archaea and bacteria, which do not have a cell nucleus (they are called prokaryotes). But biodiversity does not only pinpoint the number of species of organisms that inhabit the Earth, it has further deeper dimensions, including the genes these organisms contain and, the functional characteristics of the ecosystems in which they live. The chemical reactions of Earth's plants, algae and many bacteria sustain life by converting sunlight and nutrients into food, useable energy, and the building blocks of life, as well as recycling waste. Their activities are often both silent and hidden from view, but they enable ecosystems to function and provide a multitude of services on which we rely. The biosphere, which is the part of Earth occupied by living organisms, is a regenerative entity. Since the ability to regenerate is a characteristic of living systems, regeneration of the biosphere is key to the sustainability of the human enterprise. Ecosystems are actually constituents of the biosphere.

1

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957292/Dasgupta_Review_-_Abridged_Version.pdf

Linkages of Biodiversity to Economy

7.3 Nature's goods and services are the foundations of our economies. They include the provisioning services that supply the goods we harvest and extract (food, water, fibres, timber, medicines) and cultural services, such as the gardens, parks and coastlines we visit for pleasure, even emotional sustenance and recuperation. But, in addition to these Nature's processes also maintain a genetic library, preserve and regenerate soil, control floods, filter pollutants, assimilate waste, pollinate crops, maintain the hydrological cycle, regulate climate and fulfil many other functions. Without these regulating and maintenance services, life would not be possible.

7.4 Depreciation is the decline in the quantity or quality of an asset over time. In the case of ecosystems, depreciation is the difference between the rate at which it is harvested and its regenerative rate. If human extraction of an ecosystem's provisioning services exceeds its regenerative rate, the ecosystem depreciates.

Figure 7.1: Links from Biodiversity to the Economy



Source: The Economics of Biodiversity: the Dasgupta Review (Abridged Version)

India- A Mega Diverse Region

7.5 Biodiversity is a characteristic of ecosystems. It enables ecosystems to flourish and supply the wide variety of services on which mankind is dependent upon. The various factors that influence the biodiversity of a region include temperature, altitude, precipitation, soils and pressures from the human activities. The biodiversity profile of a country at any point of time reflects the presence of different variety of taxa of flora and

fauna, the consequences of the way it has been utilized and how it has been conserved through legal or other measures. For instance, the faunal species of India has steadily climbed up making India the world's 8th highest mega biodiverse country². Different aspects of India's biodiversity have been discussed in the 2020 issue of this publication³.

7.6 India has tremendously rich in species and ecosystem diversity. Over 1,03,258 species of fauna and 55,048 species of flora have been documented in the 10 biogeographic zones of the country. Considering floral diversity, out of the 55,048 known plant species in India, 12,095 are endemic (Table 7.1). Endemism describes taxa that are distributed on particular areas. Endemic species are those that live in a limited area, such as a mountain range, lake or island, among others.

Table 7.1: India's Floral Species Diversity and Endemism - 2021

Major Groups	Number of Species	No. of Endemic Species	No. of Threatened Species
Flowering Plants			
Gymnosperms	82	12	12
Angiosperms	21,984	4,556	416
Non-flowering Plants			
Bryophytes	2,800	640	7
Pteridophytes	1,314	74	2
Others			
Virus & Bacteria	1,269	26	
Algae	9,008	1,965	
Fungi	15,602	c. 4240	1
Lichens	2,989	c. 582	
Total	55,048	12,095	

Source: *Botanical Survey of India, Kolkata.*

7.7 In the case of fauna, 28,948 species are endemic to the country and account for 28% of the total 1,03,258 species identified so far in India. **Table 7.2** shows the known faunal species, their endemism and threat status.

² Animal Discoveries 2020, Zoological Survey of India

³ EnviStats India 2020, Vol. II

Table 7.2: India's Faunal Species Diversity and Endemism – 2021

Major Groups	Number of Species	No. of Endemic Species	No. of Threatened Species
Protozoans	3,557	645	
Invertebrates	92,741	27,125	135
Chordates, Cephalochordates and Urochordates	6,960	1,178	540
<i>Of which</i>			
Fishes	3,496	500	228
Amphibia	443	296	75
Reptilia	706	255	54
Birds	1,346	81	89
Mammals	432	46	94
Total	1,03,258	28,948	675

Source: Zoological Survey of India, Kolkata, 2022.

7.8 Along with many other countries, India has its own fair share of issues due to Invasive Alien Species. Alien species⁴ is a species, subspecies or lower taxon, introduced outside its natural past or present distribution, which includes any part, gametes, seeds, eggs or propagules of such species that might survive and subsequently reproduce. Invasive alien species are species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity⁵. Some examples of the commonly found faunal alien species in India are the African apple snail (*Achatina fulica*), Papaya Mealy Bug (*Paracoccus marginatus*), Cotton Mealy Bug (*Phenacoccus solenopsis*) and Amazon sailfin catfish (*Pterygoplichthys pardalis*), while commonly found floral alien species in India are *Prosopis juliflora*, Vilayti Kikar, *Parthenium hysterophorus*, Lantana Camara and Water Hyacinth (*Eichhornia crassipes*).

7.9 In recent past, Invasive Alien Species have been emerging as the second biggest threat to global biodiversity after habitat fragmentation. Invasive Alien Species Management, preventing the entry and periodical monitoring of the alien species in a new habitat, is one of the important steps to be followed to get rid of the Invasive Alien Species menace.

⁴ Invasive Alien Species: Threat to inland wetlands of India, Centre for Biodiversity Policy and Law (CEBPOL)

⁵ [https://www.cbd.int/invasive/WhatareIAS.shtml#:~:text=Invasive%20alien%20species%20\(IAS\)%20are,affect%20all%20types%20of%20ecosystems.](https://www.cbd.int/invasive/WhatareIAS.shtml#:~:text=Invasive%20alien%20species%20(IAS)%20are,affect%20all%20types%20of%20ecosystems.)

Table 7.3: Invasive Alien Species of India

Category	Number of Invasive Alien Species
Terrestrial Plants	54
Aquatic Ecosystem	56
Agriculture Ecosystem	47
Island Ecosystem	14
Total	171

Source: National Biodiversity Authority

Taxonomic diversity of India

7.10 The Botanical Survey of India (BSI) and the Zoological Survey of India (ZSI) (largest faunal specimen repositories in the world⁶) are the two apex organisations of India that have been actively engaged in taxonomic study of all major groups of Indian plants and animals, respectively. Every year, these two organisations collate information on the discoveries during the previous year using the research published by scientists on various aspects of taxonomy including species new to science and new records. **Table 7.4** below gives the phylum-wise details of the taxonomic diversity of India compiled using information from the BSI and ZSI.

Table 7.4: Number of Fauna and Flora Species in India – 2021

Category	Taxonomic group	Number of Species in India
FAUNA	Protista	3,557
	Phylum Protozoa	3,557
	Animalia	99,701
	Phylum Mesozoa	10
	Phylum Porifera	571
	Phylum Cnidaria	1,461
	Phylum Ctenophora	20
	Phylum Platyhelminthes	1,800
	Phylum Rotifera	467
	Phylum Gastrotricha	163
	Phylum Kinorhyncha	10
	Phylum Nematoda	3,017
	Phylum Acanthocephala	308
	Phylum Sipuncula	41
	Phylum Mollusca	5,249
	Phylum Echiura	47
	Phylum Annelida	1,051
Phylum Onychophora	1	

⁶ <https://zsi.gov.in/WriteReadData/userfiles/file/Annual%20Report/Annual%20Report%202020-21.pdf>

Category	Taxonomic group	Number of Species in India
	Phylum Arthropoda	77,270
	Phylum Phoronida	3
	Phylum Bryozoa (Ectoprocta)	350
	Phylum Entoprocta	10
	Phylum Brachiopoda	8
	Phylum Chaetognatha	44
	Phylum Tardigrada	32
	Phylum Nemertea	6
	Phylum Echinodermata	788
	Phylum Hemichordata	14
	Phylum Protochordata	
	Phylum Chordata	6,960
	Of Which	
VERTEBRATA	Class Pisces: Fresh water Fishes	3,496
	Class Pisces: Marine and Estuarine Fishes	
	Class Amphibia	443
	Class Reptilia	706
	Class Aves	1,346
	Class Mammalia	432
TOTAL FAUNAL SPECIES		1,03,258
FLORA	Virus/Bacteria	1,269
	Algae	9,008
	Fungi	15,602
	Lichens	2,989
	Bryophytes	2,800
	Pteridophytes	1,314
	Gymnosperms	82
	Angiosperms	21,984
TOTAL FLORAL SPECIES		55,048
GRAND TOTAL (FLORA + FAUNA)		1,58,306

Source: Botanical Survey of India, Zoological Survey of India

Agro-Biodiversity Hot spots of India

7.11 Hotspots are earth's biologically richest places with vast number of species found nowhere else. India is one among the megadiverse country⁷. Biodiversity hot spots are areas that are rich in species, most of which are endemic and are under constant threat of being overexploited. Agrobiodiversity is a vital sub-set of biodiversity and is more related to genetic diversity. FAO defines it as the variety and variability of animals, plants

⁷ Megadiversity: Earth's Biologically Wealthiest Nations, Russell A. Mittermeier, 2004

and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fibre, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators), and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic) as well as the diversity of the agro-ecosystems⁸.

7.12 India is a center of origin or diversity for several crops such as rice, sugarcane, coconut, arecanut, maize, mango, coffee etc. The long farming tradition, soil features topography and rainfall variation have permitted the development of diverse agricultural ecosystems and enormous biodiversity in the region. The list of Agrobiodiversity hot spots in India as identified by the Protection of Plant Varieties and Farmers' Right Authority is provided in the **Annexure 7.1**.

Status of Leopard in India

7.13 Large animals need large areas. When these areas are protected, thousands of other plants and animals also benefit from this protection. Failing to protect them can lead not only to the extinction of these species, but the loss of many other plant and animal species that make up the ecological community of their habitat. This loss of species and genetic level biodiversity also impacts ecosystem functions and makes ecosystems less resilient to environmental shocks and change (including climate change). This also threatens the supply of future ecosystem services. These considerations are reflected in India's long-standing and successful track record of protecting its tigers and elephants.

7.14 Leopards serve as apex predators in most of the forested landscapes in India, beyond the realm of tiger and lion. Leopard is vitally important in culling its prey-base in a sustainable manner. In the absence of these, the prey-base would breed exponentially with no natural control and the forest would not be capable to provide sufficient fodder to the prey base.

7.15 Leopard (*Panthera pardus*) is the most widely distributed and adaptable member of the family Felidae. The Indian subspecies, *Panthera pardus fusca*, is found in all forested habitats in the country, absent only in the arid deserts and above the timber line in the Himalayas⁹. The current distribution and numbers of Leopard have significantly decreased across the range due to habitat loss, prey depletion, conflict and poaching over the last century. In IUCN, its status changed from 'Near Threatened' to 'Vulnerable'¹⁰. It is also listed in Appendix I of the Convention on International Trade of Endangered Species

⁸ FAO, 1999a <https://www.fao.org/3/y5609e/y5609e01.htm>

⁹ Status of Leopards in India, 2018

¹⁰ <https://www.iucn.org/news/species/201610/keeping-leopards-spotlight-cites>

of Wild Fauna and Flora (CITES) and in Schedule I of the Wildlife (Protection) Act 1972 in India providing it with the highest level of protection.

7.16 In India, the population estimates of Leopard are obtained along with the assessment for the tigers, which acts as an umbrella species for majority of eco-regions in the Indian subcontinent. The National Tiger Conservation Authority (NTCA) in collaboration with the State Forest Departments, Conservation NGO's and coordinated by the Wildlife Institute of India (WII), conducts a National assessment for the "Status of Tigers, Co-predators, Prey and their Habitat" every four years since 2006. This exercise not only comes up with tiger numbers for the country but also evaluates the status of co-predators, prey, habitat and human disturbance parameters. Third cycle of this assessment yielded the first country-wide minimal population estimation of leopards at 7,910 (SE 6,566-9,181) in forested habitats of 18 tiger-bearing states of the country¹¹.

7.17 The fourth cycle of the tiger assessment, undertaken in 2018, also estimated leopard abundance for each tiger conservation landscape in India. The fourth status assessment was the most comprehensive to date, in terms of both resource and data amassed. The likelihood based Spatially Explicit Capture Recapture (SECR) method was used to estimate leopard abundance from camera trap data. The 2018 estimates of leopard population in India is 12,852 with standard error limit 12,172-13,535. The status of Leopard population estimates in the forested areas of tiger states in 2018 is given in Table.

Table 7.5: Leopard population estimates in the forested areas of tiger states, 2018

State	Population estimates with SE limits
Shivalik Hills & Gangetic Plains	
Bihar	98 (90-106)
Uttarakhand	839 (791-887)
Uttar Pradesh	316 (277-355)
Shivalik-Gangetic	1,253 (1,158-1,348)
Central India & Eastern Ghats	
Andhra Pradesh	492 (461-523)
Telangana	334 (318-350)
Chhattisgarh	852 (813-891)
Jharkhand	46 (36-56)
Madhya Pradesh	3,421 (3,271-3,571)
Maharashtra	1,690 (1,591-1,789)
Odisha	760 (727-793)
Rajasthan	476 (437-515)
Central India & Eastern Ghats	8,071 (7,654-8,488)
Western Ghats	
Goa	86 (83-89)
Karnataka	1,783 (1,712-1,854)
Kerala	650 (622-678)
Tamil Nadu	868 (828-908)
Western Ghats	3,387 (3,245-3,529)

¹¹ Status of Leopards in India, 2018

State	Population estimates with SE limits
North East Hills, and Brahmaputra Flood Plains*	
Arunachal Pradesh (Pakke)	11 (8-14)
Assam (Manas, Nameri and Kaziranga)	47 (38-56)
West Bengal (Gorumara, Jaldapara and Buxa)	83 (66-100)
North East Hills, and Brahmaputra Flood Plains*	141 (115-170)
TOTAL	12,852 (12,172-13,535)

Source: *Status of Leopards in India, 2018*

* Estimates are only from camera trap sites

Conservation Measures in India

7.18 Biological resources nationally and globally are depleting at an alarming rate in the last few decades due to increased destructive anthropogenic factors causing distress to all biological forms and disrupting the ecosystems. There are two broad approaches in conservation that are adopted to protect and maintain biodiversity – in-situ and ex-situ. In-situ conservation refers to the conservation of species in their natural habitats, while ex-situ conservation is the preservation of components of biological diversity outside their natural habitats, e.g., zoos. In-situ conservation is considered the most appropriate way of conserving biodiversity. Conserving the areas where populations of species exist naturally is an underlying condition for the conservation of biodiversity and hence, protected areas form a central element of any national strategy to conserve biodiversity.

7.19 In India, the Protected Areas are declared under Wildlife (Protection) Act, 1972. India has 18 biosphere reserves and 99 conservation reserves. Amongst the protected areas, India has 106 national parks and 564 sanctuaries covering an area of 1.7 lakh sq. km. EnviStats- India: Vol. II 2020 provides the detailed discussion on these protected areas. Table 7.6 provides the status of different categories of Protected Areas in India and Table 7.8 provides the status of Protected Areas of India since 2000.

Table 7.6: Status of different categories of Protected Areas in India

Categories of Protected Area		Number	Area (in Km ²)
Protected Area	National Parks	106	44,372
	Wild Life Sanctuaries	564	1,22,509
	Community Reserves	218	1,446
	Conservation Reserves	99	4726
	Total	987	1,73,053
Of Which Marine Protected Areas	National Parks	10	3381
	Sanctuaries	115	5064
	Community/ Conservation Reserves	4	272
	Total	129	8717

Source: 1. *Wildlife Institute of India and K Sivakumar, Coastal and Marine Biodiversity Protected Areas in India: Challenges and Way Forward, K. Venkataraman et al. (eds.), Ecology and Conservation of Tropical Marine Faunal Communities, Springer-Verlag Berlin Heidelberg 2013.*

State-wise number of Terrestrial and Marine Protected Areas is given at Statement 1.29 and Statement 1.32 of EnviStats-India Vol I : Environment Statistics -2022¹²

Table 7.7: Protected Areas of India from 2000 to 2021 (As on December, 2021)

Year	National Parks		Wild Life Sanctuaries		Community Reserves		Conservation Reserves		Total Protected Area	
	Number	Area (km ²)	Number	Area (km ²)	Number	Area (km ²)	Number	Area (km ²)	Number	Area (km ²)
2000	89	37,803.1	485	1,08,862.5	-	-	-	-	574	1,46,665.6
2006	96	38,392.1	503	1,11,229.5	1	0.3	4	42.9	604	1,49,664.8
2007	98	38,428.9	507	1,11,529.0	5	21.0	7	94.8	617	1,50,073.7
2008	99	39,441.7	510	1,13,123.4	5	21.0	45	1,259.8	659	1,53,845.9
2009	99	39,441.7	512	1,13,395.4	5	21.0	45	1,259.8	661	1,54,117.9
2010	102	40,283.6	516	1,13,842.9	5	21.0	47	1,382.3	670	1,55,529.8
2011	102	40,283.6	518	1,13,998.8	5	21.0	52	1,801.3	677	1,56,104.7
2012	103	40,500.1	526	1,14,933.4	5	21.0	59	2,012.9	693	1,57,467.5
2013	102	40,500.1	532	1,17,123.6	19	30.9	64	2,232.6	717	1,59,887.3
2014	103	40,500.1	535	1,18,290.7	43	58.2	64	2,232.6	745	1,61,081.6
2015	103	40,500.1	541	1,18,866.4	44	59.5	71	2,548.8	759	1,61,974.9
2016	103	40,500.1	543	1,18,917.7	45	59.7	72	2,566.2	763	1,62,043.7
2017	103	40,500.1	544	1,18,931.8	46	72.6	76	2,588.0	769	1,62,092.5
2018	104	40,501.1	544	1,18,931.8	46	72.6	77	2,594.0	771	1,62,099.5
2019	101	40,564.0	553	1,19,757.0	163	833.3	86	3,858.3	903	1,65,012.6
2020	104	43,716.0	566	1,22,420.0	214	1,302.0	97	4,483.0	981	1,71,921.0
2021	106	44,372.4	564	1,22,509.3	218	1,445.7	99	4,726.2	987	1,73,053.7

Source: National Wildlife Database, Wildlife Institute of India

Note: 1. These data are based on availability of data from Forest Department and Gazette Notification notified by the Ministries.

1. Community Reserves and Conservation Reserves have been established in India from 2006 onwards. Hence these values are zero for the year 2000.

Red List Species in India

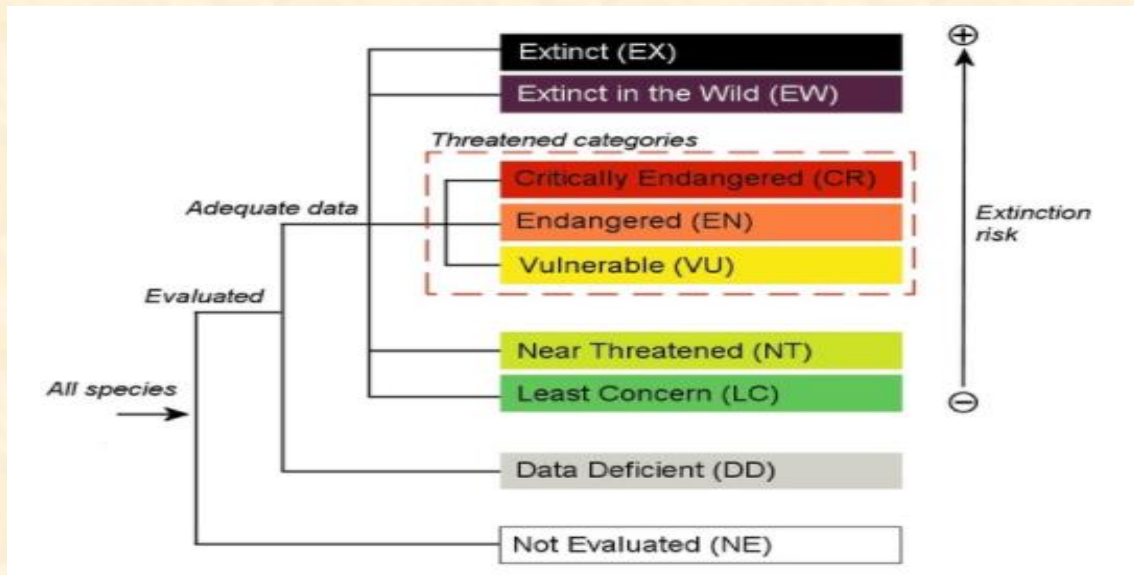
7.20 A well- managed ecosystem and the diversity of life they encompass are critical for a healthy, safe and prosperous world. The dynamic economic growth in countries is driving dramatic loss of biodiversity which is impacting the health of the societies and economies, thus increasing the vulnerability to the impacts of climate change and disasters. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species is one of the most well-known objective assessment systems for classifying the status of plants, animals and other organisms threatened with extinction. It is a comprehensive information source on the global extinction risk status of animal, fungus and plant species¹³. It contains explicit criteria and categories to classify the conservation status of individual species on the basis of their probability of extinction.

¹² <https://www.mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/27706?q=RPCAT>

¹³ IUCN Red List of Threatened Species <https://www.iucnredlist.org/about/background-history>

7.21 The IUCN Red List categories and criteria are intended to be an easily and widely understood system for classifying species according to the risk of global extinction. It divides species into nine categories: Not Evaluated, Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct. These nine categories are shown below:

Figure: 7.2 IUCN Red List Categories



Source: IUCN Red List of Threatened Species™

7.22 Any species that has been assessed as Critically Endangered, Endangered or Vulnerable are called ‘threatened species’. The IUCN list also includes ‘Least Concern’ Species, which have a lower risk of extinction, but are still important in terms of global biodiversity. Some ‘Least Concern’ species are undergoing slow declines and hence, it is important to monitor these species and to develop appropriate conservation actions to prevent them from becoming threatened in the future. The inclusion of the different categories of species helps track the changing status of biodiversity.

7.23 The IUCN Red List is a powerful tool to inform and catalyse action for biodiversity conservation and policy change, critical to protecting the natural resources required for survival. By providing information about range, population size, habitat and ecology, use and/or trade, threats and conservation actions, the IUCN Red List helps inform necessary conservation decisions and guide funding priorities.

7.24 The IUCN Red List relies on Assessors (trained individuals and species experts) to assess species based on the currently available data and information. The information is gathered from a range of sources, including published scientific papers, books, reports, expert knowledge, indigenous knowledge and citizen science. The Red List Authorities review the assessments, and then the IUCN Red List Unit checks the assessments before publishing them on IUCN Red List website.

IUCN Red List Spatial Data

7.25 The IUCN Red List of Threatened Species contains global assessments for over 147,500 species. The IUCN provides, in public domain, intercontinental species shape files with the Geographic Coordinate System as GCS_WGS_1984 and the Unit as Degree (~100km). The IUCN data repository has spatial datasets on mammals, amphibians, birds, reptiles, fishes, plants and other groups. More than 81% of the total red list species (>120,500 species) have spatial data¹⁴. The data is freely accessible and includes taxonomic information, distribution status, IUCN Red List Category, sources and other relevant details. More information and resources can be found at the IUCN Red List Resources & Publications page¹⁵.

7.26 The IUCN spatial datasets can be used to evaluate the species richness of the red list species for any defined region/area. Species Richness represents a measure of the variety of species based simply on a count of the number of species in a particular sample and is generally expressed as the number of species per unit area.

7.27 In order to facilitate its use, the IUCN Red List Toolbox for ArcMap¹⁶ is also available alongside the dataset, which intersects the red list species polygon with a grid or shapefile of polygons, giving the number of species per cell or region polygon. The toolbox also enables the preparation of Species Richness Map, which shows the number of IUCN red list species found per pixel having an area of 0.07 degree², or roughly 865 sq.km.

7.28 To understand the distribution of the red-listed species in India, IUCN spatial datasets using the IUCN Red List of Threatened Species, Red List Version 2020-2 downloaded on August 31, 2020 were analyzed for Mammals, Amphibians and Reptiles. The results were published in EnviStats India Vol. II-2020. The analysis was extended to three more categories – Plants, Mangroves and Freshwater group (consisting of both flora and fauna present in freshwater) using IUCN Red List spatial datasets Version 2020-3 downloaded in December, 2020 and Version 2021-1 downloaded in May 2021 in EnviStats India Vol. II-2021. In the current publication, species richness counts have been calculated using data of 2021 Version 2, 2021 Version 3 and 2022 Version 1, downloaded in October, 2021, March, 2022 and August, 2022 respectively. The number of red listed species in India under these categories, as available in the IUCN spatial datasets is given in the following Table 7.8.

¹⁴ <https://www.iucnredlist.org/resources/spatial-data-download>

¹⁵ <https://www.iucnredlist.org/resources>

¹⁶ <https://www.iucnredlist.org/resources/spatialtoolsanddata>

Table 7.8: Data availability for India in IUCN Spatial Database

Species		Version	Critically Endangered	Endangered	Near Threatened	Vulnerable	Least Concerned	Data Deficient	Grand Total
			CR	EN	NT	VU	LC	DD	
Mammals		2021-2	9	64	60	88	339	35	595
		2021-3	9	64	60	82	334	35	584
		2022-1	9	67	60	80	337	35	588
Amphibians		2021-2	20	36	13	23	119	87	298
		2021-3	20	36	14	25	118	88	301
		2022-1	20	36	14	25	119	90	304
Reptiles		2021-2	18	25	20	25	201	70	359
		2021-3	28	50	38	36	388	115	655
		2022-1	28	50	38	36	395	117	664
Mangroves		2021-2	1	1	4		32	2	40
		2021-3	1	1	4		32	2	40
		2022-1	1	1	4		32	2	40
Plants	Magnolias	2021-2	1	2		1	1	3	8
		2021-3	1	2		1	1	3	8
		2022-1	1	2		1	1	3	8
	Orchids#		74	108	50	505	18	15	770
	Balsams#			5		3	1		9
Musa#		1				3		4	
Fresh Water Group	Crabs	2021-2			3	4	25	66	98
		2021-3			3	4	25	66	98
		2022-1			3	4	25	66	98
	Crayfishes	2021-2					3		3
		2021-3					3		3
		2022-1					3		3
	Fishes (not comprehensive)	2021-2	20	97	56	129	749	195	1246
		2021-3	20	97	56	129	749	195	1246
		2022-1	18	97	57	134	763	199	1268
	Molluscs (not comprehensive)	2021-2		5	2	6	505	155	673
		2021-3		5	2	6	505	155	673
		2022-1		5	2	6	505	155	673
	Odonata (not comprehensive)	2021-2		3	14	12	404	118	551
		2021-3		3	14	13	410	136	576
		2022-1		3	14	13	410	136	576
Plants (not comprehensive)	2021-2	26	37	18	17	640	29	767	
	2021-3	26	37	18	17	640	29	767	

Species	Version	Critically Endangered	Endangered	Near Threatened	Vulnerable	Least Concerned	Data Deficient	Grand Total
		CR	EN	NT	VU	LC	DD	
Shrimps	2022-1	26	37	18	17	640	29	767
	2021-2		2		1	73	32	108
	2021-3		2		1	73	32	108
	2022-1		2		1	73	32	108
Scleractinian corals*	2021-2		10	117	131	195	20	473
	2021-3		10	117	131	195	20	473
	2022-1		10	117	131	195	20	473
Organ Pipe coral*	2021-2				1			1
	2021-3				1			1
	2022-1				1			1
Hydrozoa*	2021-2					5		5
	2021-3					5		5
	2022-1					5		5
Merostomata*	2021-2						2	2
	2021-3						2	2
	2022-1						2	2
Echinodermata*	2021-2		2	4		12	21	39
	2021-3		2	4		12	21	39
	2022-1		2	4		12	21	39
Cephalopoda*	2021-2					22	25	47
	2021-3					22	25	47
	2022-1					22	25	47
Bivalvia*	2021-2			1		2	1	4
	2021-3			1		2	1	4
	2022-1			1		2	1	4
Actinopterygii (Fishes)*	2021-2			15	9	395	89	508
	2021-3			15	9	395	89	508
	2022-1			15	9	395	89	508
Chondrichthyes (Fishes)*	2021-2	18	28	34	24	14	13	131
	2021-3	18	28	34	24	14	13	131
	2022-1	18	28	34	24	14	13	131
Reptiles*	2021-2	1	1	4		21	4	31
	2021-3	1	1	4		21	4	31
	2022-1	1	1	4		21	4	31
Mammals*	2021-2	1	3	3	2	13	11	33
	2021-3	1	3	3	2	13	11	33
	2022-1	1	3	3	2	13	11	33

Source: Botanical Survey of India. Excluded from Spatial Distribution of Species.

*Source: Zoological Survey of India. Excluded from Spatial Distribution of Species.

7.29 From the **Table 7.8**, most of the Red List species in India are under the 'Least Concern' category. State-level red list species counts, as compiled using the IUCN Red List Toolbox, are given in the **Annexure 7.2**. The counts have been calculated using different versions of IUCN Red List data. The increase (decrease) in the species richness count does not necessarily show the true change in number of species for a state/region. Change can also be attributed to the increase in the number of species assessed and improvement in the knowledge of species' distribution. The richness count calculated also depends on the extent or boundaries of the shapefile used to calculate these values.

7.30 **Figure 7.3** shows the species richness of different species across the country. The species richness for different categories namely Amphibians, Reptiles, Mammals, Mangroves and Fresh Water Group has been mapped separately. The map denoting the richness of 'All Species', with the protected areas of India marked on the map includes only those species described in the **Annexure 7.1**.

Conclusion

7.31 India is a signatory to several major international conventions relating to the conservation and management of wildlife such as the Convention on Biological Diversity (CBD)¹⁷, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)¹⁸. There is a growing consciousness about the value of biodiversity and the need for its conservation.

7.32 The Government of India has taken several steps to protect the biodiversity. India brought out the National Environment Policy (NEP) in 2006 which provided the much-needed synergy and coherence for sustainable development in all the sectoral policies. The specific provisions of sector-specific policies help in protecting the biodiversity and conservation and sustainable use of natural resources. India reported its progress in implementing National Biodiversity Action Plan to CBD in 2019.

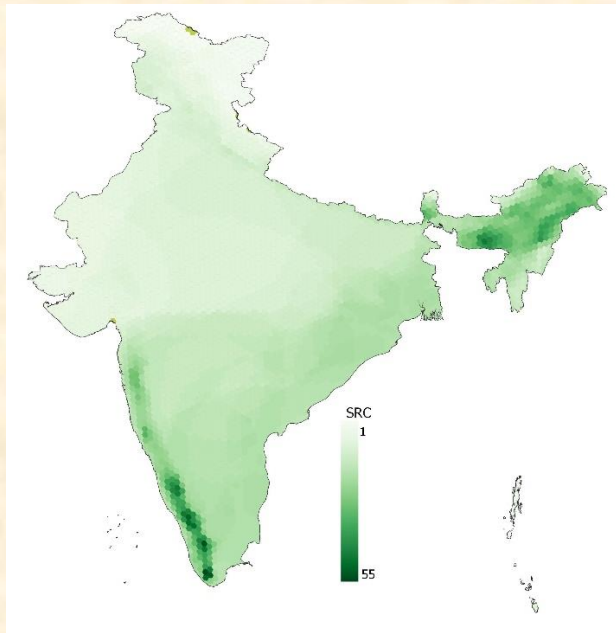
7.33 CBD will adopt a post-2020 global biodiversity framework as a stepping stone towards the 2050 Vision of "Living in harmony with nature" in its 15th meeting of Conference of Parties. The framework sets out an ambitious plan to implement broad-based action to bring about a transformation in society's relationship with biodiversity and to ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled.

7.34 The very existence of legislation and policies is a proof that some consensus has developed concerning the importance of conserving species and ecosystems. The current publication provides information about the biodiversity and enables to get a fair idea about the biodiversity scenario of the country. Biodiversity impacts many aspects of sustainability and keeping a tap on biodiversity which is vital for both environmental, social and economic development.

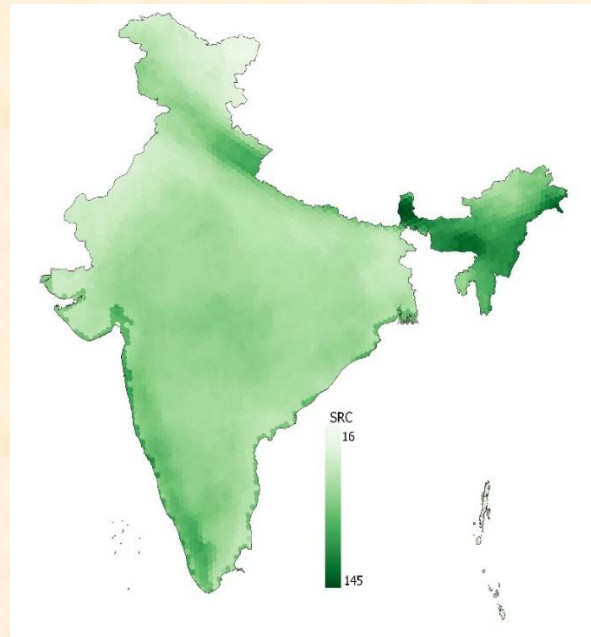
¹⁷ <https://www.cbd.int/countries/?country=in>

¹⁸ <https://cites.org/eng/parties/country-profiles/in>

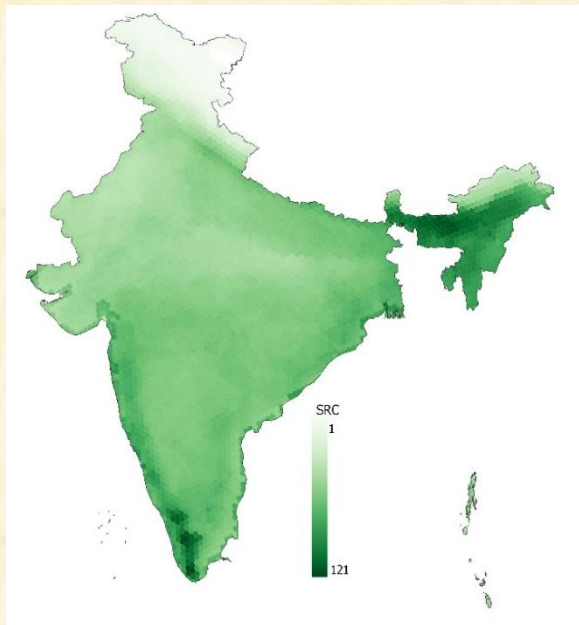
Figure 7.3: Species Richness of IUCN Red List Species



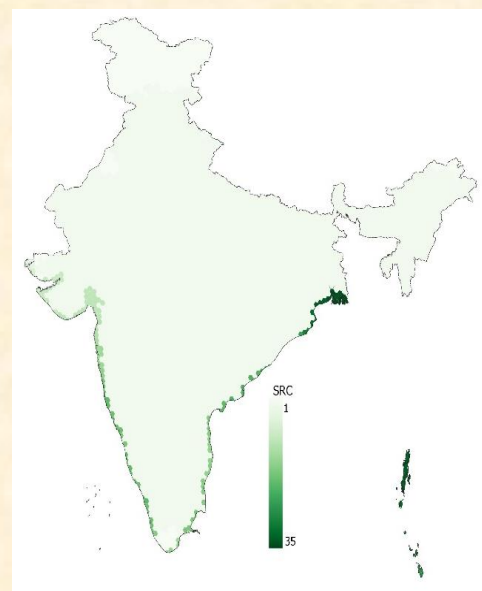
(a) Amphibians



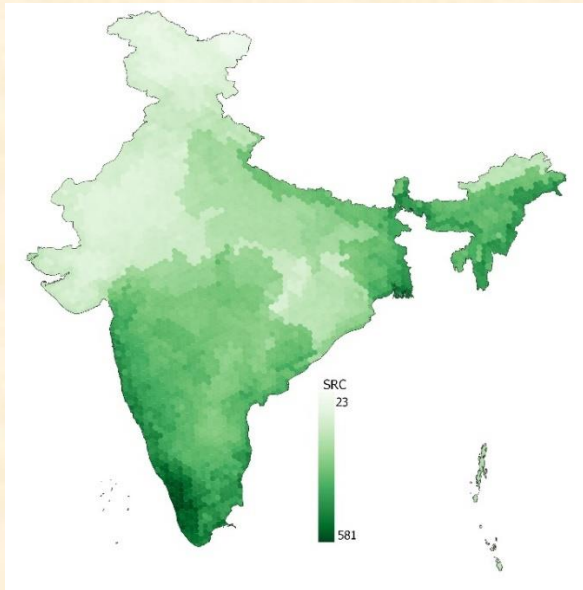
(b) Mammals



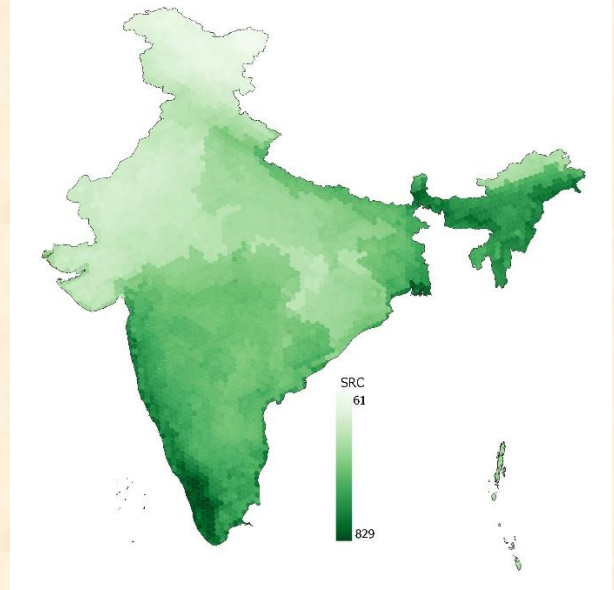
(c) Reptiles



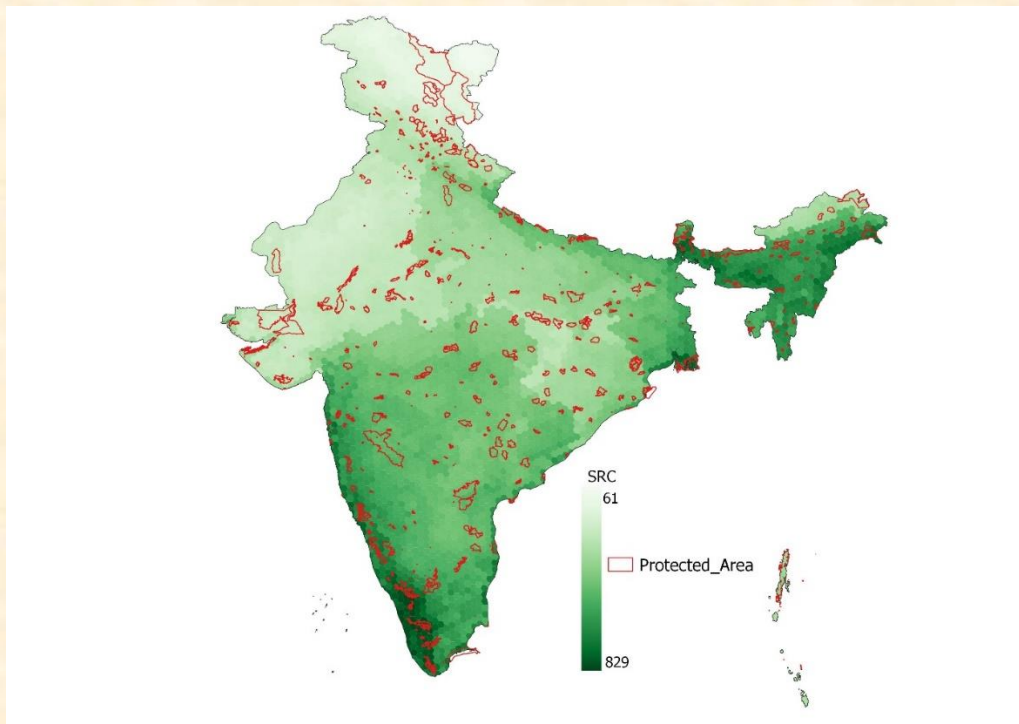
(d) Mangroves



(e) Fresh Water Group Species



(f) All Species



(g) Species Richness Map for All Species with Protected Area marked in Red

ANNEXURES

Annexure 2.1

Conversion Factors

1 kilogram	= 2.2046 pounds
1 Pound	= 454 gm.
1 Cubic metres	= 35.3 cubic feet (gas)
1 Metric ton	= 1 Tonne =1000 kilogram
1 Joule	= 0.23884 calories
1 Mega Joule	= 10^6 joules = 238.84×10^3 calories
1 Giga Joule	= 10^9 joules = 238.84×10^6 calories
1 Tera Joule	= 10^{12} joules = 238.84×10^9 calories
1 Peta Joule	= 10^{15} joules = 238.84×10^{12} calories
One million tonnes of Coal	= 15.13 petajoules of energy
One million tonnes of Lignite	= 11.37 petajoules of energy
One million tonnes of oil equivalent (MTOE)	= 41.87 petajoules of energy
One billion cubic meter of natural gas	= 38.52 petajoules of energy
One million cubic meter of natural gas	= 38.52 terajoules of energy
One billion-kilowatt hour of electricity	= 3.60 petajoules of energy

Source: Energy Statistics India 2022, MoSPI

Physical Supply Table of Energy: 2015-16

SICAL SUPPLY TABLE (Unit:PJ)	Production (Incl. household own account) & generation of residuals						Household s	Accumulation (in Million Tonnes)	Flows from the rest of the world (Imports)	Flows from the environmen t	Total
	Industries (by ISIC)										
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)							
1 Energy from natural inputs:											
Natural resource inputs											
Crude Oil										1,547	1,547
Natural Gas										1,242	1,242
Coal										9,928	9,928
Lignite										499	499
Inputs of energy form renewable sources (Nuclear)-Electricity										816	816
Other natural inputs (Biofuels)										27	27
Total										14,059	14,059
2 Energy Products:											
<i>Production of energy products by SIEC class:</i>											
Coal		9,672							3,086		12,757
Natural gas		1,242							824		2,066
Biofuels	89										89
Electricity				4,809					19		4,828
Nuclear fuels and other fuels				816							816
Lignite		499							0		499
Crude Oil		1,547							8,494		10,041
Petroleum Products			9,712						1,233		10,945
Total	89	12,959	9,712	5,626	0	0	0	0	13,657	0	42,042
3 Energy Residuals:											
Distribution		0		867							867
Extraction		44		86							130
Other Losses (Coal Reject/other residuals)		257									257
Other Energy Residuals	677	328	4,992	597	683	8,603	3,161				19,040
Total energy residuals	677	628	4,992	1,550	683	8,603	3,161				20,294
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes											0
Energy from solid waste											0
5 TOTAL SUPPLY	766	13,588	14,704	7,176	683	8,603	3,161	0	13,657	14,059	76,395

PJ: Petajoules

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Physical Use Table of Energy: 2015-16

PHYSICAL USE TABLE (Unit:PJ)		Intermediate consumption, Use of energy resources, receipt of energy losses					Final Consumption	Accumulation	Export	Flows to the Environment	Total
		Industries (by ISIC)									
		Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries				
		(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)					
1	Energy from natural inputs:										
	Natural resource inputs										
	Crude Oil		1,547							1,547	
	Natural Gas		1,242							1,242	
	Coal		9,928							9,928	
	Lignite		499							499	
	Inputs of energy form renewable sources	62			754					816	
	Other natural inputs	27								27	
	Total	89	13,216	0	754	0	0			14,059	
2	Energy Products:										
	<i>Transformation of energy products by SIEC class</i>										
	Coal				7,834					7,834	
	Natural gas				460					460	
	Biofuels				62					62	
	Electricity									0	
	Nuclear fuels and other fuels				816					816	
	Lignite				427					427	
	Crude Oil			9,753						9,753	
	Petroleum Products				32					32	
	Total Transformed Energy	0	0	9,753	9,632	0	0			19,385	
	<i>End-use of energy products by SIEC class:</i>										
	Coal			1,180		3,646		73	24	4,923	
	Natural gas	8	247	886	17	208	174	23	43	1,606	
	Biofuels							27		27	
	Electricity	623	0	1,834	520	60	227	1,546	19	4,829	
	Nuclear fuels and other fuels									0	
	Lignite			27		26		19	0	71	

PHYSICAL USE TABLE (Unit:PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Crude Oil			29				260			289	
Petroleum Products	46	81	1,035	60	415	4,531	1,565	645	2,535	10,914	
Total End Use for Energy purposes	677	328	4,992	597	683	8,603	3,161	1,040	2,578	0	22,658
<i>End-use of energy products for non-energy purposes</i>											0
3 Energy Residuals:											
Distribution										867	867
Extraction										130	130
Other Losses (Coal Reject/other residuals)										257	257
Other Energy Residuals										19,040	19,040
Total energy residuals										20,294	20,294
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes								0			0
Energy from solid waste											0
5 TOTAL USE	766	13,544	14,745	10,983	683	8,603	3,161	1,040	2,578	20,294	76,396

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Physical Supply Table of Energy: 2016-17

PHYSICAL SUPPLY TABLE (Unit:PJ)	Production (Incl. household own account) & generation of residuals						Household s	Accumulation (in Million Tonnes)	Flows from the rest of the world (Imports)	Flows from the Environment	Total
	Industries (by ISIC)										
	Agriculture & Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)							
1 Energy from natural inputs:											
Natural resource inputs											
Crude Oil										1,508	1,508
Natural Gas										1,229	1,229
Coal										10,202	10,202
Lignite										514	514
Inputs of energy form renewable sources (Nuclear)-Electricity										879	879
Other natural inputs (Biofuels)										30	30
Total										14,362	14,362
2 Energy Products:											
<i>Production of energy products by SIEC class:</i>											
Coal		9,954							2,889		12,843
Natural gas		1,229							957		2,186
Biofuels	83										83
Electricity				5,067					20		5,087
Nuclear fuels and other fuels				879							879
Lignite		514							0		515
Crude Oil		1,508							8,959		10,466
Petroleum Products			10,197						1,520		11,717
Total	83	13,204	10,197	5,946	0	0	0	0	14,345	0	43,775
3 Energy Residuals:											
Distribution		0		897							897
Extraction		40		87							128
Other Losses (Coal Reject/other residuals)		248									248
Other Energy Residuals	741	347	4,990	608	761	8,764	3,325				19,536
Total energy residuals	741	635	4,990	1,592	761	8,764	3,325				20,809
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes											0
Energy from solid waste											0
5 TOTAL SUPPLY	824	13,840	15,187	7,538	761	8,764	3,325	0	14,345	14,362	78,946

PJ: Petajoules

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

EnviStats India 2022: Vol II Environment Accounts:

Physical Use Table of Energy: 2016-17

PHYSICAL USE TABLE (Unit: PJ)		Intermediate consumption, Use of energy resources, receipt of energy losses					Final Consumption	Accumulation	Export	Flows to the Environment	Total	
		Industries (by ISIC)					Households					
		Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage						Other Industries
		(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
1	Energy from natural inputs:											
	Natural resource inputs											
	Crude Oil		1,508							1,508		
	Natural Gas		1,229							1,229		
	Coal		10,202							10,202		
	Lignite		514							514		
	Inputs of energy form renewable sources	52			827					879		
	Other natural inputs	30								30		
	Total	83	13,452	0	827	0	0			14,362		
2	Energy Products:											
	<i>Transformation of energy products by SIEC class</i>											
	Coal				8,095					8,095		
	Natural gas				491					491		
	Biofuels				52					52		
	Electricity									0		
	Nuclear fuels and other fuels				879					879		
	Lignite				441					441		
	Crude Oil			10,276						10,276		
	Petroleum Products				34					34		
	Total Transformed Energy	0	0	10,276	9,994	0	0			20,270		
	<i>End-use of energy products by SIEC class:</i>											
	Coal			1,027		3,545	148	27		4,747		
	Natural gas	8	259	899	20	279	158	31	41	1,695		
	Biofuels						30			30		
	Electricity	688	0	1,908	532	56	247	1,631	24	5,086		
	Nuclear fuels and other fuels									0		
	Lignite			24			25	24	0	73		
	Crude Oil			19				171		190		

PHYSICAL USE TABLE (Unit: PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Petroleum Products	45	88	1,113	56	426	4,789	1,632	790	2,743		11,682
Total End Use for Energy purposes	741	347	4,990	608	761	8,764	3,325	1,174	2,794	0	23,505
<i>End-use of energy products for non-energy purposes</i>											0
3 Energy Residuals:											
Distribution										897	897
Extraction										128	128
Other Losses (Coal Reject/other residuals)										248	248
Other Energy Residuals										19,536	19,536
Total energy residuals										20,809	20,809
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes								0			0
Energy from solid waste											0
5 TOTAL USE	824	13,800	15,266	11,428	761	8,764	3,325	1,174	2,794	20,809	78,946

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Physical Supply Table of Energy: 2017-18

PHYSICAL SUPPLY TABLE (Unit:PJ)	Production (Incl. household own account) & generation of residuals						Households	Accumulation (in Million Tonnes)	Flows from the rest of the world (Imports)	Flows from the Environment	Total
	Industries (by ISIC)										
	Agriculture Forestry & Fishery (ISIC A)	Mining & Quarrying (ISIC B)	Manufacturing (ISIC C)	Electricity, gas, steam & air conditioning supply (ISIC D)	Transportation & Storage (ISIC M)	Other Industries					
1 Energy from natural inputs:											
Natural resource inputs											
Crude Oil										1,494	1,494
Natural Gas										1,258	1,258
Coal										10,448	10,448
Lignite										530	530
Inputs of energy form renewable sources (Nuclear)-Electricity										967	967
Other natural inputs (Biofuels)										24	24
Total										14,721	14,721
2 Energy Products:											
<i>Production of energy products by SIEC class:</i>											
Coal		10,219							3,151		13,370
Natural gas		1,258							1,057		2,315
Biofuels	80										80
Electricity				5,340					18		5,358
Nuclear fuels and other fuels				967							967
Lignite		530							0		531
Crude Oil		1,494							9,231		10,725
Petroleum Products			10,653						1,485		12,138
Total	80	13,501	10,653	6,307	0	0	0	0	14,942	0	45,483
3 Energy Residuals:											
Distribution		0		975							975
Extraction		35		89							124
Other Losses (Coal Reject/other residuals)		229									229
Other Energy Residuals	773	408	5,321	631	863	9,167	3,426				20,588
Total energy residuals	773	672	5,321	1,695	863	9,167	3,426				21,915
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes											0
Energy from solid waste											0
5 TOTAL SUPPLY	852	14,173	15,974	8,002	863	9,167	3,426	0	14,942	14,721	82,120

PJ: Petajoules

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Physical Use Table of Energy: 2017-18

PHYSICAL USE TABLE (Unit:PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
1 Energy from natural inputs:											
Natural resource inputs											
Crude Oil		1,494								1,494	
Natural Gas		1,258								1,258	
Coal		10,448								10,448	
Lignite		530								530	
Inputs of energy form renewable sources	56			911						967	
Other natural inputs	24									24	
Total	80	13,730	0	911	0	0				14,721	
2 Energy Products:											
<i>Transformation of energy products by SIEC class</i>											
Coal				8,858						8,858	
Natural gas				519						519	
Biofuels				56						56	
Electricity										0	
Nuclear fuels and other fuels				967						967	
Lignite				442						442	
Crude Oil			10,548							10,548	
Petroleum Products				30						30	
Total Transformed Energy	0	0	10,548	10,873	0	0				21,422	
<i>End-use of energy products by SIEC class:</i>											
Coal			1,191			3,545		-247	23	4,512	
Natural gas	8	316	905	21	333	139	37	35		1,795	
Biofuels							24			24	
Electricity	717	0	2,025	558	63	255	1,715		26	5,358	
Nuclear fuels and other fuels										0	
Lignite			50			35		4	0	89	
Crude Oil			18					158		176	

PHYSICAL USE TABLE (Unit:PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Petroleum Products	47	91	1,133	51	467	5,193	1,650	676	2,799		12,108
Total End Use for Energy purposes	773	408	5,321	631	863	9,167	3,426	626	2,847	0	24,061
<i>End-use of energy products for non-energy purposes</i>											0
3 Energy Residuals:											
Distribution										975	975
Extraction										124	124
Other Losses (Coal Reject/other residuals)										229	229
Other Energy Residuals										20,588	20,588
Total energy residuals										21,915	21,915
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes								0			0
Energy from solid waste											0
5 TOTAL USE	852	14,137	15,870	12,415	863	9,167	3,426	626	2,847	21,915	82,120

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Physical Supply Table of Energy-2018-19

PHYSICAL SUPPLY TABLE (Unit:PJ)	Production (Incl. household own account) & generation of residuals							Accumulation (in Million Tonnes)	Flows from the rest of the world (Imports)	Flows from the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery (ISIC A)	Mining & Quarrying (ISIC B)	Manufacturing (ISIC C)	Electricity, gas, steam & air conditioning supply (ISIC D)	Transportation & Storage (ISIC M)	Other Industries					
1 Energy from natural inputs:											
Natural resource inputs											
Crude Oil										1,432	1,432
Natural Gas										1,266	1,266
Coal										11,291	11,291
Lignite										504	504
Inputs of energy form renewable sources (Nuclear)-Electricity										1,092	1,092
Other natural inputs (Biofuels)										55	55
Total										15,640	15,640
2 Energy Products:											
<i>Production of energy products by SIEC class:</i>											
Coal		11,026							3,561		14,586
Natural gas		1,266							1,107		2,373
Biofuels	115										115
Electricity				5,705					16		5,721
Nuclear fuels and other fuels				1,092							1,092
Lignite		504							0		504
Crude Oil		1,432							9,485		10,917
Petroleum Products			10,986						1,396		12,383
Total	115	14,228	10,986	6,798	0	0	0	0	15,565	0	47,692
3 Energy Residuals:											
Distribution		3		973							975
Extraction		32		90							122
Other Losses (Coal Reject/other residuals)		266									266
Other Energy Residuals	829	450	5,760	759	920	9,628	3,499				21,845
Total energy residuals	829	750	5,760	1,822	920	9,628	3,499				23,208
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes											0
Energy from solid waste											0
5 TOTAL SUPPLY	944	14,977	16,747	8,619	920	9,628	3,499	0	15,565	15,640	86,540

PJ: Petajoules

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Physical Use Table of Energy: 2018-19

PHYSICAL USE TABLE (Unit:PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
1 Energy from natural inputs:											
Natural resource inputs											
Crude Oil		1,432								1,432	
Natural Gas		1,266								1,266	
Coal		11,291								11,291	
Lignite		504								504	
Inputs of energy form renewable sources	60			1,032						1,092	
Other natural inputs	55									55	
Total	115	14,493	0	1,032	0	0				15,640	
2 Energy Products:											
<i>Transformation of energy products by SIEC class</i>											
Coal				9,405						9,405	
Natural gas				522						522	
Biofuels				60						60	
Electricity										0	
Nuclear fuels and other fuels				1,092						1,092	
Lignite				429						429	
Crude Oil			10,770							10,770	
Petroleum Products				20						20	
Total Transformed Energy	0	0	10,770	11,529	0	0				22,300	
<i>End-use of energy products by SIEC class:</i>											
Coal			1,351			3,895	-85	20		5,181	
Natural gas	8	345	895	24	360	148	40	31		1,851	
Biofuels							55			55	
Electricity	768	0	2,223	677	68	259	1,696		30	5,721	
Nuclear fuels and other fuels										0	
Lignite			58			34	-18	1		74	
Crude Oil			14				132			146	

PHYSICAL USE TABLE (Unit:PJ)	Intermediate consumption, Use of energy resources, receipt of energy losses						Final Consumption	Accumulation	Export	Flows to the Environment	Total
	Industries (by ISIC)						Households				
	Agriculture Forestry & Fishery	Mining & Quarrying	Manufacturing	Electricity, gas, steam & air conditioning supply	Transportation & Storage	Other Industries					
	(ISIC A)	(ISIC B)	(ISIC C)	(ISIC D)	(ISIC M)						
Petroleum Products	52	106	1,219	59	492	5,292	1,709	876	2,558		12,363
Total End Use for Energy purposes	829	450	5,760	759	920	9,628	3,499	936	2,610	0	25,391
<i>End-use of energy products for non-energy purposes</i>											0
3 Energy Residuals:											
Distribution										975	975
Extraction										122	122
Other Losses (Coal Reject/other residuals)										266	266
Other Energy Residuals										21,845	21,845
Total energy residuals										23,208	23,208
4 Other Residual Flows:											
Residuals from end-use for non-energy purposes								0			0
Energy from solid waste											0
5 TOTAL USE	944	14,943	16,531	13,320	920	9,628	3,499	936	2,610	23,208	86,539

Note: Grey Cells are nil by definition. Totals may not match due to rounding off.

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Andhra Pradesh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area(% of wetlands)		Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	27	12484	1.1	16	10263	1.0	2221	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	35	9991	0.9	30	9869	0.9	122	1	10	-	-	-
6			River/Stream	766	266625	23.4	741	273828	25.5	-7203	-	-	-	-	-
7		Man-made	Reservoir/Barrage	88	118664	10.4	77	93665	8.7	24999	-	-	10	8635	
8			Tank/Pond	19861	321647	28.2	19615	306705	28.5	14942	15	171	293	4788	
9			Waterlogged	8	266	0.0	3	227	0.0	39	-	-	5	39	
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	1900	119961	10.5	1076	77617	7.2	42344	270	5190	860	37335	
12	Coastal	Natural	Lagoon	1	30131	2.6	1	30229	2.8	-98	-	-	-	-	
13			Creek	97	8639	0.8	97	9168	0.9	-529	-	-	-	-	
14			Sand/Beach	90	8019	0.7	91	9588	0.9	-1569	1	19	1	8	
15			Intertidal mud flat	231	47475	4.2	219	50860	4.7	-3385	-	-	7	244	
16			Salt Marsh	5	628	0.1	5	952	0.1	-324	-	-	-	-	
17			Mangrove	362	48086	4.2	299	40546	3.8	7540	4	50	6	15	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	139	19632	1.7	111	20794	1.9	-1162	1	94	7	152	
20			Aquaculture pond	494	129358	11.3	641	140788	13.1	-11430	141	3424	103	7257	
			Total	24104	1141606	100	23022	1075099	100	66507	433	8958	1292	58473	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Decadal wetland inventory and change analysis - Arunachal Pradesh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	3	116	0.1	3	118	0.1	-2	-	-	-	-
2			Ox-bow lake/cut-off meander	13	291	0.2	13	291	0.2	0	-	-	-	-
3			High altitude lake	1074	11294	7.5	1073	11307	7.6	-13	-	-	1	2
4			Riverine Wetlands	-	-	0.0	-	-	0.0	-	-	-	-	-
5			Waterlogged	7	289	0.2	6	576	0.4	-287	-	-	-	-
6			River/Stream	57	138863	91.9	53	135476	91.6	3387	-	-	-	-
7		Man-made	Reservoir/Barrage	3	116	0.1	2	53	0.0	63	-	-	1	63
8			Tank/Pond	5	20	0.0	4	12	0.0	8	-	-	1	7
9			Waterlogged	-	-	-	-	-	0.0	-	-	-	-	-
10			Salt pan	-	-	-	-	-	0.0	-	-	-	-	-
11			Aquaculture Pond	20	115	0.1	10	81	0.1	34	-	-	11	34
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20	Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-	
			Total	1182	151104	100	1164	147914	100	3190	-	-	14	106

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Assam

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	1254	57316	6.8	1297	55667	7.1	1649	-	-	-	-
2			Ox-bow lake/cut-off meander	945	15471	1.8	891	14463	1.8	1008	-	-	23	275
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	125	3905	0.5	130	4125	0.5	-220	-	-	-	-
5			Waterlogged	2573	51965	6.1	2444	47262	6.0	4703	20	323	131	1791
6			River/Stream	615	705210	83.1	527	658004	83.4	47206	-	-	-	-
7		Man-made	Reservoir/Barrage	2	2939	0.3	2	2828	0.4	111	-	-	-	-
8			Tank/Pond	236	1462	0.2	162	925	0.1	537	-	-	57	385
9			Waterlogged	34	380	0.0	40	437	0.1	-57	-	-	3	17
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	118	10430	1.2	103	5506	0.7	4924	-	-	12	1324
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	
				Total	5902	849078	100	5596	789217	100	59861	20	323	226

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Bihar

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	387	14820	4.0	387	17047	4.4	-2227	-	-	-	-
2			Ox-bow lake/cut-off meander	912	16432	4.4	922	15756	4.0	676	-	-	5	61
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	172	2194	0.6	172	2136	0.5	58	-	-	1	6
5			Waterlogged	1537	30700	8.2	1604	39577	10.2	-8877	56	2752	35	619
6			River/Stream	209	294685	78.6	202	301158	77.3	-6473	-	-	-	-
7		Man-made	Reservoir/Barrage	71	9116	2.4	69	8090	2.1	1026	-	-	2	1637
8			Tank/Pond	1216	6484	1.7	1174	5576	1.4	908	1	10	42	888
9			Waterlogged	22	335	0.1	25	373	0.1	-38	3	24	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-	
			Total	4526	374766	100	4555	389713	100	-14947	60	2786	85	3211

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Chandigarh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
6			River/Stream	6	156	46.4	5	156	46.6	0	-	-	-	-	-
7		Man-made	Reservoir/Barrage	1	156	46.4	1	156	46.6	0	-	-	-	-	-
8			Tank/Pond	4	24	7.1	4	23	6.9	1	-	-	-	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-	-
			Total	11	336	100	10	335	100	1	-	-	-	-	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Chhattisgarh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-
2			Ox-bow lake/cut-off meander	12	74	0.0	12	68	0.0	6	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	30	212	0.1	29	199	0.1	13	-	-	1	3
5			Waterlogged	1	42	0.0	2	48	0.0	-6	-	-	-	-
6			River/Stream	192	168735	49.3	184	177698	54.3	-8963	-	-	-	-
7		Man-made	Reservoir/Barrage	693	110559	32.3	595	93039	28.4	17520	-	-	82	13348
8			Tank/Pond	10487	62423	18.2	10005	55904	17.1	6519	31	320	492	3903
9			Waterlogged	40	307	0.1	34	260	0.1	47	-	-	4	36
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	2	91	0.0	2	58	0.0	33	1	25	1	58
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	
			Total	11457	342443	100	10863	327274	100	15169	32	345	580	17348

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Daman & Diu

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
6			River/Stream	3	237	8.7	4	450	15.9	-213	-	-	-	-	-
7		Man-made	Reservoir/Barrage	-	-	-	-	-	-	-	-	-	-	-	-
8			Tank/Pond	16	163	6.0	18	186	6.6	-23	-	-	-	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	1	160	5.9	1	167	5.9	-7	-	-	-	-	
13			Creek	1	53	1.9	4	31	1.1	22	-	-	-	-	
14			Sand/Beach	6	163	6.0	6	192	6.8	-29	-	-	-	-	
15			Intertidal mud flat	12	1285	47.1	10	1448	51.1	-163	-	-	-	-	
16			Salt Marsh	-	-	-	1	57	2.0	-57	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	16	558	20.5	10	240	8.5	318	-	-	-	-	
19		Man-made	Salt pan	4	109	4.0	1	63	2.2	46	-	-	-	-	
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-	
				Total	59	2728	100	55	2834	100	-106	-	-	-	-

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Delhi

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	2	136	4.9	2	122	4.8	14	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	21	209	7.5	22	206	8.1	3	1	2	1	11	
6			River/Stream	2	1012	36.5	2	1005	39.6	7	-	-	-	-	
7		Man-made	Reservoir/Barrage	1	278	10.0	1	282	11.1	-4	-	-	-	-	
8			Tank/Pond	48	518	18.7	49	419	16.5	99	3	16	3	15	
9			Waterlogged	38	521	18.8	29	449	17.7	72	-	-	7	68	
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	
11			Aquaculture Pond	11	99	3.6	9	54	2.1	45	2	10	4	51	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-	
				Total	123	2773	100	114	2537	100	236	6	28	15	145

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Dadar Nagar Haveli

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
6			River/Stream	4	760	36.8	4	715	35.5	45	-	-	-	-	-
7		Man-made	Reservoir/Barrage	1	1278	61.9	1	1279	63.4	-1	-	-	-	-	
8			Tank/Pond	7	25	1.2	6	22	1.1	3	-	-	1	3	
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	
20	Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-		
			Total	12	2063	100	11	2016	100	44	-	-	1	3	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Goa

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	21	356	1.4	21	387	1.8	-31	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	16	180	0.7	4	48	0.2	132	-	-	12	137	
6			River/Stream	32	3339	13.5	31	2699	12.3	640	-	-	-	-	
7		Man-made	Reservoir/Barrage	6	2679	10.8	5	2572	11.7	107	-	-	-	-	
8			Tank/Pond	158	1085	4.4	121	915	4.2	170	2	10	39	167	
9			Waterlogged	3	26	0.1	1	3	0.0	23	-	-	2	23	
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	41	6490	26.2	29	6258	28.5	232	-	-	-	-	
14			Sand/Beach	30	713	2.9	27	604	2.8	109	-	-	2	8	
15			Intertidal mud flat	101	3669	14.8	65	2578	11.8	1091	-	-	6	109	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	252	3660	14.8	150	2621	11.9	1039	-	-	87	886	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	59	2081	8.4	64	2736	12.5	-655	-	-	1	5	
20			Aquaculture pond	23	471	1.9	19	513	2.3	-42	-	-	-	-	
			Total	742	24749	100	537	21934	100	2815	2	10	149	1335	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Gujarat

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	54	22858	0.7	54	23018	0.7	-160	-	-	-	-
2			Ox-bow lake/cut-off meander	2	44	-	2	44	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	351	23081	0.7	305	24892	0.7	-1811	7	189	61	754
6			River/Stream	1142	275224	7.9	1058	275076	8.0	148	-	-	-	-
7		Man-made	Reservoir/Barrage	620	254320	7.3	591	237690	6.9	16630	-	-	20	3695
8			Tank/Pond	11331	99724	2.8	9864	89262	2.6	10462	20	216	1442	9295
9			Waterlogged	229	9490	0.3	63	8982	0.3	508	13	201	175	1640
10			Salt pan	5	775	-	5	761	-	14	-	-	-	-
11			Aquaculture Pond	20	197	-	0	0	-	197	-	-	20	197
12	Coastal	Natural	Lagoon	5	14420	0.4	5	14504	0.4	-84	-	-	-	-
13			Creek	78	171254	4.9	169	149506	4.3	21748	-	-	-	-
14			Sand/Beach	84	6465	0.2	67	6516	0.2	-51	-	-	-	-
15			Intertidal mud flat	839	2142215	61.2	1079	2251962	65.3	-109747	-	-	7	304
16			Salt Marsh	313	136397	3.9	317	142122	4.1	-5725	-	-	12	1462
17			Mangrove	1304	107372	3.1	741	90188	2.6	17184	-	-	14	542
18			Coral Reef	79	35419	1.0	106	33538	1.0	1881	-	-	-	-
19		Man-made	Salt pan	1097	192287	5.5	221	97849	2.8	94438	-	-	66	1908
20			Aquaculture pond	60	7887	0.2	87	3503	0.1	4384	-	-	5	81
				Total	17613	3499429	100	14734	3449413	100	50016	40	606	1822

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Decadal wetland inventory and change analysis - Haryana

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	9	881	2.6	8	839	2.8	42	-	-	-	-
2			Ox-bow lake/cut-off meander	5	58	0.2	6	59	0.2	-1	1	6	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	2	39	0.1	2	40	0.1	-1	-	-	-	-
5			Waterlogged	95	1138	3.4	90	1357	4.6	-219	4	21	6	24
6			River/Stream	22	13680	40.7	20	15529	52.3	-1849	-	-	-	-
7		Man-made	Reservoir/Barrage	3	585	1.7	2	28	0.1	557	-	-	1	103
8			Tank/Pond	1422	10767	32	1171	8352	28.1	2415	16	94	84	1343
9			Waterlogged	253	5375	16	231	3374	11.4	2001	25	420	60	1453
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	94	1126	3.3	16	132	0.4	994	2	9	52	614
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-
				Total	1905	33649	100	1546	29710	100	3939	48	550	203

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Himachal Pradesh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	9	64	0.1	9	64	0.1	-	-	-	-	-
2			Ox-bow lake/cut-off meander	0	0	0.0	-	-	0.0	-	-	-	-	-
3			High altitude lake	87	801	0.9	87	667	0.7	134	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	8	52	0.1	10	48	0.1	4	-	-	-	-
6			River/Stream	74	49551	52.7	71	50225	53.8	-674	-	-	-	-
7		Man-made	Reservoir/Barrage	26	43471	46.2	19	42323	45.3	1148	-	-	7	1334
8			Tank/Pond	8	38	0.0	5	25	0.0	13	-	-	3	12
9			Waterlogged	3	34	0.0	3	31	0.0	3	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
			Total	215	94011	100	204	93383	100	628	-	-	10	1346

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Jammu & Kashmir

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	20	15550	9.5	20	15570	9.5	-20	-	-	-	-
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	189	3007	1.8	189	3008	1.8	-1	-	-	-	-
4			Riverine Wetlands	75	9344	5.7	75	9341	5.7	3	-	-	-	-
5			Waterlogged	2	12	0.0	2	12	0.0	-	-	-	-	-
6			River/Stream	96	111275	67.8	95	111398	67.8	-123	-	-	-	-
7		Man-made	Reservoir/Barrage	5	24835	15.1	4	24811	15.1	24	-	-	-	-
8			Tank/Pond	17	87	0.1	18	90	0.1	-3	1	3	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20	Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-	
			Total	404	164110	100	403	164230	100	-120	1	3	-	-

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Jharkhand

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	16	3180	1.7	16	3180	1.8	0	-	-	-	-
2			Ox-bow lake/cut-off meander	22	94	0.1	22	96	0.1	-2	-	-	-	-
3			High altitude lake	0	0	0.0	0	0	0.0	0	-	-	-	-
4			Riverine Wetlands	32	1152	0.6	32	1126	0.6	26	-	-	-	-
5			Waterlogged	60	272	0.1	60	246	0.1	26	-	-	-	-
6			River/Stream	284	118473	63.3	284	120105	66.5	-1632	-	-	-	-
7		Man-made	Reservoir/Barrage	1073	55889	29.9	1067	49446	27.4	6443	-	-	6	1213
8			Tank/Pond	1137	7926	4.2	985	6410	3.5	1516	7	54	142	1395
9			Waterlogged	9	51	0.0	9	51	0.0	0	-	-	-	-
10			Salt pan	0	0	0.0	-	-	0.0	-	-	-	-	-
11			Aquaculture Pond	2	8	0.0	2	8	0.0	0	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
			Total	2635	187045	100	2477	180668	100	6377	7	54	148	2608

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Karnataka

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	28	1319	0.2	28	1318	0.2	1	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	59	1076	0.1	61	1091	0.1	-15	-	-	-	-	-
5			Waterlogged	72	1706	0.2	73	1747	0.2	-41	2	28	-	-	-
6			River/Stream	962	226642	28.8	939	229701	29.2	-3059	-	-	-	-	-
7		Man-made	Reservoir/Barrage	85	240641	30.6	82	240246	30.5	395	-	-	1	106	
8			Tank/Pond	13226	304625	38.7	12776	301872	38.4	2753	13	544	455	3084	
9			Waterlogged	43	1846	0.2	41	2143	0.3	-297	-	-	1	21	
10			Salt pan	7	32	-	7	32	-	-	-	-	-	-	-
11			Aquaculture Pond	22	573	0.1	12	326	-	247	-	-	4	36	
12	Coastal	Natural	Lagoon	3	109	-	3	109.96	-	-0.96	-	-	-	-	
13			Creek	13	102	-	13	102	-	-	-	-	-	-	
14			Sand/Beach	58	1887	0.2	59	1899	0.2	-12	-	-	-	-	
15			Intertidal mud flat	55	1236	0.2	73	1357	0.2	-121	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	196	1665	0.2	181	1286	0.2	379	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	8	433	0.1	7	429	0.1	4	-	-	-	-	
20			Aquaculture pond	99	3235	0.4	102	3445	0.4	-210	-	-	-	-	
				Total	14936	787127	100	14457	787104	100	23	15	572	461	3247

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Kerala

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	5	640	0.4	5	619	0.4	21	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	45	1374	0.9	42	1242	0.8	132	-	-	-	-	-
5			Waterlogged	553	9680	6.1	576	9574	6.2	106	4	38	-	-	-
6			River/Stream	317	66152	41.8	317	63996	41.4	2156	-	-	-	-	-
7		Man-made	Reservoir/Barrage	59	29237	18.5	59	28441	18.4	796	-	-	-	-	-
8			Tank/Pond	173	991	0.6	162	947	0.6	44	-	-	12	47	
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	65	4454	2.8	53	4087	2.6	367	-	-	-	-	-
12	Coastal	Natural	Lagoon	30	38825	24.5	30	38805	25.1	20	-	-	-	-	
13			Creek	14	75	0.0	14	76	0.0	-1	-	-	-	-	
14			Sand/Beach	95	2715	1.7	95	2707	1.8	8	-	-	3	17	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	34	390	0.2	32	362	0.2	28	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
20	Aquaculture pond		9	3803	2.4	11	3597	2.3	206	-	-	1	3		
			Total	1399	158336	100	1396	154453	100	3883	4	38	16	67	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Ladakh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	1011	112113	30.1	975	103825	28.42	8288	6	33	19	107	
4			Riverine Wetlands	-	-	-	1	3	0.00	-3	1	3	-	-	
5			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	
6			River/Stream	62	260936	69.9	60	261466	71.58	-530	-	-	-	-	
7		Man-made	Reservoir/Barrage	-	-	-	-	-	-	-	-	-	-	-	
8			Tank/Pond	-	-	-	-	-	-	-	-	-	-	-	
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-		
13			Creek	-	-	-	-	-	-	-	-	-	-		
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-		
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-		
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-		
17			Mangrove	-	-	-	-	-	-	-	-	-	-		
18			Coral Reef	-	-	-	-	-	-	-	-	-	-		
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-		
				Total	1073	373049	100	1036	365294	100	7755	7	36	19	107

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Lakshadweep

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
6			River/Stream	-	-	-	-	-	-	-	-	-	-	-	-
7		Man-made	Reservoir/Barrage	-	-	-	-	-	-	-	-	-	-	-	-
8			Tank/Pond	-	-	-	-	-	-	-	-	-	-	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	15	23769	29.82	15	23780	29.83	-11	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	20	308	0.39	20	320	0.4	-12	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	15	55639	69.8	15	55628	69.77	11	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-	-
				Total	50	79716	100	50	79728	100	-12	-	-	-	-

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Decadal wetland inventory and change analysis - Madhya Pradesh

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	-	-	-	-	-	-	-	-	-	-	-
2			Ox-bow lake/cut-off meander	3	76	-	3	28	-	48	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	7	155	-	2	16	-	139	-	-	4	30
5			Waterlogged	3	12	-	1	12	-	0	-	-	-	-
6			River/Stream	370	327457	38.0	367	317516	41.8	9941	-	-	-	-
7		Man-made	Reservoir/Barrage	3704	486091	56.4	2750	408237	53.8	77854	-	-	826	63953
8			Tank/Pond	9855	47922	5.6	7445	33196	4.4	14726	25	159	2522	12499
9			Waterlogged	5	23	-	2	11	-	12	-	-	3	12
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-	
				Total	13947	861736	100	10570	759016	100	102720	25	159	3355

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Maharashtra

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	34	8366	0.7	34	7798	0.8	568	-	-	-	-
2			Ox-bow lake/cut-off meander	1	12	-	1	12	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	3	33	-	5	40	-	-7	2	9	-	-
6			River/Stream	2522	321118	27.9	2176	292746	29.8	28372	-	-	-	-
7		Man-made	Reservoir/Barrage	1208	488461	42.4	983	402286	40.9	86175	-	-	199	54117
8			Tank/Pond	19736	222315	19.3	15456	175516	17.9	46799	93	648	2637	27757
9			Waterlogged	7	69	-	9	75	-	-6	2	5	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	17	200	-	-	-	-	200	-	-	8	108
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	
13			Creek	104	47095	4.1	128	41389	4.2	5706	-	-	-	-
14			Sand/Beach	206	3490	0.3	261	4739	0.5	-1249	2	41	1	3
15			Intertidal mud flat	715	20498	1.8	574	21172	2.2	-674	4	140	12	309
16			Salt Marsh	14	237	-	26	445	-	-208	4	41	-	-
17			Mangrove	1096	31313	2.7	892	29537	3	1776	-	-	29	317
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	202	8370	0.7	184	6794	0.7	1576	3	113	4	34
20			Aquaculture pond	70	1048	0.1	6	71	-	977	-	-	8	66
			Total	25935	1152625	100	20735	982620	100	170005	110	997	2898	82711

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Manipur

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	21	42660	64.39	28	40043	63.9	2617	-	-	-	-
2			Ox-bow lake/cut-off meander	8	56	0.08	8	50	0.1	6	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	40	2365	3.42	43	1914	3.1	451	-	-	6	102
6			River/Stream	18	16828	25.4	17	16974	27.1	-146	-	-	-	-
7		Man-made	Reservoir/Barrage	5	1878	1.28	3	860	1.4	1018	-	-	2	1027
8			Tank/Pond	24	114	0.17	24	96	0.2	18	-	-	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11		Aquaculture Pond	16	3507	5.25	16	2720	4.3	787	-	-	2	28	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
				Total	132	67408	100	139	62657	100	4751	-	-	10

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Decadal wetland inventory and change analysis - Meghalaya

Sr No	Level- I	Level- II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	66	1307	4.2	67	1334	4.3	-27	-	-	-	-
2			Ox-bow lake/cut-off meander	1	150	0.5	1	152	0.5	-2	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	6	1163	3.8	6	1308	4.2	-145	-	-	-	-
5			Waterlogged	18	303	1.0	18	303	1.0	0	-	-	-	-
6			River/Stream	100	26387	85.1	98	26195	84.8	192	-	-	-	-
7		Man-made	Reservoir/Barrage	9	1559	5.0	7	1447	4.7	112	-	-	2	75
8			Tank/Pond	25	133	0.4	25	136	0.4	-3	-	-	1	7
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-
			Total	225	31002	100	222	30875	100	127	-	-	3	82

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Mizoram

Sr No.	Level-I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	17	168	0.9	17	139	1.0	29	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	61	710	3.6	47	401	2.9	309	-	-	13	118	
6			River/Stream	39	12542	64.4	37	13224	95.9	682	-	-	-	-	
7		Man-made	Reservoir/Barrage	3	6016	30.9	1	20	0.1	5996	-	-	2	6012	
8			Tank/Pond	6	38	0.2	1	7	0.1	31	-	-	5	33	
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	
11			Aquaculture Pond	1	2	-	-	-	-	-	-	-	-	-	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-	
			Total	127	19476	100	103	13791	100	5685	-	-	21	6165	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Nagaland

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	2	15	0.1	2	15	0.1	0	-	-	-	-
2			Ox-bow lake/cut-off meander	3	11	0.1	2	12	0.1	-1	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	14	66	0.3	15	68	0.3	-2	-	-	-	-
6			River/Stream	40	19052	90.2	40	19041	90.5	11	-	-	-	-
7		Man-made	Reservoir/Barrage	3	1544	7.3	3	1543	7.3	1	-	-	-	-
8			Tank/Pond	72	357	1.7	65	295	1.4	62	-	-	5	52
9			Waterlogged	-	-	-	1	3	-	-3	1	3	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	14	73	0.3	14	73	0.3	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
				Total	148	21118	100	142	21050	100	68	1	3	5

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Odisha

Sr No	Level-I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	5	796	0.1	5	745	0.1	51	-	-	-	-
2			Ox-bow lake/cut-off meander	76	719	0.1	72	674	0.1	45	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	191	1646	0.2	177	1397	0.2	249	-	-	13	240
5			Waterlogged	1108	14509	2.0	1068	12725	1.8	1784	-	-	27	153
6			River/Stream	664	285999	39.7	642	281676	40.7	4323	-	-	-	-
7		Man-made	Reservoir/Barrage	1941	201293	28.0	1773	193357	27.9	7936	-	-	48	1259
8			Tank/Pond	6930	31944	4.4	6698	29088	4.2	2856	3	10	232	1518
9			Waterlogged	125	1436	0.2	101	1286	0.2	150	-	-	2	5.7
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	5	18	-	1	3	-	15	-	-	2	9
12	Coastal	Natural	Lagoon	2	89419	12.4	1	89023.1	12.9	395.9	-	-	-	-
13			Creek	52	3246	0.5	51	3405.23	0.5	-159.23	-	-	-	-
14			Sand/Beach	67	5557	0.8	62	6090	0.9	-533	-	-	7	116
15			Intertidal mud flat	302	24757	3.4	326	27159	3.9	-2402	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	256	27808	3.9	163	23165	3.3	4643	-	-	12	227
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	2	1088	0.2	2	1843	0.3	-755	-	-	-	-
20	Aquaculture pond		1605	29708	4.1	861	20391	2.9	9317	-	-	634	5605	
			Total	13331	719942	100	12003	692027	100	27915	3	10	977	9132

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Puducherry

Sr No.	Level-I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	15	1174	21.1	16	1163	19.5	11	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	1	20	0.4	1	20	0.3	-	-	-	-	-	-
6			River/Stream	9	1802	32.4	9	1858	31.2	-56	-	-	-	-	-
7		Man-made	Reservoir/Barrage	-	-	-	-	-	-	-	-	-	-	-	-
8			Tank/Pond	65	1099	19.8	66	1113	18.7	-14	-	-	-	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	7	55	1.0	1	11	0.2	44	-	-	5	18	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	6	381	6.9	6	373	6.3	8	-	-	-	-	
14			Sand/Beach	5	69	1.2	4	72	1.2	-3	-	-	-	-	
15			Intertidal mud flat	6	223	4.0	9	298	5.0	-75	3	45	-	-	
16			Salt Marsh	-	-	-	1	66	1.1	-66	-	-	-	-	
17			Mangrove	11	292	5.3	6	180	3.0	112	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	1	4	0.1	-	-	-	4	-	-	-	-	
20			Aquaculture pond	13	436	7.8	6	796	13.4	-360	1	11	5	35	
			Total	139	5555	100	125	5950	100	-395	4	56	10	53	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Punjab

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	2	13	-	2	15	-	-2	-	-	-	-
2			Ox-bow lake/cut-off meander	3	176	0.4	9	276	0.6	-100	6	85	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	11	1082	2.3	12	565	1.2	517	1	19	1	9
5			Waterlogged	13	117	0.2	14	126	0.3	-9	2	28	3	33
6			River/Stream	41	27581	58.7	42	29922	61.8	-2341	-	-	-	-
7		Man-made	Reservoir/Barrage	41	11716	24.9	37	11790	24.4	-74	-	-	4	72
8			Tank/Pond	959	4744	10.1	1031	4450	9.2	294	92	343	51	633
9			Waterlogged	59	785	1.7	60	807	1.7	-22	6	143	5	30
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	61	810	1.7	38	438	0.9	372	3	26	26	363
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
				Total	1190	47024	100	1245	48389	100	-1365	110	644	90

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Rajasthan

Sr No.	Level-I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	78	41285	5.3	76	42129	5.6	-844	-	-	-	-
2			Ox-bow lake/cut-off meander	6	184	-	1	10	-	174	-	-	4	132
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	88	20040	2.6	61	16863	2.2	3177	-	-	21	681
6			River/Stream	577	310611	39.9	572	310956	41.4	-345	-	-	-	-
7		Man-made	Reservoir/Barrage	1017	200792	25.8	984	190765	25.4	10027	-	-	43	6825
8			Tank/Pond	11379	159153	20.4	10800	151606	20.2	7547	11	1274	452	6512
9			Waterlogged	116	9337	1.2	99	7559	1.0	1778	-	-	16	1188
10			Salt pan	52	18721	2.4	39	12283	1.6	6438	-	-	18	1683
11			Aquaculture Pond	4	38	-	2	21	-	17	-	-	1	4
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	2	18404	2.4	3	18939	2.5	-535	-	-	-	
16			Salt Marsh	2	259	-	1	143	-	116	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	
20	Aquaculture pond		-	-	-	-	-	-	-	-	-	-		
			Total	13321	778824	100	12638	751274	100	27550	11	1274	555	17025

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Sikkim

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	1	15	0.2	1	15	0.2	-	-	-	-	-	
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	239	2991	42.4	231	2533	38.5	458	-	-	8	31	
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
6			River/Stream	15	3963	56.2	12	4034	61.2	-71	-	-	-	-	-
7		Man-made	Reservoir/Barrage	4	80	1.1	1	5	0.1	75	-	-	3	74	
8			Tank/Pond	-	-	-	-	-	-	-	-	-	-	-	-
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-	-
			Total	259	7049	100	245	6587	100	462	-	-	11	105	

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Decadal wetland inventory and change analysis - Tamil Nadu

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	4504	323949	35	4529	324032	35.0	-83	-	-	-	-
2			Ox-bow lake/cut-off meander	3	105	-	3	105	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	4	110	-	4	110	-	-	-	-	-	-
5			Waterlogged	41	3104	0.3	42	3120	0.3	-16	1	16	-	-
6			River/Stream	183	140094	15.1	209	139188	15.0	906	-	-	-	-
7		Man-made	Reservoir/Barrage	128	59237	6.4	129	59242	6.4	-5	-	-	-	-
8			Tank/Pond	21220	277065	29.9	21308	277477	30.0	-412	4	90	17	107
9			Waterlogged	35	6742	0.7	34	7091	0.8	-349	-	-	1	4
10			Salt pan	1	29	-	1	29	-	-	-	-	-	-
11			Aquaculture Pond	18	320	-	13	256	-	64	-	-	4	47
12	Coastal	Natural	Lagoon	24	19054	2.1	24	19157	2.1	-103	-	-	-	-
13			Creek	31	7741	0.8	33	8398	0.9	-657	-	-	-	-
14			Sand/Beach	90	3662	0.4	89	3693	0.4	-31	-	-	1	7
15			Intertidal mud flat	93	29797	3.2	98	29798	3.2	-1	-	-	-	-
16			Salt Marsh	35	4300	0.5	38	4419	0.5	-119	1	7	-	-
17			Mangrove	81	7807	0.8	81	7783	0.8	24	-	-	-	-
18			Coral Reef	25	2207	0.2	25	2207	0.2	-	-	-	-	-
19		Man-made	Salt pan	104	25935	2.8	101	25572	2.8	363	-	-	5	280
20			Aquaculture pond	263	14454	1.6	250	13171	1.4	1283	1	9	16	284
				Total	26883	925712	100	27011	924848	100	864	7	122	44

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Decadal wetland inventory and change analysis - Telangana

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	13	3698	0.7	13	3681	0.7	17	-	-	-	-
2			Ox-bow lake/cut-off meander	-	-	-	-	-	-	-	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	5	46	-	11	110	-	-64	4	19	1	4
6			River/Stream	153	151072	26.7	127	158756	31.8	-7684	-	-	-	-
7		Man-made	Reservoir/Barrage	477	217099	38.3	428	174865	35.0	42234	-	-	40	20619
8			Tank/Pond	11637	194097	34.3	9454	161766	32.4	32331	8	80	1245	9681
9			Waterlogged	52	630	0.1	25	385	0.1	245	-	-	26	176
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	1	38	-	-	-	-	-	38	-	-	1
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
				Total	12338	566680	100	10058	499563	100	67117	12	99	1313

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Tripura

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	56	1103	6.0	56	1031	7.3	72	-	-	-	-
2			Ox-bow lake/cut-off meander	71	389	2.1	76	377	2.7	12	-	-	-	-
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	-	-	-	-	-	-	-	-	-	-	-
5			Waterlogged	214	2433	13.2	214	2042	14.4	391	1	13	2	17
6			River/Stream	18	6833	37.1	16	7147	50.3	-314	-	-	-	-
7		Man-made	Reservoir/Barrage	8	7247	39.3	8	3365	23.7	3882	-	-	-	-
8			Tank/Pond	46	408	2.2	31	230	1.6	178	-	-	9	46
9			Waterlogged	-	-	-	-	-	-	-	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	3	25	0.1	1	4	-	21	-	-	2	20
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-
				Total	416	18438	100	402	14196	100	4242	1	13	13

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Uttarakhand

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	12	162	0.1	12	162	0.2	0	-	-	-	-
2			Ox-bow lake/cut-off meander	13	75	0.1	13	85	0.1	-10	-	-	-	-
3			High altitude lake	27	239	0.2	27	150	0.1	89	-	-	-	-
4			Riverine Wetlands	1	24	-	1	29	-	-5	-	-	-	-
5			Waterlogged	1	22	-	1	24	-	-2	-	-	-	-
6			River/Stream	78	86927	77.0	80	78664	77.3	8263	-	-	-	-
7		Man-made	Reservoir/Barrage	11	25108	22.2	11	22352	22.0	2756	-	-	-	-
8			Tank/Pond	20	104	0.1	20	94	0.1	10	-	-	-	-
9			Waterlogged	9	221	0.2	8	211	0.2	10	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	-	-	-	-	-	-	-	-	-	-	-
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-
13			Creek	-	-	-	-	-	-	-	-	-	-	-
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-
19			Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-
20		Aquaculture pond		-	-	-	-	-	-	-	-	-	-	-
				Total	172	112882	100	173	101771	100	11111	-	-	-

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - Uttar Pradesh

Sr No.	Level-I	Level-II	Level-III	2017-18			2006-07			Decadal Change	Disappeared		New		
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)	Area(ha)	Number	Area(ha)	Number	Area(ha)	
1	Inland	Natural	Lake/Pond	3330	120511	10.9	3332	120647	11.0	-136	-	-	-	-	
2			Ox-bow lake/cut-off meander	1528	54324	4.9	1535	53727	4.9	597	2	52	39	863	
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	1214	58297	5.3	1394	57965	5.3	332	3	29	80	10769	
5			Waterlogged	2361	57224	5.2	2415	58267	5.3	-1043	108	2308	79	964	
6			River/Stream	930	612856	55.5	829	601140	54.9	11716	-	-	-	-	-
7		Man-made	Reservoir/Barrage	1158	109461	9.9	1114	107064	9.8	2397	-	-	44	1839	
8			Tank/Pond	5305	34360	3.1	5575	34713	3.2	-353	36	256	38	332	
9			Waterlogged	2708	57236	5.2	2866	60390	5.5	-3154	170	3762	42	715	
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	21	293	-	9	111	-	182	1	16	14	205	
12	Coastal	Natural	Lagoon	-	-	-	-	-	-	-	-	-	-	-	
13			Creek	-	-	-	-	-	-	-	-	-	-	-	
14			Sand/Beach	-	-	-	-	-	-	-	-	-	-	-	
15			Intertidal mud flat	-	-	-	-	-	-	-	-	-	-	-	
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-	
17			Mangrove	-	-	-	-	-	-	-	-	-	-	-	
18			Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	-	-	-	-	-	-	-	-	-	-	-	
20			Aquaculture pond	-	-	-	-	-	-	-	-	-	-	-	
				Total	18555	110456 2	100	19069	109402 4	100	10538	320	6423	336	15687

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

EnviStats India 2022: Vol II Environment Accounts:

Annexure 4.1

State-wise Decadal wetland inventory and change analysis - West Bengal

Sr No.	Level- I	Level-II	Level-III	2017-18			2006-07			Decadal Change Area(ha)	Disappeared		New	
				Number	Area(ha)	Area (% of wetlands)	Number	Area(ha)	Area (% of wetlands)		Number	Area(ha)	Number	Area(ha)
1	Inland	Natural	Lake/Pond	799	17129	1.52	816	17304	1.55	-175	-	-	-	-
2			Ox-bow lake/cut-off meander	1067	24571	2.18	1078	24527	2.2	44	1	15	2	117
3			High altitude lake	-	-	-	-	-	-	-	-	-	-	-
4			Riverine Wetlands	708	17627	1.57	722	17635	1.58	-8	2	64	-	-
5			Waterlogged	1730	41381	3.68	1763	46793	4.2	-5412	7	124	3	34
6			River/Stream	332	654344	58.17	339	655068	58.76	-724	-	-	-	-
7		Man-made	Reservoir/Barrage	342	22732	2.02	343	22694	2.04	38	-	-	-	-
8			Tank/Pond	5119	21680	1.93	5124	21692	1.95	-12	7	36	60	643
9			Waterlogged	87	1096	0.1	87	1092	0.1	4	-	-	-	-
10			Salt pan	-	-	-	-	-	-	-	-	-	-	-
11			Aquaculture Pond	465	23858	2.12	432	17262	1.55	6596	-	-	14	2608
12	Coastal	Natural	Lagoon	0	0	0	0	0	0	0	-	-	-	-
13			Creek	336	2503	0.22	353	2287	0.21	216	-	-	-	-
14			Sand/Beach	61	6498	0.58	37	2700	0.24	3798	-	-	-	-
15			Intertidal mud flat	39	1158	0.1	23	911	0.08	247	-	-	-	-
16			Salt Marsh	-	-	-	-	-	-	-	-	-	-	-
17			Mangrove	792	221410	19.68	832	224873	20.17	-3463	-	-	-	-
18		Coral Reef	-	-	-	-	-	-	-	-	-	-	-	
19		Man-made	Salt pan	15	3768	0.33	17	4592	0.41	-824	-	-	3	104
20	Aquaculture pond		925	65056	5.78	864	55299	4.96	9757	-	-	56	1810	
			Total	12817	1124811	100	12830	1114729	100	10082	17	239	138	5316

Note: Wetlands database of 2006-07 was updated by incorporating interpretational changes

Source: Space based observation of Indian wetlands, Space Applications Centre, ISRO Ahmedabad, India

State-wise Details of Ramsar Sites (Wetlands) as on 06.09.2022

Sl. No.	State/UT	Site Name	Area (hectares)	State Wetlands Area (hectares)#	Ramsar wetland as % of Wetlands Area
1	Andhra Pradesh	Kolleru Lake	90,100	11,41,606	7.89
2	Assam	Deepor Beel	4,000	8,49,078	0.47
3	Bihar	Kabartal Wetland	2,620	3,74,766	0.7
4	Gujarat	Nalsarovar	12,000	34,99,429	0.4
		Wadhvana Wetland	630		
		Thol Lake Wildlife Sanctuary	699		
		Khijadia Wildlife Sanctuary	512		
5	Goa	Nanda Lake	42	24,749	0.17
6	Haryana	Bhindawas Wildlife Sanctuary	412	33,649	1.65
		Sultanpur National Park	143		
7	Himachal Pradesh	Chandertal Wetland	49	94,011	16.73
		Pong Dam Lake	15,662		
		Renuka Wetland	20		
8	Jammu & Kashmir	Surinsar-Mansar Lakes	350	1,64,110	14.08
		Wular Lake	18,900		
		Hygam Wetland Conservation Reserve	802		
		Shallbugh Wetland Conservation Reserve	1,675		
		Hokera Wetland	1,375		
9	Kerala	Vembanad-Kol Wetland	1,51,250	1,58,336	99.64
		Sasthamkotta Lake	373		
		Ashtamudi Wetland	6,140		
10	Ladakh	Tsomoriri	12,000	3,73,049	5.78
		Tso Kar Wetland Complex	9,577		
11	Madhya Pradesh	Bhoj Wetland	3,201	8,61,736	0.57
		Sakhya Sagar	248		
		Sirpur Wetland	161		
		Yashwant Sagar	822.9		
		Ranganathittu Bird Sanctuary	518		
12	Maharashtra	Nandur Madhameshwar	1,437	11,52,625	0.73
		Thane Creek	6,521		
		Lonar Lake	427		
13	Manipur	Loktak Lake	26,600	67,408	39.46
14	Mizoram	Pala Wetland	1,850	19,476	9.5
15	Odisha	Bhitarkanika Mangroves	65,000	7,19,942	48.01
		Chilika Lake	1,16,500		
		Satkosia Gorge	98,197		
		Tampara Lake	300		
		Hirakud Reservoir	65,400		
		Ansupa Lake	231		
16	Punjab	Beas Conservation Reserve	6,429	47,024	26.66
		Keshopur-Miani Community Reserve	344		
		Nangal Wildlife Sanctuary	116		
		Kanjli	183		
		Ropar	1,365		

Sl. No.	State/UT	Site Name	Area (hectares)	State Wetlands Area (hectares)#	Ramsar wetland as % of Wetlands Area
		Harike Lake	4,100		
17	Rajasthan	Keoladeo National Park	2,873	7,78,824	3.45
		Sambhar Lake	24,000		
18	Tamil Nadu	Point Calimere Wildlife and Bird Sanctuary	38,500	9,25,712	10.24
		Pallikaranai Marsh Reserve Forest	1,248		
		Karikili Bird Sanctuary	58		
		Pichavaram Mangrove	1,479		
		Udhayamarthandapuram Bird Sanctuary	44		
		Vedanthangal Bird Sanctuary	40		
		Koonthankulam Bird Sanctuary	72		
		Vellore Bird Sanctuary	77		
		Vembannur Wetland Complex	20		
		Chitrangudi Bird Sanctuary	260.47		
		Suchindram Theroor Wetland Complex	94.23		
		Vaduvur Bird Sanctuary	112.64		
		Kanjirankulam Bird Sanctuary	96.89		
		Gulf of Mannar Marine Biosphere Reserve	52,672		
19	Tripura	Rudrasagar Lake	240	18,438	1.3
20	Uttar Pradesh	Samaspur Bird Sanctuary	799	11,04,562	3.58
		Parvati Arga Bird Sanctuary	722		
		Sarsai Nawar Jheel	161		
		Sandi Bird Sanctuary	309		
		Saman Bird Sanctuary	526		
		Upper Ganga River	26,590		
		Sur Sarovar	431		
		Nawabganj Bird Sanctuary	225		
		Haiderpur Wetland	6,908		
		Bakhira Wildlife Sanctuary	2,894		
21	Uttarakhand	Asan Conservation Reserve	444	1,12,882	0.39
22	West Bengal	East Calcutta Wetlands	12,500	11,30,127	38.54
		Sundarban Wetland	4,23,000		
All India \$			13,26,678	1,59,81,516	8.3

Sourced from www.ramsar.org, and PIB[1] dated 13.08.2022 of MoEFCC

Area in 2017-18 as reported in Wetlands of India, \$Total wetland area of India in 2017-18

[1] <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1851484>

Annexure 4.3

District wise Mangrove Cover- Very Dense Mangrove

(Area in Sq. Km.)

State/UTs and District	Very Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
ANDHRA PRADESH											
East Godavari	7										
Guntur	3										
Krishna	4										
Sri Potti Sriramalu Nellore Prakasham											
West Godavari											
Total	14										
GOA											
North Goa	4										
South Goa	1										
Total	5										
GUJARAT											
Ahmedabad	1										
Amreli											
Anand											
Bharuch	17										
Bhavnagar	10										
Jamnagar	28										
Junagarh											
Kuchchh	118										

State/UTs and District	Very Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Navsari	1										
Porbandar	1										
Rajkot											
Surat	8										
Vadodara											
Valsad											
Total	184										
KARNATAKA											
Dakshin Kannada	2										0
Uttar Kannada											
Udupi											
Total	2										0
KERALA											
Ernakulum											
Kannur											
Kasaragod											
Total											
MAHARASHTRA											
Mumbai City											
Mumbai Sub-Urban	15										
Raigarh	31										
Ratnagiri	7	7									
Sindhudurg	1	1									
Thane	36										
Total	90	8									
ODISHA											

State/UTs and District	Very Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Baleshwar											
Bhadrak	11				1	1					
Jagatsinghpur	4										
Kendrapara	179				81	81	82	82	82	80	80
Puri											
Total	194				82	82	82	82	82	80	80
TAMILNADU											
Chidambaranar											
Cuddalore	5										
Nagapattinam	5										
Pudukkottai									1	1	1
Ramanathapuram	1							1		0	0
Thanjavur	2										
Thiruvallur											
Thiruvarur											
Thoothukkudi											
Total	13							1	1	1	1
WEST BENGAL											
Purba Medinipur	2	6	6		4	4					
North 24 Parganas	25	16	16		20	20	13	13	13	13	13
South 24 Parganas	1,624	870	870		1,014	1,014	980	977	986	983	981
Total	1,651	892	892		1,038	1,038	993	990	999	996	994
ANDAMAN & NICOBAR ISLANDS											
North Andaman	692	262	255		285	283	276	399	285	285	285
South Andaman									114	114	114
Nicobar	17										

State/UTs and District	Very Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Total	709	262	255		285	283	276	399	399	398	399
D&NH and DAMAN & DIU											
Daman											
Diu											
Total											
PUDUCHERRY											
Kaaikal											
Mahe											
Puducherry											
Yanam											
Total											
GRAND TOTAL	2,862	1,162	1,147		1,405	1,403	1,351	1,472	1,481	1,476	1,475

Annexure 4.3

District wise Mangrove Cover- Moderately Dense Mangrove

(Area in Sq. Km.)

State/UTs and District	Moderately Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
ANDHRA PRADESH											
East Godavari		7	7		63	63	63	62	126	126	126
Guntur		3	3		28	28	28	28	35	35	35
Krishna		5	5		35	35	35	39	50	50	50
Sri Potti Sriramalu Nellore									2	2	2
Prakasham											
West Godavari											
Total		15	15		126	126	126	129	213	213	213
GOA											
North Goa		7	10		10	16	16	17	17	17	17
South Goa		3	4		4	4	4	3	3	3	4
Total		10	14		14	20	20	20	20	20	21
GUJARAT											
Ahmedabad		2	2		2	1	1	1	1	1	1
Amreli											
Anand											
Bharuch		20	22		23	21	16	15	14	13	13
Bhavnagar		10	6		6	6	6	6	6	6	6
Jamnagar		29	28		28	28	28	28	28	28	28
Junagarh											
Kuchchh		126	127		121	118	118	118	118	116	116
Navsari											

State/UTs and District	Moderately Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Porbandar		1	1		1						
Rajkot		1	1		7	1	1	1	1	1	1
Surat		8	7			7	5	5	4	4	4
Vadodara											
Valsad		1	1								
Total		198	195		188	182	175	174	172	169	169
KARNATAKA											
Dakshin Kannada											0
Uttar Kannada		2	2		1	1	1	1		0	0
Udupi		1	1		2	2	2	2	2	2	2
Total		3	3		3	3	3	3	2	2	2
KERALA											
Ernakulum								1	1	1	1
Kannur		3	3		3	3	3	4	4	4	4
Kasaragod										0	0
Total		3	3		3	3	3	5	5	5	5
MAHARASHTRA											
Mumbai City											
Mumbai Sub-Urban		15	20		23	23	23	24	27	27	27
Raigarh		9	9		10	10	10	10	12	12	15
Ratnagiri		7	9		12	12	12	15	15	15	15
Sindhudurg		1	1		2	2	2	5	5	5	5
Thane		12	19		22	22	22	25	29	29	28
Total		44	58		69	69	69	79	88	88	90
ODISHA											
Baleshwar					2	2			1	1	1

State/UTs and District	Moderately Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Bhadrak		17	17		9	9	7	9	9	9	9
Jagatsinghpur		1	2		2	2	2	2	1	1	1
Kendrapara		142	137		83	83	79	84	83	84	84
Puri					1	1					
Total		160	156		97	97	88	95	94	94	94
TAMILNADU											
Chidambaranar											
Cuddalore		5	5						7	7	7
Nagapattinam		8	8		9	9	9	8	1	1	1
Pudukkottai								1		0	0
Ramanathapuram		1	1		2	2	2	1	1	1	1
Thanjavur		4	4		5	5	5	8	8	9	9
Thiruvallur											
Thiruvarur									7	8	8
Thoothukkudi									1	1	1
Total		18	18		16	16	16	18	25	27	27
WEST BENGAL											
Purba Medinipur		1	1		2	2			1	1	1
North 24 Parganas		10	10		6	6	11	11	11	11	11
South 24 Parganas		883	884		873	873	688	689	680	680	680
Total		894	895		881	881	699	700	692	692	692
ANDAMAN & NICOBAR ISLANDS											
North Andaman		286	262		260	259	256	167	112	112	111
South Andaman									55	55	55
Nicobar		26	10		2	2	2	1	2	2	2
Total		312	272		262	261	258	168	169	169	168

State/UTs and District	Moderately Dense Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
D&NH and DAMAN & DIU											
Daman											
Diu						0	0				
Total						0	0				
PUDUCHERRY											
Kaikal											
Mahe											
Puducherry											
Yanam											
Total											
GRAND TOTAL		1,657	1,629		1,659	1,658	1,457	1,391	1,480	1,479	1,481

Annexure 4.3

District wise Mangrove Cover- Open Mangrove

(Area in Sq. Km.)

State/UTs and District	Open Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
ANDHRA PRADESH											
East Godavari	187	181	181		126	125	125	122	62	62	62
Guntur	44	44	44		21	21	21	22	33	33	33
Krishna	87	88	88		74	74	74	87	87	87	88
Sri Potti Sriramalu Nellore					5	5	5	5	8	8	8
Prakasham	1	1	1		1	1	1	1	1	1	1
West Godavari								1			
Total	319	314	314		227	226	226	238	191	191	192
GOA											
North Goa			1		2	1	1	3	3	3	3
South Goa			1		1	1	1	3	3	3	4
Total			2		3	2	2	6	6	6	7
GUJARAT											
Ahmedabad	1		4		25	29	35	32	31	30	26
Amreli						1	2	2	2	2	3
Anand					3		8	8	8	7	6
Bharuch	11	13	14		19	22	28	27	31	31	32
Bhavnagar	6	6	8		7	13	5	11	16	16	15
Jamnagar	114	112	122		129	131	139	145	156	201	203
Junagarh						1	1	1	3	3	4
Kuchchh	588	623	580		654	660	671	668	680	678	683
Navsari	1	1	1		1	1	13	13	14	13	11

State/UTs and District	Open Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Porbandar					1		1	1	1	1	1
Rajkot	1	1	1		10	1	3	3	3	3	3
Surat	5	5	10		4	13	16	16	17	16	15
Vadodara						2	3	3	3	3	3
Valsad		1	1		5	2	3	3	3	2	2
Total	727	762	741		858	876	928	933	968	1,008	1,006
KARNATAKA											
Dakshin Kannada											0
Uttar Kannada									8	8	10
Udupi											0
Total									8	8	11
KERALA											
Ernakulum		1	1					1	1	1	1
Kannur		4	4		2	2	2	2	2	2	3
Kasaragod						1	1	1	1	1	1
Total		5	5		2	3	3	4	4	4	5
MAHARASHTRA											
Mumbai City	1	1	2		2	2	2	2	2	2	2
Mumbai Sub-Urban	11	16	20		20	20	20	24	37	37	36
Raigarh	3	29	38		52	52	52	67	94	109	112
Ratnagiri	2		12		11	11	11	14	15	15	15
Sindhudurg					1	1	1	2	7	7	7
Thane	11	18	28		31	31	31	34	61	62	62
Total	28	64	100		117	117	117	143	216	232	234
ODISHA											
Baleshwar	3	4	4		1	2	2	2	4	4	4

State/UTs and District	Open Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Bhadrak	8	3	3		13	13	14	21	23	26	26
Jagatsinghpur	1	2	2		5	5	5	6	7	7	7
Kendrapara	13	38	38		23	23	22	24	32	37	45
Puri								1	1	1	1
Total	25	47	47		42	43	43	54	67	76	84
TAMILNADU											
Chidambaranar	1	2	2								
Cuddalore	2	2	2		7	7	7	7	1	1	1
Nagapattinam	5	9	9		10	10	10	12	3	2	2
Pudukkottai									1	1	1
Ramanathapuram					1	1	1	1	1	1	1
Thanjavur	2	4	4		3	3	3	4	4	3	3
Thiruvallur								1	1	1	1
Thiruvarur									9	5	5
Thoothukkudi					2	2	2	3	3	3	3
Total	10	17	17		23	23	23	28	23	17	17
WEST BENGAL											
Purba Medinipur	6	2	2		4	5	3	3	3	3	3
North 24 Parganas	2	2	2				1	2	2	2	2
South 24 Parganas	422	330	327		229	231	401	411	418	420	422
Total	430	334	331		233	236	405	416	423	424	427
ANDAMAN & NICOBAR ISLANDS											
North Andaman	80	96	108		67	72	69	50	28	28	28
South Andaman									21	21	21
Nicobar		1	2		1	1	1			0	0
Total	80	97	110		68	73	70	50	49	49	49

State/UTs and District	Open Mangrove										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
D&NH and DAMAN & DIU											
Daman									1	1	1
Diu		1	1		1	1	1	3	2	2	2
Total		1	1		1	1	1	3	3	3	3
PUDUCHERRY											
Kaaikal											
Mahe											
Puducherry								1			
Yanam	1	1	1		1	1	1	1	2	2	2
Total	1	1	1		1	1	1	2	2	2	2
GRAND TOTAL	1,620	1,642	1,669		1,575	1,601	1,819	1,877	1,960	2,020	2,037

Annexure 4.3

District wise Mangrove Cover- Total

(Area in Sq. Km.)

State/UTs and District	Total										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
ANDHRA PRADESH											
East Godavari	194	188	188		189	188	188	184	188	188	188
Guntur	47	47	47		49	49	49	50	68	68	68
Krishna	91	93	93		109	109	109	126	137	137	138
Sri Potti Sriramalu Nellore					5	5	5	5	10	10	10
Prakasham	1	1	1		1	1	1	1	1	1	1
West Godavari								1			
Total	333	329	329		353	352	352	367	404	404	405
GOA											
North Goa	4	7	11		12	17	17	20	20	20	20
South Goa	1	3	5		5	5	5	6	6	6	7
Total	5	10	16		17	22	22	26	26	26	27
GUJARAT											
Ahmedabad	2	2	6		27	30	36	33	32	31	26
Amreli						1	2	2	2	2	3
Anand					3		8	8	8	7	6
Bharuch	28	33	36		42	43	44	42	45	44	45
Bhavnagar	16	16	14		13	19	11	17	22	22	21
Jamnagar	142	141	150		157	159	167	173	184	230	231
Junagarh						1	1	1	3	3	4
Kuchchh	706	749	707		775	778	789	786	798	795	799

State/UTs and District	Total										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Navsari	2	1	1		1	1	13	13	14	13	11
Porbandar	1	1	1		2		1	1	1	1	1
Rajkot	1	2	2		17	2	4	4	4	4	4
Surat	13	13	17		4	20	21	21	21	20	19
Vadodara						2	3	3	3	3	3
Valsad		2	2		5	2	3	3	3	2	2
Total	911	960	936		1,046	1,058	1,103	1,107	1,140	1,177	1,175
KARNATAKA											
Dakshin Kannada	2										0
Uttar Kannada		2	2		1	1	1	1	8	9	10
Udupi		1	1		2	2	2	2	2	2	2
Total	2	3	3		3	3	3	3	10	10	13
KERALA											
Ernakulum		1	1					2	2	2	2
Kannur		7	7		5	5	5	6	6	6	6
Kasaragod						1	1	1	1	1	1
Total		8	8		5	6	6	9	9	9	9
MAHARASHTRA											
Mumbai City	1	1	2		2	2	2	2	2	2	2
Mumbai Sub-Urban	26	31	40		43	43	43	48	64	64	63
Raigarh	34	38	47		62	62	62	77	106	121	127
Ratnagiri	9	14	21		23	23	23	29	30	30	30
Sindhudurg	1	2	1		3	3	3	7	12	12	12
Thane	47	30	47		53	53	53	59	90	91	90
Total	118	116	158		186	186	186	222	304	320	324
ODISHA											

State/UTs and District	Total										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Baleshwar	3	4	4		3	4	2	2	5	5	5
Bhadrak	19	20	20		23	23	21	30	32	35	35
Jagatsinghpur	5	3	4		7	7	7	8	8	8	8
Kendrapara	192	180	175		187	187	183	190	197	201	209
Puri					1	1		1	1	1	1
Total	219	207	203		221	222	213	231	243	251	259
TAMILNADU											
Chidambaranar	1	2	2								
Cuddalore	7	7	7		7	7	7	7	8	8	8
Nagapattinam	10	17	17		19	19	19	20	4	3	3
Pudukkottai								1	2	2	2
Ramanathapuram	1	1	1		3	3	3	3	2	2	3
Thanjavur	4	8	8		8	8	8	12	12	12	12
Thiruvallur								1	1	1	1
Thiruvarur									16	13	13
Thoothukkudi					2	2	2	3	4	4	4
Total	23	35	35		39	39	39	47	49	45	45
WEST BENGAL											
Purba Medinipur	8	9	9		10	11	3	3	4	4	4
North 24 Parganas	27	28	28		26	26	25	26	26	26	26
South 24 Parganas	2,046	2,083	2,081		2,116	2,118	2,069	2,077	2,084	2,082	2,084
Total	2,081	2,120	2,118		2,152	2,155	2,097	2,106	2,114	2,112	2,114
ANDAMAN & NICOBAR ISLANDS											
North Andaman	772	644	625		612	614	601	616	425	425	425
South Andaman									190	190	190
Nicobar	17	27	12		3	3	3	1	2	2	2

State/UTs and District	Total										
	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Total	789	671	637		615	617	604	617	617	616	616
D&NH and DAMAN & DIU											
Daman									1	1	1
Diu		1	1		1	2	2	3	2	2	2
Total		1	1		1	2	2	3	3	3	3
PUDUCHERRY											
Kaaikal											
Mahe											
Puducherry								1			
Yanam	1	1	1		1	1	1	1	2	2	2
Total	1	1	1		1	1	1	2	2	2	2
GRAND TOTAL	4,482	4,461	4,445		4,639	4,663	4,628	4,740	4,921	4,975	4,992

Source: India State of Forest Report, FSI, MoEFCC

Note: Totals may not match due to rounding off.

Faunal diversity of Mangrove Ecosystem of India

Kingdom	Phylum	Number of Species					
		World	India	%	Indian Mangrove Ecosystem	%	
Protista	Phylum Protozoa	50,012	3,557	7.1	349	9.8	
Animalia	Phylum MESOZOA	122	10	8.2			
	Phylum PORIFERA	8,550	571	6.7	5	0.9	
	Phylum CNIDARIA	1,19,935	1,461	1.2	73	5.0	
	Phylum CTENOPHORA	199	20	10.1	4	20.0	
	Phylum PLATYHELMINTHES	29,495	1,800	6.1	1	0.1	
	Phylum ROTIFERA	2,200	467	21.2	53	11.3	
	Phylum GASTROTRICHA	790	163	20.6	1	0.6	
	Phylum KINORHYNCHA	315	10	3.2	1	10.0	
	Phylum NEMATODA	30,027	3,017	10.0	125	4.1	
	Phylum ACANTHOCPHALA	1,308	308	23.5			
	Phylum SIPUNCULA	162	41	25.3	1	2.4	
	Phylum ECHIURA	198	47	23.7			
	Phylum ANNELIDA	20,006	1,051	5.3	269	25.6	
	Phylum ONYCHOPHORA	183	1	0.5			
	Phylum ARTHROPODA	12,04,015	77,270	6.4	2,393	3.1	
	Subphylum CHELICERATA	61,592	6,172	10.0	311	5.0	
	Class ARACHNIDA	60,052	6,134	10.2	309	5.0	
	Class MEROSTOMATA	200	2	1.0	2	100.0	
	Class PYCNOGONIDA	1,340	36	2.7			
	Subphylum CRUSTACEA	67,735	3,972	5.9	624	15.7	
	Subphylum HEXAPODA	10,63,834	66,741	6.3	1,455	2.2	
	Subphylum MYRIAPODA	11,155	385	3.5	1	0.3	
	Class CHILOPODA	3,112	101	3.2	3	3.0	
	Class DIPLOPODA	7,839	274	3.5			
	Class SYMPHYLA	204	10	4.9			
	Phylum PHORONIDA	12	3	25.0			
	Phylum BRYOZOA(Ectoprocta)	5,434	350	6.4	2	0.6	
	Phylum ENTOPROCTA	150	10	6.7	1	10.0	
	Phylum BRACHIOPODA	392	8	2.0	2	25.0	
	Phylum CHAETOGNATHA	170	44	25.9	15	34.1	
	Phylum TARDIGRADA	1,381	32	2.3			
	Phylum MOLLUSCA	85,015	5,249	6.2	173	3.3	
	Phylum NEMERTEA	1,368	6	0.4	1	16.7	
	Phylum ECHINODERMATA	7,551	788	10.4	8	1.0	
	Phylum HEMICHORDATA	139	14	10.1	1	7.1	
	Phylum CHORDATA	1,10,394	6,960	6.3	1,544	22.2	
	Subphylum CEPHALOCHORDATA	33	6	18.2			
	Subphylum UROCHORDATA	2,804	531	18.9	6	1.1	
	Subphylum VERTEBRATA[=Craniate]	1,07,557	6,423	6.0	1,338	20.8	
	Class PISCES	70,449	3,496	5.0	659	18.9	
	Class AMPHIBIA	8,445	443	5.2	14	3.2	
	Class REPTILIA	11,733	706	6.0	57	8.1	
	Class AVES	10,357	1,346	13.0	523	38.9	
	Class MAMMALIA	6,500	432	6.6	86	19.9	
	Total (Animalia)		16,29,511	99,701	6.1	4,473	4.5
	Grand Total (Protista+Animalia)		16,79,523	1,03,258	6.1	4,822	4.7

Source: 1. Faunal Diversity of Mangrove Ecosystem in India, ZSI, 2019; 2. Animal Discoveries, 2021, ZSI

Annexure 4.5

State-wise distribution of faunal species of different taxa in mangrove ecosystems in India

Taxa Kingdom Phyllum Subphyllum Class Order	West Bengal	Odisha	Andhra Pradesh	Tamil Nadu	Kerala	Karnataka	Maarashtra	Gujarat	Andaman & Nicobar Islands	All India
Kingdom PROTOZOA (PROTISTA)	195	2	16	53	45	48	5	9	23	349
Kingdom ANIMALIA										
Porifera	2	2	2				2			5
Cnidaria	51	18	6	7	7	3	7	2	1	73
Ctenophora	4									4
Platyhelminthes	1	1								1
Rotifera	1			52				2		53
Gastrotricha									1	1
Kinorhyncha									1	1
Nematoda (Free-living)	27		12	46			14		36	125
Sipuncula	1	1							1	1
Annelida										269
Polychaeta	62	52	41	179	38	36	8	3	8	244
Oligochaeta	4	3	6	3	12	3	3	1	3	21
Hirudinea	3	1								4
Arthropoda										2,393
Chelicerata										311
Arachnida										309
Acari(Mites)	129				16				8	148
Aranea(Spiders)	111			6	71			1		160
Scorpiones(=Ischnuridae)									1	1
Merostomata: Xiphosurida	2	2	1							2
Myriapoda: Chilopoda: Scolopendrimorpha									3	3
Crustacea	342	167	118	175	42	20	85	51	77	624
Hexapoda										1,455
Entognatha (Apterygota)	20								20	33
Insecta										1,422
Orthoptera	35	1							1	48
Lepidoptera	210		22	40	30	5	8	8	119	343
Diptera	169	44	20	71	51	51	41	29	35	259
Hymenoptera	95		9	20	33	13			53	157
Odonata	29			8	23				15	47
Coleoptera	149		13	35	30	3	2		92	340
Hemiptera	97	5	11	33	5	11	30	4	36	168
Neuroptera	5								4	10
Blattodea	6								10	23
Dermaptera	8									11
Mantodea	8			1						10
Phasmatodea				1						1
Phthiraptera	2									2
Psocoptera									1	1
Thysanoptera									2	2

Taxa Kingdom Phyllum Subphyllum Class Order	West Bengal	Odisha	Andhra Pradesh	Tamil Nadu	Kerala	Karnataka	Maarashtra	Gujarat	Andaman & Nicobar Islands	All India
Bryozoa (Ectoprocta)	2						1			2
Entoprocta	1									1
Brachiopoda	1	2				1	1	1		2
Chaetognatha	2	3		1		2		3	14	15
Mollusca	56	23	22	26	21		55	9	100	173
Nemertea	1	1								1
Echinodermata	1								7	8
Hemichordata	1									1
Chordata										1,344
Tunicata(Urochordata)		2		1		2			2	6
Pisces	322	245	346	110	11 8	74	16 5	31	284	659
Amphibia	13	14							4	14
Reptilia	53	48							18	57
Aves	360	264		160	42		14 7	17 0	226	523
Mammalia	47	30	16	15	23		17	32	12	86
TOTAL	2,628	931	661	1,043	607	272	591	356	1,218	4,822

Source: Faunal Diversity of Mangrove Ecosystem in India, ZSI, 2019

IUCN Conservation status of fishes known from mangroves in India

Sl. No.	Orders	No. of Families	No. of Species	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concerned (LC)	Data deficient (DD)	Not Evaluated (NE)
1	ORECTOLOBIFORMES	2	2		1		1			
2	CARCHARHINIFORMES	2	12	2	2	1	6	1		
3	TORPEDINIFORMES	1	1							1
4	RHINOPRISTIFORMES	4	11	1	2	4			3	1
5	MYLIOBATIFORMES	3	14		1	2	1		4	6
6	OSTEOGLOSSIFORMES	1	1					1		
7	ELOPIFORMES	2	2					1	1	
8	ALBULIFORMES	1	1						1	
9	ANGUILLIFORMES	6	29				2	2		25
10	CLUPEIFORMES	5	64					15	1	48
11	GONORYNCHIFORMES	1	1							1
12	CYPRINIFORMES	3	7					7		
13	SILURIFORMES	4	29			1	1	9	1	17
14	AULOPIFORMES	1	8					4		4
15	GADIFORMES	2	2							2
16	BATRACHOIDIFORMES	1	2							2
17	SCOMBRIFORMES	4	12				1	1	3	7
18	SYNGNATHIFORMES	2	17			2	1	12	1	1
19	KURTIFORMES	1	1							1
20	GOBIIFORMES	2	95					27	6	62
21	SYNBRANCHIFORMES	2	6					6		
22	ANABANTIFORMES	2	2					2		
23	CICHLIFORMES	1	3				1	2		
24	ATHERINIFORMES	1	3					1		2
25	CYPRINODONTIFORMES	1	3					3		
26	BELONIFORMES	4	20			1		7		12
27	MUGILIFORMES	1	13					6	1	6
28	BLENIIFORMES	1	6					6		
29	SCORPAENIFORMES	4	13					4	1	8
30	CENTRARCHIFORMES	1	4					2		2
31	ACROPOMATIFORMES	1	1							1
32	PERCIFORMES	35	227			1	4	110	9	103
33	PLEURONECTIFORMES	5	25					2		23
34	TETRAODONTIFORMES	4	22			1		14	2	5
	TOTAL	111	659	3	6	13	18	245	34	340

Source: Faunal Diversity of Mangrove Ecosystem in India, ZSI, 2019

Floral and Faunal diversity of major estuaries of India

Taxonomic group	Major estuaries of India																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
FLORAL GROUPS																					
Phytoplankton	45	40			162				61	68	12	53		41	39		67		53	47	468
Mangroves	23	9	26	10			8		16	13	12	3			8	11	15	15	3		32
Other Flora			19				9		19	13		1			3		10	10			39
Subtotal	68	49	45	10	162		17		96	94	24	57		41	50	11	92	25	56	47	539
FAUNAL GROUPS																					
Protozoa					25	26					20	3		23					4	3	58
Foraminifera					5					47	11					73		14			130
Porifera	1								2								2	2			4
Cnidaria	24	12		11	20	5			13	3	10					34	3	3			92
Ctenophora	1			1	2						1	1				1					5
Rotifera	5								14		2	16		13							38
Nematoda	2				11												20				30
Acanthocephala									1												1
Sipuncula	1	1																			1
Mollusca	83	49	19	152	47		28	43	73	103	82	10		11	51	26	40	41	30	32	426
Annelida	91	37	11	34	19		13	4	70	45				24	48	47	70	3			269
Arthropoda	377	53	88	45	159	99	24	17	88	118	125	56	58	35	55	167	72	21	25	60	1003
Bryozoa	4																				4
Brachiopoda	1	2								1											3
Chaetognatha	4			3	6	2				1	2	3				4	6	6		3	14
Echinodermata	22	6	1						7	2	1										28
Hemichordata	1																				1
Urochordata				3	6	4					3					1					6
Class Pisces	314	146	157	177	45	91	64	71	307	268	63	17	135	82	135	126	73	44	64	49	764

Taxonomic group	Major estuaries of India																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Class Amphibia	13	3	14							4		3				27					39
Class Reptilia	57	5	45	6	2	1	1	1	1	10		1				4	7	7			71
Class Aves	156	108	269	46	1			52	75	17						45	43	150	23	23	347
Class Mammalia	41	2	27		4				1	11		8			2	5					55
Subtotal	1198	424	631	478	352	228	130	188	652	630	320	118	193	188	291	560	336	291	146	170	3392
TOTAL	1266	473	676	488	514	228	147	188	748	724	344	175	193	229	341	571	428	316	202	217	3928

[1. Hoogly-Matla Estuary; 2. Subarnarekha esuary; 3. Brahmani-Baitarani estuarine complex; 4. Mahanadi Estuary; 5. Rushikulya Estuary; 6. Bahuda Esuary; 7. Vamsadhara Esuary; 8. Nagavali Estuary; 9. Godavari Estuary; 10. Krishan Estuary; 11. Pennar Estuary; 12. Ennore Estuary; 13. Adyar Estuary; 14. Vellar Estuary; 15. Cauvery Estuary Estuary; 16. Cochin Estuary; 17. Zuari Estuary; 18. Mandovi Estuary; 19. Tapi Estuary and 20. Narmada Estuary

Source: Kaliash Chandra, C. Raghunathan and Swetapadma Dash, (2018), Current Status of Estuarine Biodiversity in India, Zoological Survey of India

Annexure 5.1

District wise Estimates of Fish Provisioning Services

State: Andhra Pradesh Year: 2015-16

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	112	2,297	139	5,528			1	985					252	8,810	6,59,821	75
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,145	1,60,344	20
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	1,98,762	35
4		East Godavari	93	989	91	1,594	21	921	1	5	5	2,126	7	123	218	5,758	1,35,079	23
5		West Godavari	77	2,074	22	432			1	700					100	3,206	1,31,464	41
6		Krishna	142	2,565	49	1,448	39	1,603			1	1,700			231	7,317	5,45,110	75
7		Guntur	14	419	13	412	23	1,028	1	993			3	29,175	54	32,027	2,12,597	7
8		Prakasam	227	9,154	46	3,285			9	1,985					282	14,424	5,50,123	38
9		SPSR Nellore	412	42,307	4	2,664	3	4,298	2	1,545			2	45,056	423	95,870	7,56,176	8
10		Chittoor	655	32,725	29	3,050			6	721					690	36,496	1,32,857	4
11		Kadapa	213	18,767	25	9,906			8	3,652					246	32,325	5,21,289	16
12		Ananthapuramu	313	46,138	12	1,958					5	8,274			330	56,370	2,73,042	5
13		Kurnool	97	4,850	63	3,409	15	1,418	5	1,787	5	11,823	1	59,573	186	82,860	6,27,669	8
Total			2,601	1,66,678	601	38,432	107	9,457	57	14,595	18	26,173	13	1,33,927	3,397	3,89,262	49,04,333	13

Source: Department of Fisheries, Government of Andhra Pradesh

District wise Estimates of Fish Provisioning Services

State: Andhra Pradesh Year: 2016-17

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	112	2,297	139	5,528			1	985					252	8,810	7,25,803	82
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,145	1,76,379	22
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	1,75,326	31
4		East Godavari	93	989	91	1,594	21	921	1	5	5	2,126	7	123	218	5,758	1,48,585	26
5		West Godavari	77	2,074	22	432			1	700					100	3,206	1,44,610	45
6		Krishna	142	2,565	49	1,448	39	1,603			1	1,700			231	7,317	5,99,355	82
7		Guntur	14	419	13	412	23	1,028	1	993			3	29,175	54	32,027	2,12,597	7
8		Prakasam	227	9,154	46	3,285			9	1,985					282	14,424	6,05,403	42
9		SPSR Nellore	412	42,307	4	2,664	3	4,298			2	1,545	2	45,056	423	95,870	8,31,793	9
10		Chittoor	655	32,725	29	3,050			6	721					690	36,496	2,78,445	8
11		Kadapa	213	18,767	25	9,906			8	3,652					246	32,325	5,73,419	18
12		Ananthapuramu	312	45,428	13	2,668					6	8,815			331	56,911	3,58,256	6
13		Kurnool	97	4,850	63	3,409	15	1,418	5	1,787	5	11,823	1	59,573	186	82,860	14,59,864	18
Total			2,600	1,65,968	602	39,142	107	9,457	55	13,050	21	28,259	13	1,33,927	3,398	3,89,803	62,89,835	16

Source: Department of Fisheries, Government of Andhra Pradesh

District wise Estimates of Fish Provisioning Services

State: Andhra Pradesh Year: 2017-18

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	112	2,297	139	5,528			1	985					252	8,810	8,49,891	96
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,145	1,94,016	24
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	1,91,599	34
4		East Godavari	93	989	91	1,594	21	921	1	5	5	2,126	7	123	218	5,758	1,63,443	28
5		West Godavari	77	2,074	22	432			1	700					100	3,206	1,59,071	50
6		Krishna	142	2,565	49	1,448	39	1,603			1	1,700			231	7,317	6,18,116	84
7		Guntur	14	419	13	412	23	1,028	1	993			3	29,175	54	32,027	2,33,857	7
8		Prakasam	227	9,154	46	3,285			9	1,985					282	14,424	7,07,221	49
9		SPSR Nellore	412	42,307	4	2,664	3	4,298			2	1,545	2	45,056	423	95,870	9,14,973	10
10		Chittoor	655	32,725	29	3,050			6	721					690	36,496	3,06,290	8
11		Kadapa	213	18,767	25	9,906			8	3,652					246	32,325	6,30,761	20
12		Ananthapuramu	310	44,231	15	3,865					6	8,815			331	56,911	3,58,256	6
13		Kurnool	97	4,850	63	3,409	15	1,418	5	1,787	5	11,823	1	59,573	186	82,860	25,43,672	31
Total			2,598	1,64,771	604	40,339	107	9,457	55	13,050	21	28,259	13	1,33,927	3,398	3,89,803	78,71,166	20

Source: Department of Fisheries, Government of Andhra Pradesh

District wise Estimates of Fish Provisioning Services

State: Andhra Pradesh Year: 2018-19

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	112	2,297	139	5,528			1	985					252	8,810	9,34,880	106
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,145	2,13,418	26
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	2,15,213	38
4		East Godavari	93	989	91	1,594	21	921	1	5	5	2,126	7	123	218	5,758	1,79,788	31
5		West Godavari	77	2,074	22	432			1	700					100	3,206	1,74,981	55
6		Krishna	145	2,613	49	1,448	39	1,603			1	1,700			234	7,365	7,16,951	97
7		Guntur	14	419	13	412	23	1,028	1	993			3	16,210	54	19,062	2,57,243	13
8		Prakasam	227	9,154	46	3,285			9	1,985					282	14,424	8,08,286	56
9		SPSR Nellore	412	42,307	4	2,664	3	4,298			2	1,545	2	45,056	423	95,870	10,06,470	10
10		Chittoor	655	32,725	29	3,050			6	721					690	36,496	3,34,946	9
11		Kadapa	213	18,767	25	9,906			10	4,348	1	2,446			249	35,467	15,56,497	44
12		Ananthapuramu	310	44,231	15	3,865					6	8,815			331	56,911	3,58,256	6
13		Kurnool	97	4,850	64	3,551	15	1,418	5	1,787	5	11,823	1	59,573	187	83,002	25,43,672	31
Total			2,601	1,64,819	605	40,481	107	9,457	57	13,746	22	30,705	13	1,20,962	3,405	3,80,170	93,00,601	24

Source: Department of Fisheries, Government of Andhra Pradesh

District wise Estimates of Fish Provisioning Services

State: Andhra Pradesh Year: 2019-20

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	113	2,326	140	5,576			1	985					254	8,887	10,28,368	116
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,145	2,34,760	29
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	2,36,734	42
4		East Godavari	93	989	111	1,594	21	921	1	5	5	2,126	7	123	238	5,758	2,72,586	47
5		West Godavari	77	2,074	22	432			1	700					100	3,206	1,92,480	60
6		Krishna	145	2,613	49	1,448	39	1,603			1	1,700			234	7,365	8,28,642	113
7		Guntur	14	419	13	412	23	1,028	1	993			3	16,210	54	19,062	2,82,967	15
8		Prakasam	227	9,154	46	3,285			10	2,083					283	14,522	9,47,656	65
9		SPSR Nellore	412	42,307	4	2,664	3	4,298			2	1,545	2	45,056	423	95,870	11,07,117	12
10		Chittoor	655	32,725	29	3,050			6	721					690	36,496	3,74,491	10
11		Kadapa	213	18,767	25	9,906			10	4,348	1	2,446			249	35,467	16,32,147	46
12		Ananthapuramu	311	44,276	14	3,820					6	8,815			331	56,911	3,58,256	6
13		Kurnool	97	4,850	64	3,551	15	1,418	5	1,787	5	11,823	1	59,573	187	83,002	27,98,040	34
Total			2,603	1,64,893	625	40,483	107	9,457	58	13,844	22	30,705	13	1,20,962	3,428	3,80,345	1,02,94,244	27

Source: Department of Fisheries, Government of Andhra Pradesh

District wise Estimates of Fish Provisioning Services

State: Andhra Pradesh Year: 2020-21

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	113	2,326	140	5,576			1	985					254	8,887	10,82,202	122
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,145	2,58,236	32
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	2,60,409	46
4		East Godavari	93	989	111	1,594	21	921	1	5	5	2,126	7	123	238	5,758	3,00,041	52
5		West Godavari	77	2,074	22	432			1	700					100	3,206	2,11,728	66
6		Krishna	145	2,613	49	1,448	39	1,603			1	1,700			234	7,365	8,60,645	117
7		Guntur	14	419	13	412	23	1,028	1	993			3	16,210	54	19,062	3,11,264	16
8		Prakasam	227	9,154	46	3,285			10	2,083					283	14,522	12,49,792	86
9		SPSR Nellore	394	37,870	1	600	1	1,020							396	39,490		
10		Chittoor	655	32,725	29	3,050			6	721					690	36,496	4,11,940	11
11		Kadapa	213	18,767	25	9,906			10	4,348	1	2,446			249	35,467	16,90,361	48
12		Ananthapuramu	311	44,276	14	3,820					6	8,815			331	56,911	3,58,256	6
13		Kurnool	97	4,850	64	3,551	15	1,418	5	1,787	5	11,823	1	59,573	187	83,002	27,98,040	34
Total			2,585	1,60,457	622	38,419	105	6,179	58	13,844	20	29,160	11	75,906	3,401	3,23,965	97,92,914	30

Source: Department of Fisheries, Government of Andhra Pradesh

District wise details of lakes, ponds and Reservoir

State: Andhra Pradesh Year: 2021-22

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Andhra Pradesh	Srikakulam	113	2,326	140	5,576			1	985					254	8,887	12,44,325	140
2		Vizianagaram	119	3,161	105	3,466	6	190	5	1,329					235	8,146	2,84,059	35
3		Visakhapatnam	127	1,232	3	1,280			18	893	2	2,250			150	5,655	3,12,610	55
4		East Godavari	93	989	111	1,594	21	921	1	5	5	2,126	7	123	238	5,758	3,30,044	57
5		West Godavari	77	2,074	22	432							7	700	106	3,206	2,32,901	73
6		Krishna	145	2,613	49	1,448	39	1,603			1	1,700			234	7,364	7,63,367	104
7		Guntur	14	419	13	412	23	1,028			1	993	3	16,210	54	19,062	3,42,390	18
8		Prakasam	288	22,926	46	3,285			5	587	5	1,496			344	28,294	17,89,077	63
9		SPSR Nellore	394	37,870	1	600	1	1,020							396	39,490	22,49,703	57
10		Chittoor	655	32,725	29	3,049			6	721					690	36,495	4,53,134	12
11		Kadapa	213	18,767	25	9,906			10	4,348	1	2,446			249	35,467	23,37,897	66
12		Ananthapuramu	171	9,886	7	360									178	10,246	1,75,502	17
13		Kurnool	97	4,850	65	3,622	15	1,418	6	2,043	5	11,823	1	59,573	189	83,329	36,13,311	43
Total			2,506	1,39,838	616	35,030	105	6,180	52	10,911	20	22,834	18	76,606	3,317	2,91,399	1,41,28,320	48

Source: Department of Fisheries, Government of Andhra Pradesh

Annexure 5.8

District wise Estimates of Fish Provisioning Services

State: Rajasthan Year: 2015-16

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major					
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area
1	Ajmer	Ajmer	103	82	596	3,337	446	11,813	33	7,083			1	7,015	1,179	29,330	1,05,35,072	359
		Bhilwara	37	37	646	3,736	339	11,584	132	28,163	10	23,302	2	13,969	1,166	80,791	4,49,99,793	557
		Nagaur	930	398	874	2,802	223	5,991	16	2,716					2,043	11,907	11,56,000	97
		Tonk	168	168	347	1,300	103	2,597	11	2,322	3	4,600	1	21,230	633	32,217	9,89,91,007	3,073
2	Bharatpur	Bharatpur	935	605	47	106	54	2,228	11	2,325	1	1,089			1,048	6,353	82,03,225	1,291
		Karauli	273	195	142	535	74	2,640	21	6,729	1	1,241			511	11,340	1,46,23,975	1,290
		Dholpur			2	11	16	798	3	1,151	1	2,250			22	4,210	1,40,53,950	3,338
		Sawai Madhopur	71	64	55	178	8	370	11	2,666	1	1,600			146	4,878	97,99,719	2,009
3	Bikaner	Sri Ganganagar	10	9									1	50,000	11	50,009		
		Hanumangarh	40	34	5	7							1	10,000	46	10,041		
		Bikaner	14	11	1	2					2	4,300			17	4,313	75,64,032	1,754
		Churu																
4	Jaipur	Alwar	525	525	1	4	82	3,275	20	4,672	2	3,000			630	11,476	1,17,59,174	1,025
		Dausa	29	23	33	184	17	650	6	2,340	1	1,360			86	4,557	33,02,605	725
		Jaipur	1	1	67	464	43	1,192	4	1,530	1	1,250	1	9,000	117	13,437	2,68,73,718	2,000
		Sikar			21	161	9	275	1	160	1	1,400			32	1,996	4,95,000	248
		Jhunjhunu			6	48	9	315							15	363	1,57,000	433
5	Jodhpur	Jodhpur	16	11	122	733	24	704	1	300					163	1,748	13,49,000	772
		Jaisalmer			38	187	8	335	4	750					50	1,272	45,25,786	3,558
		Barmer	49	36	99	277	5	131							153	444		
		Jalor	50	43	59	253	4	85	1	135					114	516	26,72,120	5,179
		Sirohi	144	75	94	428	11	355	1	1,000					250	1,858	1,32,59,913	7,137
		Pali	3	3	71	381	12	394	4	1,100	2	2,300			92	4,178	2,74,34,186	6,566
6	Kota	Kota	371	175	224	615	30	977	3	1,212					628	2,979	51,50,379	1,729
		Baran	94	52	31	163	20	635	2	967					147	1,817	1,05,47,825	5,805
		Jhalawar	666	336	295	795	19	571	5	725	2	2,540	1	10,030	988	14,997	1,61,00,271	1,074
		Bundi	207	182	63	182	22	798	7	2,080	1	1,859			300	5,101	1,80,09,351	3,531
7	Udaipur	Rajasmand	517	441	481	1,776	95	2,734	2	530	1	1,792			1,096	7,273	26,86,348	369
		Udaipur	370	338	668	2,588	172	5,581	15	3,972			2	14,200	1,227	26,679	2,61,14,203	979
		Daungarpur	317	292	697	2,732	108	3,215	7	1,609	1	3,018			1,130	10,866	1,57,31,394	1,448
		Banswara	346	142	73	204	20	619					2	35,280	441	36,245	25,88,000	71
		Chittotgarh	627	469	349	1,330	74	2,785	25	6,159	4	7,250	1	19,600	1,080	37,593	5,32,53,416	1,417
Total			6,913	4,747	6,207	25,519	2,047	63,647	346	82,396	35	64,151	13	1,90,324	15,561	4,30,784	45,19,36,462	1,049

Nil Area for Churu.

Source: Department of Fisheries, Rajasthan

District wise Estimates of Fish Provisioning Services

State: Rajasthan Year: 2016-17

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Ajmer	Ajmer	103	82	596	3,337	446	11,813	33	7,083			1	7,015	1,179	29,330	3,52,36,608	1,201
		Bhilwara	37	37	646	3,736	339	11,584	132	28,163	10	23,302	2	13,969	1,166	80,791	4,93,57,161	611
		Nagaur	930	398	874	2,802	223	5,991	16	2,716					2,043	11,907	6,55,286	55
		Tonk	168	168	347	1,300	103	2,597	11	2,322	3	4,600	1	21,230	633	32,217	11,57,93,898	3,594
2	Bharatpur	Bharatpur	935	605	47	106	54	2,228	11	2,325	1	1,089			1,048	6,353	92,39,612	1,454
		Karauli	273	195	142	535	74	2,640	21	6,729	1	1,241			511	11,340	1,60,94,031	1,419
		Dholpur			2	11	16	798	3	1,151	1	2,250			22	4,210	1,32,55,578	3,149
		Sawai Madhopur	71	64	55	178	8	370	11	2,666	1	1,600			146	4,878	46,38,606	951
3	Bikaner	Sri Ganganagar	10	9									1	50,000	11	50,009		
		Hanumangarh	40	34	5	7							1	10,000	46	10,041		
		Bikaner	14	11	1	2					2	4,300			17	4,313	84,71,716	1,964
		Churu#																
4	Jaipur	Alwar	525	525	1	4	82	3,275	20	4,672	2	3,000			630	11,476	1,51,84,920	1,323
		Dausa	29	23	33	184	17	650	6	2,340	1	1,360			86	4,557	45,46,398	998
		Jaipur	1	1	67	464	43	1,192	4	1,530	1	1,250	1	9,000	117	13,437	2,75,39,710	2,050
		Sikar			21	161	9	275	1	160	1	1,400			32	1,996	19,42,725	973
		Jhunjhunu			6	48	9	315							15	363	1,57,000	433
5	Jodhpur	Jodhpur	16	11	122	733	24	704	1	300					163	1,748	20,72,675	1,186
		Jaisalmar			38	187	8	335	4	750					50	1,272	54,51,788	4,286
		Barmer	49	36	99	277	5	131							153	444		
		Jalor	50	43	59	253	4	85	1	135					114	516	21,44,234	4,155
		Sirohi	144	75	94	428	11	355	1	1,000					250	1,858	1,81,36,415	9,761
		Pali	3	3	71	381	12	394	4	1,100	2	2,300			92	4,178	3,30,44,019	7,909
6	Kota	Kota	371	175	224	615	30	977	3	1,212					628	2,979	54,80,204	1,840
		Baran	94	52	31	163	20	635	2	967					147	1,817	1,30,31,559	7,172
		Jhalawar	666	336	295	795	19	571	5	725	2	2,540	1	10,030	988	14,997	2,28,26,312	1,522
		Bundi	207	182	63	182	22	798	7	2,080	1	1,859			300	5,101	4,93,23,415	9,669
7	Udaipur	Rajasmad	517	441	481	1,776	95	2,734	2	530	1	1,792			1,096	7,273	38,48,657	529
		Udaipur	370	338	668	2,588	172	5,581	15	3,972			2	14,200	1,227	26,679	2,71,54,682	1,018
		Daungarpur	317	292	697	2,732	108	3,215	7	1,609	1	3,018			1,130	10,866	2,16,90,343	1,996
		Banswara	346	142	73	204	20	619					2	35,280	441	36,245	24,58,000	68
		Chittotgarh	627	469	349	1,330	74	2,785	25	6,159	4	7,250	1	19,600	1,080	37,593	7,04,62,857	1,874
Total			6,913	4,747	6,207	25,519	2,047	63,647	346	82,396	35	64,151	13	1,90,324	15,561	4,30,784	57,92,38,409	1,345

Nil Area for Churu.

Source: Department of Fisheries, Rajasthan

Annexure 5.10

District wise Estimates of Fish Provisioning Services

State: Rajasthan Year: 2017-18

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major					
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	(Rs.)	(Rs./Hectare)
1	Ajmer	Ajmer	103	82	596	3,337	446	11,813	33	7,083			1	7,015	1,179	29,330	2,94,84,693	1,005
		Bhilwara	37	37	646	3,736	339	11,584	132	28,163	10	23,302	2	13,969	1,166	80,791	5,25,33,617	650
		Nagaur	930	398	874	2,802	223	5,991	16	2,716					2,043	11,907	7,36,280	62
		Tonk	168	168	347	1,300	103	2,597	11	2,322	3	4,600	1	21,230	633	32,217	10,81,57,419	3,357
2	Bharatpur	Bharatpur	935	605	47	106	54	2,228	11	2,325	1	1,089			1,048	6,353	4,12,000	65
		Karauli	273	195	142	535	74	2,640	21	6,729	1	1,241			511	11,340	10,66,71,342	9,407
		Dholpur			2	11	16	798	3	1,151	1	2,250			22	4,210	1,59,31,207	3,784
		Sawai Madhopur	71	64	55	178	8	370	11	2,666	1	1,600			146	4,878	58,83,350	1,206
3	Bikaner	Sri Ganganagar	10	9									1	50,000	11	50,009		
		Hanumangarh	40	34	5	7							1	10,000	46	10,041		
		Bikaner	14	11	1	2					2	4,300			17	4,313	94,88,322	2,200
		Churu#																
4	Jaipur	Alwar	525	525	1	4	82	3,275	20	4,672	2	3,000			630	11,476	1,37,34,296	1,197
		Dausa	29	23	33	184	17	650	6	2,340	1	1,360			86	4,557	2,98,68,725	6,554
		Jaipur	1	1	67	464	43	1,192	4	1,530	1	1,250	1	9,000	117	13,437	2,81,83,488	2,097
		Sikar			21	161	9	275	1	160	1	1,400			32	1,996	2,73,000	137
		Jhunjhunu			6	48	9	315							15	363	2,82,000	777
5	Jodhpur	Jodhpur	16	11	122	733	24	704	1	300					163	1,748	24,48,866	1,401
		Jaisalmar			38	187	8	335	4	750					50	1,272	30,16,065	2,371
		Barmer	49	36	99	277	5	131							153	444		
		Jalor	50	43	59	253	4	85	1	135					114	516	24,48,422	4,745
		Sirohi	144	75	94	428	11	355	1	1,000					250	1,858	1,96,41,745	10,571
		Pali	3	3	71	381	12	394	4	1,100	2	2,300			92	4,178	3,49,31,893	8,361
6	Kota	Kota	371	175	224	615	30	977	3	1,212					628	2,979	51,13,204	1,716
		Baran	94	52	31	163	20	635	2	967					147	1,817	1,12,73,588	6,205
		Jhalawar	666	336	295	795	19	571	5	725	2	2,540	1	10,030	988	14,997	2,80,32,786	1,869
		Bundi	207	182	63	182	22	798	7	2,080	1	1,859			300	5,101	4,88,19,790	9,571
7	Udaipur	Rajasmand	517	441	481	1,776	95	2,734	2	530	1	1,792			1,096	7,273	1,24,62,391	1,714
		Udaipur	370	338	668	2,588	172	5,581	15	3,972			2	14,200	1,227	26,679	5,33,92,029	2,001
		Daungarpur	317	292	697	2,732	108	3,215	7	1,609	1	3,018			1,130	10,866	2,38,97,745	2,199
		Banswara	346	142	73	204	20	619					2	35,280	441	36,245	35,86,900	99
		Chittotgarh	627	469	349	1,330	74	2,785	25	6,159	4	7,250	1	19,600	1,080	37,593	6,96,63,819	1,853
Total			6,913	4,747	6,207	25,519	2,047	63,647	346	82,396	35	64,151	13	1,90,324	15,561	4,30,784	72,03,68,982	1,672

Nil Area for Churu.

Source: Department of Fisheries, Rajasthan

Annexure 5.11

District wise Estimates of Fish Provisioning Services

State: Rajasthan Year: 2018-19

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major					
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	(Rs.)	(Rs./Hectare)
1	Ajmer	Ajmer	103	82	596	3,337	446	11,813	33	7,083			1	7,015	1,179	29,330	2,55,83,507	872
		Bhilwara	37	37	646	3,736	339	11,584	132	28,163	10	23,302	2	13,969	1,166	80,791	5,47,80,412	678
		Nagaur	930	398	874	2,802	223	5,991	16	2,716					2,043	11,907	31,000	3
		Tonk	168	168	347	1,300	103	2,597	11	2,322	3	4,600	1	21,230	633	32,217	6,12,55,883	1,901
2	Bharatpur	Bharatpur	935	605	47	106	54	2,228	11	2,325	1	1,089			1,048	6,353	75,01,358	1,181
		Karauli	273	195	142	535	74	2,640	21	6,729	1	1,241			511	11,340	1,76,81,335	1,559
		Dholpur			2	11	16	798	3	1,151	1	2,250			22	4,210	1,57,25,066	3,735
		Sawai Madhopur	71	64	55	178	8	370	11	2,666	1	1,600			146	4,878	73,27,778	1,502
3	Bikaner	Sri Ganganagar	10	9									1	50,000	11	50,009		
		Hanumangarh	40	34	5	7							1	10,000	46	10,041		
		Bikaner	14	11	1	2					2	4,300			17	4,313	1,12,02,786	2,597
		Churu#																
4	Jaipur	Alwar	525	525	1	4	82	3,275	20	4,672	2	3,000			630	11,476	1,12,47,030	980
		Dausa	29	23	33	184	17	650	6	2,340	1	1,360			86	4,557	1,07,98,593	2,370
		Jaipur	1	1	67	464	43	1,192	4	1,530	1	1,250	1	9,000	117	13,437	2,31,05,880	1,720
		Sikar			21	161	9	275	1	160	1	1,400			32	1,996	24,06,999	1,206
		Jhunjhunu			6	48	9	315							15	363	3,41,000	939
5	Jodhpur	Jodhpur	16	11	122	733	24	704	1	300					163	1,748	22,71,209	1,299
		Jaisalmar			38	187	8	335	4	750					50	1,272	33,77,993	2,656
		Barmer	49	36	99	277	5	131							153	444		
		Jalor	50	43	59	253	4	85	1	135					114	516	27,42,432	5,315
		Sirohi	144	75	94	428	11	355	1	1,000					250	1,858	2,53,92,599	13,667
6	Kota	Pali	3	3	71	381	12	394	4	1,100	2	2,300			92	4,178	3,83,02,313	9,168
		Kota	371	175	224	615	30	977	3	1,212					628	2,979	42,04,318	1,411
		Baran	94	52	31	163	20	635	2	967					147	1,817	1,22,22,119	6,727
		Jhalawar	666	336	295	795	19	571	5	725	2	2,540	1	10,030	988	14,997	2,50,10,172	1,668
		Bundi	207	182	63	182	22	798	7	2,080	1	1,859			300	5,101	2,54,07,873	4,981
7	Udaipur	Rajasmand	517	441	481	1,776	95	2,734	2	530	1	1,792			1,096	7,273	1,31,25,276	1,805
		Udaipur	370	338	668	2,588	172	5,581	15	3,972			2	14,200	1,227	26,679	5,78,18,902	2,167
		Daungarpur	317	292	697	2,732	108	3,215	7	1,609	1	3,018			1,130	10,866	2,62,75,270	2,418
		Banswara	346	142	73	204	20	619					2	35,280	441	36,245	32,59,151	90
		Chittotgarh	627	469	349	1,330	74	2,785	25	6,159	4	7,250	1	19,600	1,080	37,593	9,01,27,449	2,397
Total			6,913	4,747	6,207	25,519	2,047	63,647	346	82,396	35	64,151	13	1,90,324	15,561	4,30,784	57,85,25,703	1,343

Nil Area for Churu.

Source: Department of Fisheries, Rajasthan

Annexure 5.12

District wise Estimates of Fish Provisioning Services

State: Rajasthan Year: 2019-20

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major					
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	(Rs.)	(Rs./Hectare)
1	Ajmer	Ajmer	103	82	596	3,337	446	11,813	33	7,083			1	7,015	1,179	29,330	3,32,54,067	1,134
		Bhilwara	37	37	646	3,736	339	11,584	132	28,163	10	23,302	2	13,969	1,166	80,791	5,99,26,318	742
		Nagaur	930	398	874	2,802	223	5,991	16	2,716					2,043	11,907	4,51,786	38
		Tonk	168	168	347	1,300	103	2,597	11	2,322	3	4,600	1	21,230	633	32,217	8,07,59,740	2,507
2	Bharatpur	Bharatpur	935	605	47	106	54	2,228	11	2,325	1	1,089			1,048	6,353	84,01,520	1,322
		Karauli	273	195	142	535	74	2,640	21	6,729	1	1,241			511	11,340	1,70,47,775	1,503
		Dholpur			2	11	16	798	3	1,151	1	2,250			22	4,210	1,76,11,954	4,183
		Sawai Madhopur	71	64	55	178	8	370	11	2,666	1	1,600			146	4,878	60,03,548	1,231
3	Bikaner	Sri Ganganagar	10	9									1	50,000	11	50,009		
		Hanumangarh	40	34	5	7							1	10,000	46	10,041		
		Bikaner	14	11	1	2					2	4,300			17	4,313	1,00,00,008	2,319
		Churu																
4	Jaipur	Alwar	525	525	1	4	82	3,275	20	4,672	2	3,000			630	11,476	1,09,18,123	951
		Dausa	29	23	33	184	17	650	6	2,340	1	1,360			86	4,557	1,15,25,824	2,529
		Jaipur	1	1	67	464	43	1,192	4	1,530	1	1,250	1	9,000	117	13,437	2,81,90,912	2,098
		Sikar			21	161	9	275	1	160	1	1,400			32	1,996	32,39,524	1,623
		Jhunjhunu			6	48	9	315							15	363	2,53,000	697
5	Jodhpur	Jodhpur	16	11	122	733	24	704	1	300					163	1,748	25,43,753	1,455
		Jaisalmar			38	187	8	335	4	750					50	1,272	36,36,036	2,859
		Barmer	49	36	99	277	5	131							153	444		
		Jalor	50	43	59	253	4	85	1	135					114	516	47,28,707	9,164
		Sirohi	144	75	94	428	11	355	1	1,000					250	1,858	1,36,08,141	7,324
6	Kota	Pali	3	3	71	381	12	394	4	1,100	2	2,300			92	4,178	5,71,71,311	13,684
		Kota	371	175	224	615	30	977	3	1,212					628	2,979	48,13,489	1,616
		Baran	94	52	31	163	20	635	2	967					147	1,817	1,45,27,414	7,995
		Jhalawar	666	336	295	795	19	571	5	725	2	2,540	1	10,030	988	14,997	3,69,22,776	2,462
		Bundi	207	182	63	182	22	798	7	2,080	1	1,859			300	5,101	3,05,30,835	5,985
7	Udaipur	Rajsamand	517	441	481	1,776	95	2,734	2	530	1	1,792			1,096	7,273	45,79,868	630
		Udaipur	370	338	668	2,588	172	5,581	15	3,972			2	14,200	1,227	26,679	6,27,13,952	2,351
		Daungarpur	317	292	697	2,732	108	3,215	7	1,609	1	3,018			1,130	10,866	2,87,23,795	2,643
		Banswara	346	142	73	204	20	619					2	35,280	441	36,245	44,00,529	121
		Chittotgarh	627	469	349	1,330	74	2,785	25	6,159	4	7,250	1	19,600	1,080	37,593	7,76,16,946	2,065
Total			6,913	4,747	6,207	25,519	2,047	63,647	346	82,396	35	64,151	13	1,90,324	15,561	4,30,784	63,41,01,651	1,472

Nil Area for Churu.

Source: Department of Fisheries, Rajasthan

Annexure 5.13

District wise Estimates of Fish Provisioning Services

State: Rajasthan Year: 2020-21

(Area in Hectare)

Sr.No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(Rs.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Ajmer	Ajmer	103	82	596	3,337	446	11,813	33	7,083			1	7,015	1,179	29,330	4,16,11,858	1,419
		Bhilwara	37	37	646	3,736	339	11,584	132	28,163	10	23,302	2	13,969	1,166	80,791	8,84,61,200	1,095
		Nagaur	930	398	874	2,802	223	5,991	16	2,716					2,043	11,907	4,10,920	35
		Tonk	168	168	347	1,300	103	2,597	11	2,322	3	4,600	1	21,230	633	32,217	3,09,38,015	960
2	Bharatpur	Bharatpur	935	605	47	106	54	2,228	11	2,325	1	1,089			1,048	6,353	94,09,702	1,481
		Karauli	273	195	142	535	74	2,640	21	6,729	1	1,241			511	11,340	1,59,73,280	1,409
		Dholpur			2	11	16	798	3	1,151	1	2,250			22	4,210	2,05,99,053	4,893
		Sawai Madhopur	71	64	55	178	8	370	11	2,666	1	1,600			146	4,878	1,69,54,768	3,476
3	Bikaner (for Churu the area was nil)	Sri Ganganagar	10	9								1	50,000	11	50,009			
		Hanumangarh	40	34	5	7							1	10,000	46	10,041		
		Bikaner	14	11	1	2					2	4,300			17	4,313	1,72,10,000	3,990
		Churu																
4	Jaipur	Alwar	525	525	1	4	82	3,275	20	4,672	2	3,000			630	11,476	1,27,52,362	1,111
		Dausa	29	23	33	184	17	650	6	2,340	1	1,360			86	4,557	1,32,49,323	2,907
		Jaipur	1	1	67	464	43	1,192	4	1,530	1	1,250	1	9,000	117	13,437	1,16,14,551	864
		Sikar			21	161	9	275	1	160	1	1,400			32	1,996	8,76,000	439
		Jhunjhunu			6	48	9	315							15	363	2,59,000	713
5	Jodhpur	Jodhpur	16	11	122	733	24	704	1	300					163	1,748	22,94,327	1,313
		Jaisalmar			38	187	8	335	4	750					50	1,272	40,72,360	3,202
		Barmer	49	36	99	277	5	131							153	444		
		Jalor	50	43	59	253	4	85	1	135					114	516	9,82,584	1,904
		Sirohi	144	75	94	428	11	355	1	1,000					250	1,858	1,30,27,319	7,011
		Pali	3	3	71	381	12	394	4	1,100	2	2,300			92	4,178	7,06,74,002	16,916
6	Kota	Kota	371	175	224	615	30	977	3	1,212					628	2,979	68,21,444	2,290
		Baran	94	52	31	163	20	635	2	967					147	1,817	1,50,41,682	8,278
		Jhalawar	666	336	295	795	19	571	5	725	2	2,540	1	10,030	988	14,997	3,53,07,660	2,354
		Bundi	207	182	63	182	22	798	7	2,080	1	1,859			300	5,101	3,88,46,216	7,615
7	Udaipur	Rajasmad	517	441	481	1,776	95	2,734	2	530	1	1,792			1,096	7,273	62,80,652	864
		Udaipur	370	338	668	2,588	172	5,581	15	3,972			2	14,200	1,227	26,679	6,62,06,889	2,482
		Daungarpur	317	292	697	2,732	108	3,215	7	1,609	1	3,018			1,130	10,866	2,91,99,408	2,687
		Banswara	346	142	73	204	20	619					2	35,280	441	36,245	43,79,290	121
		Chittotgarh	627	469	349	1,330	74	2,785	25	6,159	4	7,250	1	19,600	1,080	37,593	7,52,56,125	2,002
			6,913	4,747	6,207	25,519	2,047	63,647	346	82,396	35	64,151	13	1,90,324	15,561	4,30,784	64,87,09,990	1,506

Nil Area for Churu.

Source: Department of Fisheries, Rajasthan

District wise Estimates of Fish Provisioning Services

State: Haryana Year: 2015-16

(Area in Hectare)

Sr. No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount per acre	Rent per Hectare	
			Small		Medium		Large		Small		Medium		Major		No	Area	(RS.)	(Rs./Hectare)	
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area					
1	Haryana	Ambala	17	7	26	20	122	232							165	258	25,000	61,750	
2		Bhiwani	80	160	130		162	358							372	868	10,000	24,700	
3		Charki Dadri																	
4		Faridabad	60	50	70	90	15	49							145	189	6,500	16,055	
5		Fatehabad	95	48	270	793	32	186							397	1,026	20,000	49,400	
6		Gurugram	42	16	78	102	12	93							132	211	10,500	25,935	
7		Hisar			771	1,394									771	1,394	10,000	24,700	
8		Jhajjar	57	98	172	395	252	598							481	1,091	12,000	29,640	
9		Jind	57	60	382	403	166	267							605	730	20,000	49,400	
10		Kaithal	10	5	15	20	210	575							235	600	18,000	44,460	
11		Karnal	285	1,140	27	208	10	145							322	1,493	28,000	69,160	
12		Kurukshetra	217	410											217	410	18,000	44,460	
13		Mahendragarh	71	67	130	211	7	18							208	296	40,000	98,800	
14		Nuh	35	175	500	500	165	357							700	1,032	15,000	37,050	
15		Palwal	20	40	35	88									55	128	40,000	98,800	
16		Panchkula	38	59			1	40	15	56					54	155	35,000	86,450	
17		Panipat	42	80	62	186	46	210							150	476	12,000	29,640	
18		Rewari	210	280	50	150	40	130							300	560	19,000	46,930	
19		Rohtak	52	108	158	324	142	288							352	721	77,800	1,92,166	
20		Sirsa	260	260	320	320	500	500					1	300	1,081	1,380	18,000	44,460	
21		Sonipat	86	119	195	413	282	591							563	1,123	12,000	29,640	
22		Yamunanagar	375	364											375	364	14,000	34,580	
Total			2,109	3,545	3,391	5,966	2,164	4,635	15	56			1	300	7,680	14,503		50,132	

Source: Fisheries Department, Government of Haryana

Annexure 5.15

District wise Estimates of Fish Provisioning Services

State: Haryana Year: 2016-17

(Area in Hectare)

Sr. No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount per acre	Rent per Hectare	
			Small		Medium		Large		Small		Medium		Major		No	Area	(RS.)	(Rs./ Hectare)	
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area					
1	Haryana	Ambala	15	5	33	24	182	401							230	430	30,000	74,100	
2		Bhiwani	190	290	420		200	475								810	1,160	10,000	24,700
3		Charki Dadri																	
4		Faridabad	65	60	75	95	20	45							160	200	7,000	17,290	
5		Fatehabad	97	49	250	762	32	186							379	996	22,000	54,340	
6		Gurugram	26	14	65	135	14	94							105	243	10,900	26,923	
7		Hisar			808	1,511									808	1,511	10,000	24,700	
8		Jhajjar	63	108	176	404	258	605							497	1,117	12,000	29,640	
9		Jind	41	45	366	387	149	251							556	683	23,000	56,810	
10		Kaithal	12	5	20	25	238	686							270	716	18,000	44,460	
11		Karnal	285	1,140	27	208	10	145							322	1,493	28,000	69,160	
12		Kurukshetra	204	395											204	395	18,000	44,460	
13		Mahendragarh	93	85	145	261	8	21							246	367	42,000	1,03,740	
14		Nuh	30	15	485	485	165	357							680	857	16,000	39,520	
15		Palwal	30	60	50	125									80	185	45,000	1,11,150	
16		Panchkula	38	68			1	40	10	47					49	108	42,000	1,03,740	
17		Panipat	44	81	62	186	46	210							152	477	15,000	37,050	
18		Rewari	260	300	100	180	28	152							388	632	12,000	29,640	
19		Rohtak	64	117	193	352	172	313							429	783	55,800	1,37,826	
20		Sirsa	251	251	350	350	620	620					1	300	1,222	1,221	20,000	49,400	
21		Sonipat	86	170	200	401	286	571							572	1,142	15,000	37,050	
22		Yamunanagar	405	378											405	378	14,500	35,815	
Total			2,299	3,636	3,825	6,286	2,429	5,171	10	47			1	300	8,564	15,093		49,734	

Source: Fisheries Department, Government of Haryana

District wise Estimates of Fish Provisioning Services

State: Haryana Year: 2017-18

(Area in Hectare)

Sr. No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount per acre (RS.)	Rent per Hectare (Rs./ Hectare)	
			Small		Medium		Large		Small		Medium		Major		No	Area			
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area					
1	Haryana	Ambala	23	9	33	22	162	336							218	367	35,000	86,450	
2		Bhiwani	234	260	350		150	444							734	1,184	15,000	37,050	
3		Charki Dadri																	
4		Faridabad	70	65	87	100	23	55							180	220	6,500	16,055	
5		Fatehabad	99	49	217	608	32	186							348	843	23,000	56,810	
6		Gurugram	21	20	61	152	18	98							100	270	11,300	27,911	
7		Hisar			775	1,692									775	1,692	10,000	24,700	
8		Jhajjar	76	99	168	391	253	517							497	1,007	15,000	37,050	
9		Jind	52	56	378	399	160	262							590	717	25,000	61,750	
10		Kaithal	15	6	27	28	261	768							303	802	18,800	46,436	
11		Karnal	285	1,140	27	208	10	145							322	1,493	28,500	70,395	
12		Kurukshetra	221	450											221	450	20,000	49,400	
13		Mahendragarh	103	94	157	273	9	24							269	391	44,000	1,08,680	
14		Nuh	66	33	550	550	259	539							875	1,122	17,000	41,990	
15		Palwal	40	80	52	130									92	210	50,000	1,23,500	
16		Panchkula	38	68			1	40	22	47					61	155	45,000	1,11,150	
17		Panipat	47	82	65	228	51	310							163	619	16,000	39,520	
18		Rewari	290	350	80	200	32	221							402	771	15,000	37,050	
19		Rohtak	72	114	218	342	195	304							485	760	19,300	47,671	
20		Sirsa	270	270	380	380	671	671					1	300	1,322	1,621	20,000	49,400	
21		Sonipat	79	152	183	355	262	506							524	1,013	15,000	37,050	
22		Yamunanagar	395	371											395	371	15,000	37,050	
Total			2,496	3,767	3,808	6,539	2,549	5,424	22	47			1	300	8,876	16,077		48,257	

Source: Fisheries Department, Government of Haryana

District wise Estimates of Fish Provisioning Services

State: Haryana Year: 2018-19

(Area in Hectare)

Sr. No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount per acre	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(RS.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Haryana	Ambala	38	11	47	36	205	335						290	382	35,000	86,450	
2		Bhiwani	250	300	280		117	311						647	961	15,000	37,050	
3		Charki Dadri	2	2	6	16	2	6						10	24	24,000	59,280	
4		Faridabad	90	90	120	180	40	130						250	400	7,000	17,290	
5		Fatehabad	87	48	313	785	32	186						432	1,019	25,000	61,750	
6		Gurugram	18	22	54	136	18	98						90	256	11,500	28,405	
7		Hisar			724	1,600								724	1,600	15,000	37,050	
8		Jhajjar	81	125	171	407	243	598						495	1,130	20,000	49,400	
9		Jind	62	72	389	439	177	293						628	804	25,000	61,750	
10		Kaithal	16	6	25	27	252	757						293	790	19,000	46,930	
11		Karnal	287	1,150	27	208	10	145						324	1,503	29,000	71,630	
12		Kurukshetra	213	410										213	410	20,000	49,400	
13		Mahendragarh	115	106	190	295	9	24						314	425	46,000	1,13,620	
14		Nuh	60	30	535	499	230	396						825	925	19,000	46,930	
15		Palwal	45	90	55	138								100	228	55,000	1,35,850	
16		Panchkula	50	68			1	40	7	48				58	156	47,000	1,16,090	
17		Panipat	43	75	61	214	48	283						152	571	22,000	54,340	
18		Rewari	250	320	85	150	38	170						373	640	15,000	37,050	
19		Rohtak	77	118	231	354	207	315						515	787	66,400	1,64,008	
20		Sirsa	330	330	320	320	700	700					1	300	1,351	1,650	22,000	54,340
21		Sonipat	87	154	201	360	288	512						576	1,026	20,000	49,400	
22		Yamunanagar	350	323										350	323	16,000	39,520	
Total			2,551	3,850	3,834	6,514	2,617	5,298	7	48			1	300	9,010	16,010	59,626	

Source: Fisheries Department, Government of Haryana

District wise Estimates of Fish Provisioning Services

State: Haryana Year: 2019-20

(Area in Hectare)

Sr. No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount per acre	Rent per Hectare
			Small		Medium		Large		Small		Medium		Major		No	Area	(RS.)	(Rs./Hectare)
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area				
1	Haryana	Ambala	36	11	44	35	191	337							271	383	35,000	86,450
2		Bhiwani	200	290	170		114	330							484	980	20,000	49,400
3		Charki Dadri	11	11	4	10	4	20							19	40	21,500	53,105
4		Faridabad	85	95	90	160	25	68							200	323	7,500	18,525
5		Fatehabad	98	49	221	577	32	186							351	812	27,000	66,690
6		Gurugram	21	19	61	127	22	128							104	274	12,200	30,134
7		Hisar			1,168	1,911									1,168	1,911	15,000	37,050
8		Jhajjar	75	130	92	393	198	658							365	1,181	20,000	49,400
9		Jind	60	67	387	433	175	289							622	789	26,000	64,220
10		Kaithal	16	6	19	19	232	685							267	710	18,000	44,460
11		Karnal	290	1,160	27	208	10	145							327	1,513	30,000	74,100
12		Kurukshetra	219	412											219	412	22,000	54,340
13		Mahendragarh	55	46	80	132	6	15							141	193	47,000	1,16,090
14		Nuh	74	37	595	595	298	456							967	1,088	20,000	49,400
15		Palwal	55	110	60	150									115	260	60,000	1,48,200
16		Panchkula	60	73			1	40	9	50					70	163	48,000	1,18,560
17		Panipat	45	76	63	220	51	307							159	603	17,000	41,990
18		Rewari	250	320	85	150	43	180							378	650	20,000	49,400
19		Rohtak	73	117	222	352	198	313							493	783	57,000	1,40,790
20		Sirsa	260	260	280	280	496	496					1	300	1,037	1,336	25,000	61,750
21		Sonipat	85	156	197	365	282	521							564	1,042	20,000	49,400
22		Yamunanagar	389	376											389	376	17,000	41,990
Total			2,457	3,820	3,865	6,478	2,378	5,173	9	50			1	300	8,710	15,821		60,001

Source: Fisheries Department, Government of Haryana

District wise Estimates of Fish Provisioning Services

State: Haryana Year: 2019-20

(Area in Hectare)

Sr. No.	Region	District	Tanks/ponds/lakes						Reservoir						Total Resource Area		Rent/Lease Amount per acre (RS.)	Rent per Hectare (Rs./Hectare)
			Small		Medium		Large		Small		Medium		Major					
			No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area	No	Area
1	Haryana	Ambala	39	13	48	38	204	349							291	400	35,000	86,450
2		Bhiwani	180	200	200		205	364							585	1,034	20,000	49,400
3		Charki Dadri	30	23	31	79	21	92					1	58	83	252	27,000	66,690
4		Faridabad	95	90	100	150	55	190							250	430	9,500	23,465
5		Fatehabad	105	54	223	585	32	186							360	825	30,000	74,100
6		Gurugram	24	18	53	102	24	156							101	276	14,000	34,580
7		Hisar			813	1,602									813	1,602	15,000	37,050
8		Jhajjar	102	137	138	422	369	729							609	1,288	25,000	61,750
9		Jind	62	67	389	433	178	287							629	787	28,000	69,160
10		Kaithal	12	5	17	17	231	682							260	704	19,500	48,165
11		Karnal	298	1,208	27	208	10	145							335	1,561	35,000	86,450
12		Kurukshetra	239	447											239	447	25,000	61,750
13		Mahendragarh	46	34	75	112	5	11							126	157	50,000	1,23,500
14		Nuh	35	18	200	200	126	373							361	591	22,000	54,340
15		Palwal	65	130	75	188									140	318	65,000	1,60,550
16		Panchkula	67	82			1	40	9	15					77	136	50,000	1,23,500
17		Panipat	51	90	66	231	54	229							171	550	37,000	91,390
18		Rewari	240	300	70	120	40	179							350	599	25,000	61,750
19		Rohtak	80	113	242	338	217	301							539	752	49,800	1,23,006
20		Sirsa	330	330	360	360	710	710					1	300	1,401	1,700	25,000	61,750
21		Sonipat	83	158	193	369	274	527							550	1,054	25,000	61,750
22		Yamunanagar	344	362											344	362	18,500	45,695
Total			2,527	3,878	3,320	6,024	2,756	5,549	9	15			2	358	8,614	15,824		66,898

Source: Fisheries Department, Government of Haryana

Note on the Conceptual Differences in the Definition of “Forests” across India’s Official Data Sources

1. The terms ‘Forest Cover’ and ‘Forest Area’ are the two most commonly used terms to describe the extent of the forest. Both the terms, ‘Forest Cover’ and ‘Forest Area’ denote extent of the forests with different meanings. The term ‘Forest Cover’ is used to define the expanse of forest resources in a region primarily based on the tree canopy density, while the term ‘Forest Area’ is used to denote the areas having legal standing, i.e., recorded as forests in government records or maintained as forests. In addition, there exists a variation in the definition followed by different Indian official agencies in the measurement and description of forests. These differences have been elucidated in the following paragraphs.

Forest Cover

2. **Definition of ‘Forest Cover’ as followed by the Forest Survey of India (FSI)¹:** It includes all **lands having trees more than one hectare in area with tree canopy density of more than 10 %** irrespective of ownership, legal status of the land and species composition of trees. The assessment of the ‘Forest Cover’ includes tree orchards, bamboos, palms etc. within recorded forests, on other government lands, private, community or institutional lands.

3. Forest cover is classified by FSI in terms of canopy density classes as follows:

Class	Description
Very Dense Forest	All lands with tree canopy density of 70% and above
Moderately Dense Forest	All lands with tree canopy density of 40 % and more but less than 70%
Open Forest	All lands with tree canopy density of 10% and more but less than 40%
Scrub	Forest lands with canopy density less than 10%
Non-Forest	Lands not included in any of the above classes. (includes water)

4. **Definition of ‘Forest Cover’ as followed by Indian Space Research Organization (ISRO), National Remote Sensing Centre (NRSC)²:** The category, Forest, in the Land Use Land Cover (LULC) mapping on 1:50,000 scale project is adopted mainly from the UN-FAO definition of forests and includes all patches with **canopy density of more than 10% greater than 0.5 hectares in size, which are not categorized under any other predominant land use**. Thus, forests are determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m. The ‘Forest’ definition does not include trees/woody vegetation under orchards/plantation crops. The definition was

¹ <https://fsi.nic.in/isfr19/vol1/chapter2.pdf>

² <https://bhuvan-app1.nrsc.gov.in/2dresources/thematic/2LULC/lulc1112.pdf>

standardized to become amenable for delineation of forest cover class by using Remote Sensing data as part of the Land Use/Land Cover Classification system adopted. Forests are further categorized in the LULC as:

- (i) Evergreen/Semi-evergreen Forests
- (ii) Deciduous Forests
- (iii) Forest Plantation
- (iv) Scrub Forests
- (v) Littoral/ Swamp/Mangrove Forests

Forest Area

5. **Definition of 'Forest' in Land Use Statistics (LUS)**³: The Ministry of Agriculture and Farmer's Welfare (MoAFW) compiles and releases Land Use Statistics according to a nine-fold classification. In this dataset, 'Forest' includes all land classified either as forest under any legal enactment, or administered as forest, whether State-owned or private, and whether wooded or maintained as potential forest land. The area of crops raised in the forest and grazinglands or areas open for grazing within the forests remain included under the 'Forest Area'.

6. **'Recorded Forest Area'** defined by Forest Survey of India (FSI): It is defined as "all such lands which have been notified as forest under any Government Act or Rules or recorded as 'forests' in the Government Records". Recorded forest areas largely consist of areas designated as Reserved Forest (RF) or Protected Forests (PF) under the provisions of Indian Forest Act, 1927 or its counterpart State Acts. Besides these, the recorded forest area may include all such areas, which have been recorded as forests under any State Act or local laws or any revenue records.

7. In terms of globally accepted standards, the extent of forests is denoted by **'Forest Area' by the Food and Agriculture Organization (FAO)**⁵. It is defined as "land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ." It does not include land that is predominantly under agricultural or urban land use.

³ https://eands.dacnet.nic.in/LUS_2013-14/Covrpage.pdf

⁴ <https://fsi.nic.in/isfr19/vol1/chapter1.pdf>

⁵ <http://www.fao.org/3/am665e/am665e.pdf>

Annexure 6.2

State wise forest cover in India

(Area in Sq. Kms)

S. No.	State/UT	VDF		MDF		OF		Total Forest Cover		Scrub		
		2017-18	2019-20	2017-18	2019-20	2017-18	2019-20	2017-18	2019-20	2017-18	2019-20	
1	Andhra Pradesh	1,994	1,994	13,938	11,929	13,205	13,861	29,137	29,784	8,255	8,276	
2	Arunachal Pradesh	21,095	21,058	30,557	30,176	15,036	15,197	66,688	66,431	229	797	
3	Assam	2,795	3,017	10,279	9,991	15,253	15,304	28,327	28,312	173	228	
4	Bihar	333	333	3,280	3,286	3,693	3,762	7,306	7,381	250	236	
5	Chhattisgarh	7,068	7,068	32,198	32,279	16,345	16,370	55,611	55,717	610	615	
6	Delhi	7	7	56	57	132	132	195	195	0	0	
7	Goa	538	538	576	576	1,123	1,130	2,237	2,244	0	0	
8	Gujarat	378	378	5,092	5,032	9,387	9,516	14,857	14,926	2,994	2,828	
9	Haryana	28	28	451	445	1,123	1,130	1,602	1,603	154	159	
10	Himachal Pradesh	3,113	3,163	7,126	7,100	5,195	5,180	15,434	15,443	315	322	
11	Jammu & Kashmir	UT of J&K	4,203	4,155	7,952	8,117	8,967	9,115	21,122	21,387	250	284
		UT of Ladakh	78	2	660	512	1,752	1,758	2,490	2,272	298	279
		Total	4,281	4,157	8,612	8,629	10,719	10,873	23,612	23,659	548	563
12	Jharkhand	2,603	2,601	9,687	9,689	11,321	11,431	23,611	23,721	688	584	
13	Karnataka	4,501	4,533	21,048	20,985	13,026	13,212	38,575	38,730	4,484	4,611	
14	Kerala	1,935	1,944	9,508	9,472	9,701	9,837	21,144	21,253	13	30	
15	Madhya Pradesh	6,676	6,665	34,341	34,209	36,465	36,619	77,482	77,493	6,002	5,457	
16	Maharashtra	8,721	8,734	20,572	20,589	21,485	21,475	50,778	50,798	4,256	4,247	
17	Manipur	905	905	6,386	6,228	9,556	9,465	16,847	16,598	1,181	1,215	
18	Meghalaya	489	560	9,267	9,160	7,363	7,326	17,119	17,046	600	663	
19	Mizoram	157	157	5,801	5,715	12,048	11,948	18,006	17,820	1	1	
20	Nagaland	1,273	1,272	4,534	4,449	6,679	6,530	12,486	12,251	635	824	

S. No.	State/UT	VDF		MDF		OF		Total Forest Cover		Scrub	
		2017-18	2019-20	2017-18	2019-20	2017-18	2019-20	2017-18	2019-20	2017-18	2019-20
21	Odisha	6,970	7,213	21,552	20,995	23,097	23,948	51,619	52,156	4,327	4,924
22	Punjab	8	11	801	793	1,040	1,043	1,849	1,847	33	34
23	Rajasthan	78	78	4,342	4,369	12,210	12,208	16,630	16,655	4,760	4,809
24	Sikkim	1,102	1,102	1,552	1,551	688	688	3,342	3,341	307	296
25	Tamil Nadu	3,605	3,593	11,030	11,034	11,729	11,792	26,364	26,419	715	758
26	Telangana	1,608	1,624	8,787	9,119	10,187	10,471	20,582	21,214	3,615	2,911
27	Tripura	654	647	5,236	5,212	1,836	1,863	7,726	7,722	29	33
28	Uttar Pradesh	2,617	2,627	4,080	4,029	8,109	8,162	14,806	14,818	587	563
29	Uttarakhand	5,047	5,055	12,805	12,768	6,451	6,482	24,303	24,305	383	392
30	West Bengal	3,019	3,037	4,160	4,208	9,723	9,587	16,902	16,832	146	156
31	A & N Islands	5,678	5,678	684	683	381	383	6,743	6,744	1	1
32	Chandigarh	1.4	1.4	14.2	13.5	6.4	8.0	22.0	22.9	0.1	0.4
33	Dadra & Nagar Haveli	0	1.4	80	85.6	127.0	140.8	207.0	227.8	5.0	4.9
34	Daman & Diu	1.4		5.7		13.4		20.5		0.2	
35	Lakshadweep	0	0	16.1	16.1	11.0	11.0	27.1	27.1	0	0
36	Puducherry	0	0	17.7	17.5	34.8	35.8	52.4	53.3	0	0
Total		99,278	99,779	3,08,472	3,06,890	3,04,499	3,07,120	7,12,249	7,13,789	46,297	46,539

Source: India State of Forest Report, FSI, MoEFCC

Annexure 6.3

State wise recorded forest area, type of protection and growing stock, 2019-20

States/UTs	Geographical Area (GA)	Recorded Forest Area (RFA)		Type of Protection			Growing Stock		
				Reserved Forests (RF)	Protected Forest (PF)	Unclassed Forests**	Volume of Growing Stock		Density of growing stock
	sq km	sq km	% of GA	sq km	sq km		million cum	% share	cum/ha
Andhra Pradesh	1,62,968	37,258	22.86	31,959	5,069	230	115.71	2.64	31.06
Arunachal Pradesh	83,743	51,540	61.55	12,371	11,857	27,312	418.99	9.55	81.29
Assam	78,438	26,836	34.21	17,864	0	8,972	112.68	2.57	41.99
Bihar	94,163	7,442	7.90	693	6,183	566	30.52	0.70	41.01
Chhattisgarh	1,35,192	59,816	44.25	25,897	24,036	9,883	389.64	8.88	65.14
Delhi	1,483	103	6.95	78	25	0	0.51	0.01	49.51
Goa	3,702	1,271	34.33	119	755	397	12.87	0.29	101.26
Gujarat	1,96,244	21,870	11.14	14,574	2,898	4,398	51.22	1.17	23.42
Haryana	44,212	1,559	3.53	249	1,158	152	4.31	0.10	27.65
Himachal Pradesh	55,673	37,948	68.16	1,883	28,887	7,178	345.62	7.88	91.08
Jharkhand	79,716	25,118	31.51	4,500	18,922	1,696	100.80	2.30	40.13
Karnataka	1,91,791	38,284	19.96	28,690	3,931	5,663	302.14	6.89	78.92
Kerala	38,852	11,522	29.66	11,522	0	0	160.53	3.66	139.32
Madhya Pradesh	3,08,252	94,689	30.72	61,886	31,098	1,705	374.44	8.53	39.54
Maharashtra	3,07,713	61,952	20.13	50,865	6,433	4,654	235.50	5.37	38.01
Manipur	22,327	17,418	78.01	984	3,254	13,180	54.99	1.25	31.57
Meghalaya	22,429	9,496	42.34	1,113	12	8,371	35.54	0.81	37.43
Mizoram	21,081	7,479	35.48	4,499	1,823	1,157	28.87	0.66	38.60
Nagaland	16,579	8,623	52.01	234	0	8,389	30.28	0.69	35.12
Odisha	1,55,707	61,204	39.31	36,049	25,133	22	276.78	6.31	45.22
Punjab	50,362	3,084	6.12	44	1,137	1,903	12.61	0.29	40.89
Rajasthan	3,42,239	32,863	9.60	12,176	18,543	2,144	26.56	0.61	8.08
Sikkim	7,096	5,841	82.31	5,452	389	0	33.91	0.77	58.06
Tamil Nadu	1,30,060	23,188	17.83	20,523	1,053	1,612	92.27	2.10	39.79

States/UTs	Geographical Area (GA)	Recorded Forest Area (RFA)		Type of Protection			Growing Stock		
				Reserved Forests (RF)	Protected Forest (PF)	Unclassed Forests**	Volume of Growing Stock		Density of growing stock
	sq km	sq km	% of GA		sq km		million cum	% share	cum/ha
Telangana	1,12,077	27,688	24.70	25,800	1,592	296	80.20	1.83	28.97
Tripura	10,486	6,294	60.02	3,588	2	2,704	23.13	0.53	36.75
Uttar Pradesh	2,40,928	17,384	7.22	11,560	296	5,528	104.39	2.38	60.05
Uttarakhand	53,483	38,000	71.05	26,547	9,885	1,568	401.01	9.14	105.53
West Bengal	88,752	11,879	13.38	7,054	3,772	1,053	61.19	1.39	51.51
Andaman and Nicobar Islands	8,249	7,171	86.93	5,613	1,558	0	121.72	2.77	169.74
Chandigarh	114	35	30.70	32	0	3	0.21	0.00	60.00
Dadra and Nagar Haveli & Daman and Diu	602	214	35.55	203	5	6	0.45	0.01	21.03
Jammu & Kashmir (Shapefile Area* 54624)	2,22,236	20,199	9.09	17,648	2,551	0	348.35	7.94	172.46
Ladakh (Shapefile Area* 168055)		7		7	0	0	0.18	0.00	50.00
Lakshadweep	30	0	0.00	0	0	0	0.00	0.00	0.00
Puducherry	490	13	2.65	0	2	11	0.03	0.00	23.08
Total	32,87,469	7,75,288	23.58	4,42,276	2,12,259	1,20,753	4388.15	100	56.60

Source: India State of Forest Report 2021, FSI, MoEFCC

*Area of Shapefile provided by Survey of India (August, 2021), Notified geographical areas for individual UT's from Sol are awaited.

** Unclassed Forest includes all forest other than Reserve Forest and Protected Forest as reported by State/UT's Forest Departments.

Annexure 6.4

State/UT wise Distribution of Bamboo bearing area under different classes of Recorded Forest Area

(in sq km)

S.No.	State/UTs	Bamboo bearing area in Recorded Forest in 2019-20					Total (ISFR 2019)	Total (ISFR 2019)
		Pure Bamboo	Dense	Scattered	Bamboo present but clumps completely hacked	Regeneration crop		
1	Andhra Pradesh	208	2,253	2,550	176	917	6,104	7,003
2	Arunachal Pradesh	274	3,148	11,906	0	411	15,739	14,981
3	Assam	449	2,300	7,798	56	56	10,659	10,525
4	Bihar	23	70	511	162	337	1,103	1,136
5	Chhattisgarh	623	1,808	5,112	496	2,428	10,467	11,255
6	Goa	0	0	137	38	113	288	418
7	Gujarat	79	852	2,378	79	159	3,547	3,393
8	Haryana	0	13	26	0	0	39	72
9	Himachal Pradesh	100	276	576	25	50	1,027	650
10	Jharkhand	32	96	2,793	366	430	3,717	4,123
11	Karnataka	287	1,083	3,155	950	3,149	8,624	10,181
12	Kerala	92	504	1,167	46	595	2,404	2,849
13	Madhya Pradesh	847	4,046	8,327	1,928	3,246	18,394	20,867
14	Maharashtra	767	2,705	6,903	1,475	1,676	13,526	15,408
15	Manipur	161	1,450	6,766	0	0	8,377	9,903
16	Meghalaya	484	750	3,676	0	97	5,007	5,410
17	Mizoram	383	1,781	2,331	33	33	4,561	3,476
18	Nagaland	172	772	2,917	0	86	3,947	4,284
19	Odisha	117	1,723	8,302	117	940	11,199	11,827
20	Punjab	0	112	149	19	0	280	255
21	Rajasthan	19	226	602	414	294	1,555	1,874
22	Sikkim	66	155	773	0	0	994	1,176
23	Tamil Nadu	46	367	1,605	797	1,186	4,001	4,357
24	Telangana	159	1,306	2,070	550	450	4,535	5,438
25	Tripura	94	669	3,318	13	107	4,201	3,783
26	Uttar Pradesh	0	351	1,255	25	201	1,832	1,235
27	Uttarakhand	34	172	789	0	206	1,201	1,489
28	West Bengal	0	43	638	0	21	702	855
29	Andaman & Nicobar Islands*	0	177	1,118	0	118	1,413	1,814
Total		5,516	29,208	89,648	7,765	17,306	1,49,443	1,60,037
Total as per ISFR 2019		4,332	30,575	1,02,139	8,260	14,731		

Source: India State of Forest Report, 2021, FSI, MoEFCC

Note: Information of bamboo bearing area for Chandigarh, Dadra & Nagar Haveli and Daman & Diu, Delhi, Lakshadweep, J&K Ladakh and Puducherry is not given due to inadequate data.

Annexure 6.5

State/UT wise number of estimated culms by soundness of culms in Recorded Forest Area

(in million)

S. No.	State/UT	ISFR 2021				ISFR 2019
		Green Culms	Dry Culms	Decayed	Total	Total
1	Andhra Pradesh	1,362	676	206	2,244	1,820
2	Arunachal Pradesh	7,455	812	557	8,824	5,769
3	Assam	4,813	407	436	5,656	3,829
4	Bihar	194	36	5	235	247
5	Chhattisgarh	1,542	860	398	2,800	2,114
6	Goa	4	19	7	30	30
7	Gujarat	625	149	104	878	677
8	Haryana	13	1	1	15	0
9	Himachal Pradesh	524	120	27	671	485
10	Jharkhand	620	169	207	996	876
11	Karnataka	1,884	549	220	2,653	1,910
12	Kerala	800	229	58	1,087	1,030
13	Madhya Pradesh	3,108	1,005	649	4,762	3,595
14	Maharashtra	2,767	932	418	4,117	2,971
15	Manipur	1,277	279	12	1,568	1,126
16	Meghalaya	1,803	214	182	2,199	1,521
17	Mizoram	1,219	173	98	1,490	1,074
18	Nagaland	2,095	296	314	2,705	2,544
19	Odisha	2,785	790	398	3,973	2,291
20	Punjab	18	6	4	28	11
21	Rajasthan	297	58	27	382	527
22	Sikkim	285	23	18	326	218
23	Tamil Nadu	466	396	159	1,021	946
24	Telangana	1,149	716	143	2,008	926
25	Tripura	1,311	185	66	1,562	1,110
26	Uttar Pradesh	200	80	30	310	236
27	Uttarakhand	163	90	48	301	384
28	West Bengal	214	31	35	280	384
29	Andaman & Nicobar Islands	157	51	7	215	803
Total		39,150	9,352	4,834	53,336	39,454

Source: India State of Forest Report, 2021, FSI, MoEF&W

Note: The difference in the total number of culms from ISFR 2019 is due to the fact that the culms of Dadar & Nagar Haveli is not included in ISFR 2021 due to inadequate area.

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

20.64

S.No.	States/ Union Territories	Geographic Area (in hectare)	2011-12		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	35,523	7,333	45
2	Arunachal Pradesh	83,74,300	1,58,779	32,776	391
3	Assam	78,43,800	76,502	15,792	201
4	Bihar	94,16,300	1,59,693	32,965	350
5	Chhattisgarh	1,35,19,200	2,55,902	52,825	391
6	Goa	3,70,200	12,172	2,513	679
7	Gujarat	1,96,24,400	3,61,282	74,578	380
8	Haryana	44,21,200	4,26,552	88,052	1,992
9	Himachal Pradesh	55,67,300	2,73,359	56,429	1,014
10	Jammu & Kashmir	2,22,23,600	62,843	12,972	58
11	Jharkhand	79,71,600	1,96,759	40,617	510
12	Karnataka	1,91,79,100	2,19,936	45,401	237
13	Kerala	38,85,200	1,81,563	37,480	965
14	Madhya Pradesh	3,08,25,200	5,40,282	1,11,529	362
15	Maharashtra	3,07,71,300	8,50,117	1,75,487	570
16	Manipur	22,32,700	37,987	7,842	351
17	Meghalaya	22,42,900	45,209	9,332	416
18	Mizoram	21,08,100	33,639	6,944	329
19	Nagaland	16,57,900	79,111	16,331	985
20	Odisha	1,55,70,700	1,56,152	32,234	207
21	Punjab	50,36,200	7,66,310	1,58,187	3,141
22	Rajasthan	3,42,23,900	9,15,515	1,88,987	552
23	Sikkim	7,09,600	2,363	488	69
24	Tamil Nadu	1,30,06,000	96,211	19,860	153
25	Telangana	1,12,07,700	44,599	9,206	82
26	Tripura	10,48,600	69,102	14,265	1,360
27	Uttar Pradesh	2,40,92,800	8,87,054	1,83,112	760
28	Uttarakhand	53,48,300	1,74,693	36,061	674
29	West Bengal	88,75,200	3,00,999	62,134	700
30	Andaman & Nicobar Islands	8,24,900	2,658	549	67
31	Chandigarh	11,400	0	0	0
32	Dadra & Nagar Haveli	49,100	1,352	279	568
33	Daman & Diu	11,100	0	0	0
34	Delhi	1,48,300	0	0	0
35	Lakshadweep	3,000	0	0	0
36	Puducherry	49,000	966	199	407
	India		74,25,186	15,32,762	

(forest and trees outside forest) (at current prices)

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

18.61

S.No.	States/ Union Territories	Geographic Area (in hectare)	2012-13		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	35,025	6,518	40
2	Arunachal Pradesh	83,74,300	1,71,226	31,862	380
3	Assam	78,43,800	88,676	16,501	210
4	Bihar	94,16,300	1,67,648	31,197	331
5	Chhattisgarh	1,35,19,200	2,45,968	45,770	339
6	Goa	3,70,200	12,953	2,410	651
7	Gujarat	1,96,24,400	4,65,031	86,535	441
8	Haryana	44,21,200	4,67,836	87,057	1,969
9	Himachal Pradesh	55,67,300	2,70,285	50,296	903
10	Jammu & Kashmir	2,22,23,600	77,791	14,476	65
11	Jharkhand	79,71,600	2,11,212	39,303	493
12	Karnataka	1,91,79,100	1,66,535	30,989	162
13	Kerala	38,85,200	1,56,439	29,111	749
14	Madhya Pradesh	3,08,25,200	5,62,281	1,04,631	339
15	Maharashtra	3,07,71,300	8,97,248	1,66,963	543
16	Manipur	22,32,700	38,850	7,229	324
17	Meghalaya	22,42,900	40,747	7,582	338
18	Mizoram	21,08,100	36,181	6,733	319
19	Nagaland	16,57,900	81,308	15,130	913
20	Odisha	1,55,70,700	1,80,401	33,570	216
21	Punjab	50,36,200	8,24,560	1,53,437	3,047
22	Rajasthan	3,42,23,900	9,84,612	1,83,220	535
23	Sikkim	7,09,600	2,316	431	61
24	Tamil Nadu	1,30,06,000	80,252	14,934	115
25	Telangana	1,12,07,700	30,000	5,582	50
26	Tripura	10,48,600	68,105	12,673	1,209
27	Uttar Pradesh	2,40,92,800	9,73,087	1,81,075	752
28	Uttarakhand	53,48,300	2,14,190	39,857	745
29	West Bengal	88,75,200	3,30,267	61,457	692
30	Andaman & Nicobar Islands	8,24,900	2,178	405	49
31	Chandigarh	11,400	0	0	0
32	Dadra & Nagar Haveli	49,100	1,324	246	502
33	Daman & Diu	11,100	0	0	0
34	Delhi	1,48,300	0	0	0
35	Lakshadweep	3,000	0	0	0
36	Puducherry	49,000	946	176	359
	India		78,85,477	14,67,356	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

16.58

S.No.	States/ Union Territories	Geographic Area (in hectare)	2013-14		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	47,150	7,818	48
2	Arunachal Pradesh	83,74,300	2,44,509	40,544	484
3	Assam	78,43,800	1,26,648	21,000	268
4	Bihar	94,16,300	1,71,505	28,438	302
5	Chhattisgarh	1,35,19,200	4,33,915	71,950	532
6	Goa	3,70,200	13,955	2,314	625
7	Gujarat	1,96,24,400	3,49,463	57,947	295
8	Haryana	44,21,200	4,49,674	74,563	1,686
9	Himachal Pradesh	55,67,300	2,56,430	42,520	764
10	Jammu & Kashmir	2,22,23,600	70,858	11,749	53
11	Jharkhand	79,71,600	3,66,329	60,743	762
12	Karnataka	1,91,79,100	2,00,160	33,190	173
13	Kerala	38,85,200	1,98,453	32,907	847
14	Madhya Pradesh	3,08,25,200	7,39,911	1,22,689	398
15	Maharashtra	3,07,71,300	10,70,991	1,77,587	577
16	Manipur	22,32,700	36,289	6,017	270
17	Meghalaya	22,42,900	93,836	15,560	694
18	Mizoram	21,08,100	46,001	7,628	362
19	Nagaland	16,57,900	92,423	15,325	924
20	Odisha	1,55,70,700	3,03,888	50,390	324
21	Punjab	50,36,200	7,80,772	1,29,465	2,571
22	Rajasthan	3,42,23,900	13,18,408	2,18,613	639
23	Sikkim	7,09,600	4,618	766	108
24	Tamil Nadu	1,30,06,000	86,751	14,385	111
25	Telangana	1,12,07,700	60,544	10,039	90
26	Tripura	10,48,600	70,706	11,724	1,118
27	Uttar Pradesh	2,40,92,800	9,23,957	1,53,207	636
28	Uttarakhand	53,48,300	2,73,843	45,407	849
29	West Bengal	88,75,200	4,01,492	66,574	750
30	Andaman & Nicobar Islands	8,24,900	2,579	428	52
31	Chandigarh	11,400	254	42	370
32	Dadra & Nagar Haveli	49,100	1,188	197	401
33	Daman & Diu	11,100	323	54	482
34	Delhi	1,48,300	3,240	537	362
35	Lakshadweep	3,000	161	27	890
36	Puducherry	49,000	911	151	308
	India		92,42,134	15,32,494	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

15.89

S.No.	States/ Union Territories	Geographic Area (in hectare)	2014-15		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	1,18,359	18,809	115
2	Arunachal Pradesh	83,74,300	2,69,225	42,784	511
3	Assam	78,43,800	1,05,791	16,812	214
4	Bihar	94,16,300	1,62,075	25,756	274
5	Chhattisgarh	1,35,19,200	4,61,048	73,268	542
6	Goa	3,70,200	18,371	2,919	789
7	Gujarat	1,96,24,400	3,54,510	56,337	287
8	Haryana	44,21,200	4,31,041	68,499	1,549
9	Himachal Pradesh	55,67,300	3,43,441	54,578	980
10	Jammu & Kashmir	2,22,23,600	73,279	11,645	52
11	Jharkhand	79,71,600	12,24,580	1,94,605	2,441
12	Karnataka	1,91,79,100	1,91,244	30,392	158
13	Kerala	38,85,200	3,91,892	62,278	1,603
14	Madhya Pradesh	3,08,25,200	8,19,286	1,30,197	422
15	Maharashtra	3,07,71,300	11,58,487	1,84,102	598
16	Manipur	22,32,700	36,989	5,878	263
17	Meghalaya	22,42,900	91,172	14,489	646
18	Mizoram	21,08,100	2,82,739	44,932	2,131
19	Nagaland	16,57,900	1,03,464	16,442	992
20	Odisha	1,55,70,700	3,49,877	55,601	357
21	Punjab	50,36,200	9,28,997	1,47,632	2,931
22	Rajasthan	3,42,23,900	13,75,189	2,18,539	639
23	Sikkim	7,09,600	3,073	488	69
24	Tamil Nadu	1,30,06,000	94,746	15,057	116
25	Telangana	1,12,07,700	89,117	14,162	126
26	Tripura	10,48,600	73,049	11,609	1,107
27	Uttar Pradesh	2,40,92,800	10,61,724	1,68,725	700
28	Uttarakhand	53,48,300	2,49,973	39,725	743
29	West Bengal	88,75,200	3,23,575	51,421	579
30	Andaman & Nicobar Islands	8,24,900	2,894	460	56
31	Chandigarh	11,400	279	44	389
32	Dadra & Nagar Haveli	49,100	2,671	425	865
33	Daman & Diu	11,100	777	123	1,113
34	Delhi	1,48,300	7,853	1,248	841
35	Lakshadweep	3,000	395	63	2,094
36	Puducherry	49,000	2,059	327	668
	India		1,12,03,241	17,80,371	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

18.43

S.No.	States/ Union Territories	Geographic Area (in hectare)	2015-16		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	1,41,725	26,123	160
2	Arunachal Pradesh	83,74,300	3,31,789	61,155	730
3	Assam	78,43,800	1,11,843	20,615	263
4	Bihar	94,16,300	1,73,968	32,066	341
5	Chhattisgarh	1,35,19,200	5,81,660	1,07,211	793
6	Goa	3,70,200	26,592	4,901	1,324
7	Gujarat	1,96,24,400	7,98,418	1,47,163	750
8	Haryana	44,21,200	4,74,068	87,379	1,976
9	Himachal Pradesh	55,67,300	3,22,943	59,524	1,069
10	Jammu & Kashmir	2,22,23,600	77,331	14,254	64
11	Jharkhand	79,71,600	5,62,157	1,03,616	1,300
12	Karnataka	1,91,79,100	3,92,260	72,301	377
13	Kerala	38,85,200	8,30,174	1,53,016	3,938
14	Madhya Pradesh	3,08,25,200	8,82,350	1,62,633	528
15	Maharashtra	3,07,71,300	11,14,193	2,05,366	667
16	Manipur	22,32,700	34,662	6,389	286
17	Meghalaya	22,42,900	96,542	17,795	793
18	Mizoram	21,08,100	3,08,296	56,825	2,696
19	Nagaland	16,57,900	1,06,498	19,630	1,184
20	Odisha	1,55,70,700	3,48,692	64,270	413
21	Punjab	50,36,200	9,33,808	1,72,118	3,418
22	Rajasthan	3,42,23,900	14,05,851	2,59,124	757
23	Sikkim	7,09,600	4,484	827	116
24	Tamil Nadu	1,30,06,000	1,05,053	19,363	149
25	Telangana	1,12,07,700	93,437	17,222	154
26	Tripura	10,48,600	74,277	13,691	1,306
27	Uttar Pradesh	2,40,92,800	11,44,593	2,10,969	876
28	Uttarakhand	53,48,300	2,45,487	45,248	846
29	West Bengal	88,75,200	3,33,530	61,476	693
30	Andaman & Nicobar Islands	8,24,900	2,960	546	66
31	Chandigarh	11,400	288	53	465
32	Dadra & Nagar Haveli	49,100	2,892	533	1,086
33	Daman & Diu	11,100	841	155	1,397
34	Delhi	1,48,300	7,533	1,388	936
35	Lakshadweep	3,000	428	79	2,629
36	Puducherry	49,000	2,228	411	838
	India		1,20,73,851	22,25,432	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

18.69

S.No.	States/ Union Territories	Geographic Area (in hectare)	2016-17		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	3,82,323	71,440	438
2	Arunachal Pradesh	83,74,300	3,46,805	64,803	774
3	Assam	78,43,800	77,249	14,435	184
4	Bihar	94,16,300	2,61,187	48,805	518
5	Chhattisgarh	1,35,19,200	9,28,789	1,73,551	1,284
6	Goa	3,70,200	1,62,345	30,335	8,194
7	Gujarat	1,96,24,400	11,72,192	2,19,033	1,116
8	Haryana	44,21,200	4,04,987	75,675	1,712
9	Himachal Pradesh	55,67,300	5,42,176	1,01,310	1,820
10	Jammu & Kashmir	2,22,23,600	71,345	13,331	60
11	Jharkhand	79,71,600	6,59,064	1,23,151	1,545
12	Karnataka	1,91,79,100	5,36,689	1,00,284	523
13	Kerala	38,85,200	8,02,877	1,50,024	3,861
14	Madhya Pradesh	3,08,25,200	9,02,453	1,68,630	547
15	Maharashtra	3,07,71,300	14,76,421	2,75,880	897
16	Manipur	22,32,700	49,893	9,323	418
17	Meghalaya	22,42,900	1,25,836	23,513	1,048
18	Mizoram	21,08,100	2,68,186	50,112	2,377
19	Nagaland	16,57,900	1,40,521	26,257	1,584
20	Odisha	1,55,70,700	4,62,679	86,455	555
21	Punjab	50,36,200	6,66,707	1,24,579	2,474
22	Rajasthan	3,42,23,900	15,53,467	2,90,277	848
23	Sikkim	7,09,600	7,497	1,401	197
24	Tamil Nadu	1,30,06,000	1,07,434	20,075	154
25	Telangana	1,12,07,700	1,77,349	33,139	296
26	Tripura	10,48,600	68,420	12,785	1,219
27	Uttar Pradesh	2,40,92,800	12,75,730	2,38,379	989
28	Uttarakhand	53,48,300	2,33,411	43,615	815
29	West Bengal	88,75,200	4,22,274	78,905	889
30	Andaman & Nicobar Islands	8,24,900	4,451	832	101
31	Chandigarh	11,400	637	119	1,044
32	Dadra & Nagar Haveli	49,100	5,146	962	1,958
33	Daman & Diu	11,100	1,651	308	2,779
34	Delhi	1,48,300	13,964	2,609	1,760
35	Lakshadweep	3,000	225	42	1,400
36	Puducherry	49,000	4,797	896	1,829
	India		1,43,17,177	26,75,269	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

13.60

S.No.	States/ Union Territories	Geographic Area (in hectare)	2017-18		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	3,62,059	49,257	302
2	Arunachal Pradesh	83,74,300	3,49,965	47,611	569
3	Assam	78,43,800	1,06,382	14,473	185
4	Bihar	94,16,300	2,63,802	35,889	381
5	Chhattisgarh	1,35,19,200	7,85,480	1,06,862	790
6	Goa	3,70,200	50,400	6,857	1,852
7	Gujarat	1,96,24,400	17,45,851	2,37,516	1,210
8	Haryana	44,21,200	4,79,599	65,248	1,476
9	Himachal Pradesh	55,67,300	4,11,688	56,009	1,006
10	Jammu & Kashmir	2,22,23,600	1,35,553	18,441	83
11	Jharkhand	79,71,600	7,26,219	98,799	1,239
12	Karnataka	1,91,79,100	4,12,354	56,099	293
13	Kerala	38,85,200	6,83,835	93,033	2,395
14	Madhya Pradesh	3,08,25,200	9,32,613	1,26,878	412
15	Maharashtra	3,07,71,300	23,39,025	3,18,215	1,034
16	Manipur	22,32,700	64,371	8,757	392
17	Meghalaya	22,42,900	1,23,935	16,861	752
18	Mizoram	21,08,100	2,70,769	36,837	1,747
19	Nagaland	16,57,900	1,69,702	23,087	1,393
20	Odisha	1,55,70,700	4,74,264	64,522	414
21	Punjab	50,36,200	6,71,804	91,396	1,815
22	Rajasthan	3,42,23,900	15,05,453	2,04,811	598
23	Sikkim	7,09,600	7,569	1,030	145
24	Tamil Nadu	1,30,06,000	2,69,798	36,705	282
25	Telangana	1,12,07,700	1,93,597	26,338	235
26	Tripura	10,48,600	68,549	9,326	889
27	Uttar Pradesh	2,40,92,800	13,85,113	1,88,439	782
28	Uttarakhand	53,48,300	2,52,262	34,319	642
29	West Bengal	88,75,200	4,23,193	57,574	649
30	Andaman & Nicobar Islands	8,24,900	3,698	503	61
31	Chandigarh	11,400	643	87	767
32	Dadra & Nagar Haveli	49,100	5,208	709	1,443
33	Daman & Diu	11,100	1,671	227	2,048
34	Delhi	1,48,300	14,100	1,918	1,294
35	Lakshadweep	3,000	228	31	1,032
36	Puducherry	49,000	4,855	661	1,348
	India		1,56,95,608	21,35,327	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

9.25

S.No.	States/ Union Territories	Geographic Area (in hectare)	2018-19		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	6,03,038	55,751	342
2	Arunachal Pradesh	83,74,300	5,44,791	50,367	601
3	Assam	78,43,800	1,19,012	11,003	140
4	Bihar	94,16,300	3,13,965	29,026	308
5	Chhattisgarh	1,35,19,200	10,67,055	98,650	730
6	Goa	3,70,200	73,914	6,833	1,846
7	Gujarat	1,96,24,400	22,05,537	2,03,904	1,039
8	Haryana	44,21,200	5,47,256	50,594	1,144
9	Himachal Pradesh	55,67,300	2,20,864	20,419	367
10	Jammu & Kashmir	2,22,23,600	1,50,729	13,935	63
11	Jharkhand	79,71,600	7,98,378	73,811	926
12	Karnataka	1,91,79,100	5,75,234	53,181	277
13	Kerala	38,85,200	10,50,927	97,159	2,501
14	Madhya Pradesh	3,08,25,200	11,20,755	1,03,615	336
15	Maharashtra	3,07,71,300	30,64,740	2,83,338	921
16	Manipur	22,32,700	55,654	5,145	230
17	Meghalaya	22,42,900	1,59,010	14,701	655
18	Mizoram	21,08,100	2,84,603	26,312	1,248
19	Nagaland	16,57,900	2,61,610	24,186	1,459
20	Odisha	1,55,70,700	7,68,122	71,014	456
21	Punjab	50,36,200	11,03,770	1,02,045	2,026
22	Rajasthan	3,42,23,900	15,27,429	1,41,212	413
23	Sikkim	7,09,600	5,289	489	69
24	Tamil Nadu	1,30,06,000	4,46,775	41,305	318
25	Telangana	1,12,07,700	2,81,858	26,058	233
26	Tripura	10,48,600	1,54,815	14,313	1,365
27	Uttar Pradesh	2,40,92,800	16,29,138	1,50,615	625
28	Uttarakhand	53,48,300	2,88,972	26,716	500
29	West Bengal	88,75,200	4,97,121	45,959	518
30	Andaman & Nicobar Islands	8,24,900	13,883	1,284	156
31	Chandigarh	11,400	2,293	212	1,860
32	Dadra & Nagar Haveli	49,100	8,094	748	1,524
33	Daman & Diu	11,100	2,224	206	1,852
34	Delhi	1,48,300	18,268	1,689	1,139
35	Lakshadweep	3,000	518	48	1,598
36	Puducherry	49,000	5,270	487	994
	India		1,99,70,914	18,46,331	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at current prices

Forest Rent to GVO - August 17, 2022

9.88

S.No.	States/ Union Territories	Geographic Area (in hectare)	2019-20		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	5,42,756	53,649	329
2	Arunachal Pradesh	83,74,300	5,51,254	54,489	651
3	Assam	78,43,800	1,26,996	12,553	160
4	Bihar	94,16,300	3,20,810	31,711	337
5	Chhattisgarh	1,35,19,200	11,27,118	1,11,411	824
6	Goa	3,70,200	79,477	7,856	2,122
7	Gujarat	1,96,24,400	19,16,843	1,89,472	965
8	Haryana	44,21,200	4,75,595	47,011	1,063
9	Himachal Pradesh	55,67,300	3,49,634	34,560	621
10	Jammu & Kashmir	2,22,23,600	1,49,378	14,765	66
11	Jharkhand	79,71,600	3,56,165	35,205	442
12	Karnataka	1,91,79,100	6,05,867	59,887	312
13	Kerala	38,85,200	11,85,907	1,17,222	3,017
14	Madhya Pradesh	3,08,25,200	11,34,801	1,12,170	364
15	Maharashtra	3,07,71,300	31,20,030	3,08,402	1,002
16	Manipur	22,32,700	47,221	4,668	209
17	Meghalaya	22,42,900	1,35,407	13,384	597
18	Mizoram	21,08,100	3,00,381	29,691	1,408
19	Nagaland	16,57,900	2,73,466	27,031	1,630
20	Odisha	1,55,70,700	7,70,428	76,154	489
21	Punjab	50,36,200	10,70,312	1,05,796	2,101
22	Rajasthan	3,42,23,900	16,70,604	1,65,132	483
23	Sikkim	7,09,600	6,043	597	84
24	Tamil Nadu	1,30,06,000	5,03,212	49,740	382
25	Telangana	1,12,07,700	2,47,667	24,481	218
26	Tripura	10,48,600	1,60,411	15,856	1,512
27	Uttar Pradesh	2,40,92,800	18,55,546	1,83,413	761
28	Uttarakhand	53,48,300	2,50,803	24,791	464
29	West Bengal	88,75,200	4,78,259	47,274	533
30	Andaman & Nicobar Islands	8,24,900	11,927	1,179	143
31	Chandigarh	11,400	2,321	229	2,012
32	Dadra & Nagar Haveli	49,100	8,102	801	1,631
33	Daman & Diu	11,100	2,226	220	1,982
34	Delhi	1,48,300	18,486	1,827	1,232
35	Lakshadweep	3,000	519	51	1,710
36	Puducherry	49,000	5,275	521	1,064
	India		1,98,61,245	19,63,200	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

20.6

S.No.	States/ Union Territories	Geographic Area (in hectare)	2011-12		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	35,523	7,333	45
2	Arunachal Pradesh	83,74,300	1,58,779	32,776	391
3	Assam	78,43,800	76,502	15,792	201
4	Bihar	94,16,300	1,59,693	32,965	350
5	Chhattisgarh	1,35,19,200	2,55,902	52,825	391
6	Goa	3,70,200	12,172	2,513	679
7	Gujarat	1,96,24,400	3,61,282	74,578	380
8	Haryana	44,21,200	4,26,552	88,052	1,992
9	Himachal Pradesh	55,67,300	2,73,359	56,429	1,014
10	Jammu & Kashmir	2,22,23,600	62,843	12,972	58
11	Jharkhand	79,71,600	1,96,759	40,617	510
12	Karnataka	1,91,79,100	2,19,936	45,401	237
13	Kerala	38,85,200	1,81,563	37,480	965
14	Madhya Pradesh	3,08,25,200	5,40,282	1,11,529	362
15	Maharashtra	3,07,71,300	8,50,117	1,75,487	570
16	Manipur	22,32,700	37,987	7,842	351
17	Meghalaya	22,42,900	45,209	9,332	416
18	Mizoram	21,08,100	33,639	6,944	329
19	Nagaland	16,57,900	79,111	16,331	985
20	Odisha	1,55,70,700	1,56,152	32,234	207
21	Punjab	50,36,200	7,66,310	1,58,187	3,141
22	Rajasthan	3,42,23,900	9,15,515	1,88,987	552
23	Sikkim	7,09,600	2,363	488	69
24	Tamil Nadu	1,30,06,000	96,211	19,860	153
25	Telangana	1,12,07,700	44,599	9,206	82
26	Tripura	10,48,600	69,102	14,265	1,360
27	Uttar Pradesh	2,40,92,800	8,87,054	1,83,112	760
28	Uttarakhand	53,48,300	1,74,693	36,061	674
29	West Bengal	88,75,200	3,00,999	62,134	700
30	Andaman & Nicobar Islands	8,24,900	2,658	549	67
31	Chandigarh	11,400	0	0	0
32	Dadra & Nagar Haveli	49,100	1,352	279	568
33	Daman & Diu	11,100	0	0	0
34	Delhi	1,48,300	0	0	0
35	Lakshadweep	3,000	0	0	0
36	Puducherry	49,000	966	199	407
	India		74,25,186	15,32,762	

(forest and trees outside forest) (at constant prices)

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

19.0

S.No.	States/ Union Territories	Geographic Area (in hectare)	2012-13		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	34,303	6,521	40
2	Arunachal Pradesh	83,74,300	1,55,813	29,619	354
3	Assam	78,43,800	74,644	14,189	181
4	Bihar	94,16,300	1,56,632	29,775	316
5	Chhattisgarh	1,35,19,200	2,52,995	48,093	356
6	Goa	3,70,200	12,375	2,352	635
7	Gujarat	1,96,24,400	3,54,999	67,483	344
8	Haryana	44,21,200	4,17,767	79,415	1,796
9	Himachal Pradesh	55,67,300	2,86,134	54,392	977
10	Jammu & Kashmir	2,22,23,600	61,779	11,744	53
11	Jharkhand	79,71,600	1,92,730	36,637	460
12	Karnataka	1,91,79,100	2,02,333	38,462	201
13	Kerala	38,85,200	1,76,816	33,612	865
14	Madhya Pradesh	3,08,25,200	5,36,804	1,02,043	331
15	Maharashtra	3,07,71,300	8,23,185	1,56,482	509
16	Manipur	22,32,700	35,573	6,762	303
17	Meghalaya	22,42,900	44,222	8,406	375
18	Mizoram	21,08,100	33,138	6,299	299
19	Nagaland	16,57,900	76,309	14,506	875
20	Odisha	1,55,70,700	1,52,979	29,080	187
21	Punjab	50,36,200	7,52,133	1,42,975	2,839
22	Rajasthan	3,42,23,900	8,97,423	1,70,594	498
23	Sikkim	7,09,600	2,316	440	62
24	Tamil Nadu	1,30,06,000	2,42,447	46,087	354
25	Telangana	1,12,07,700	47,341	8,999	80
26	Tripura	10,48,600	68,044	12,935	1,234
27	Uttar Pradesh	2,40,92,800	8,75,861	1,66,495	691
28	Uttarakhand	53,48,300	1,74,977	33,262	622
29	West Bengal	88,75,200	3,01,532	57,319	646
30	Andaman & Nicobar Islands	8,24,900	2,157	410	50
31	Chandigarh	11,400	0	0	0
32	Dadra & Nagar Haveli	49,100	1,324	252	513
33	Daman & Diu	11,100	0	0	0
34	Delhi	1,48,300	0	0	0
35	Lakshadweep	3,000	0	0	0
36	Puducherry	49,000	946	180	367
	India		74,48,031	14,15,820	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

17.2

S.No.	States/ Union Territories	Geographic Area (in hectare)	2013-14		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	39,869	6,841	42
2	Arunachal Pradesh	83,74,300	1,96,825	33,771	403
3	Assam	78,43,800	73,979	12,693	162
4	Bihar	94,16,300	1,48,799	25,531	271
5	Chhattisgarh	1,35,19,200	3,64,432	62,529	463
6	Goa	3,70,200	15,478	2,656	717
7	Gujarat	1,96,24,400	3,52,116	60,416	308
8	Haryana	44,21,200	4,16,387	71,444	1,616
9	Himachal Pradesh	55,67,300	3,08,712	52,969	951
10	Jammu & Kashmir	2,22,23,600	70,857	12,158	55
11	Jharkhand	79,71,600	2,89,024	49,591	622
12	Karnataka	1,91,79,100	1,92,674	33,059	172
13	Kerala	38,85,200	2,24,302	38,486	991
14	Madhya Pradesh	3,08,25,200	6,89,752	1,18,348	384
15	Maharashtra	3,07,71,300	10,73,976	1,84,273	599
16	Manipur	22,32,700	33,700	5,782	259
17	Meghalaya	22,42,900	45,551	7,816	348
18	Mizoram	21,08,100	40,011	6,865	326
19	Nagaland	16,57,900	77,495	13,297	802
20	Odisha	1,55,70,700	2,14,627	36,826	237
21	Punjab	50,36,200	7,15,269	1,22,726	2,437
22	Rajasthan	3,42,23,900	12,01,731	2,06,194	602
23	Sikkim	7,09,600	3,848	660	93
24	Tamil Nadu	1,30,06,000	86,850	14,902	115
25	Telangana	1,12,07,700	33,658	5,775	52
26	Tripura	10,48,600	68,288	11,717	1,117
27	Uttar Pradesh	2,40,92,800	8,77,040	1,50,483	625
28	Uttarakhand	53,48,300	1,66,052	28,491	533
29	West Bengal	88,75,200	2,98,227	51,170	577
30	Andaman & Nicobar Islands	8,24,900	2,551	438	53
31	Chandigarh	11,400	254	44	383
32	Dadra & Nagar Haveli	49,100	1,188	204	415
33	Daman & Diu	11,100	323	55	499
34	Delhi	1,48,300	3,240	556	375
35	Lakshadweep	3,000	161	28	921
36	Puducherry	49,000	911	156	319
	India		83,28,158	14,28,949	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

17.3

S.No.	States/ Union Territories	Geographic Area (in hectare)	2014-15		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	31,284	5,415	33
2	Arunachal Pradesh	83,74,300	1,94,222	33,620	401
3	Assam	78,43,800	62,449	10,810	138
4	Bihar	94,16,300	1,29,191	22,363	237
5	Chhattisgarh	1,35,19,200	3,80,224	65,817	487
6	Goa	3,70,200	15,917	2,755	744
7	Gujarat	1,96,24,400	3,57,357	61,859	315
8	Haryana	44,21,200	4,39,487	76,076	1,721
9	Himachal Pradesh	55,67,300	3,03,682	52,568	944
10	Jammu & Kashmir	2,22,23,600	73,269	12,683	57
11	Jharkhand	79,71,600	3,06,297	53,021	665
12	Karnataka	1,91,79,100	1,83,498	31,764	166
13	Kerala	38,85,200	2,44,960	42,403	1,091
14	Madhya Pradesh	3,08,25,200	7,34,518	1,27,146	412
15	Maharashtra	3,07,71,300	11,61,716	2,01,095	654
16	Manipur	22,32,700	31,449	5,444	244
17	Meghalaya	22,42,900	43,291	7,494	334
18	Mizoram	21,08,100	2,29,232	39,681	1,882
19	Nagaland	16,57,900	78,471	13,584	819
20	Odisha	1,55,70,700	2,24,597	38,878	250
21	Punjab	50,36,200	7,38,294	1,27,800	2,538
22	Rajasthan	3,42,23,900	12,53,381	2,16,962	634
23	Sikkim	7,09,600	3,150	545	77
24	Tamil Nadu	1,30,06,000	86,015	14,889	114
25	Telangana	1,12,07,700	27,155	4,701	42
26	Tripura	10,48,600	68,078	11,784	1,124
27	Uttar Pradesh	2,40,92,800	8,92,103	1,54,425	641
28	Uttarakhand	53,48,300	1,75,972	30,461	570
29	West Bengal	88,75,200	2,64,650	45,811	516
30	Andaman & Nicobar Islands	8,24,900	2,497	432	52
31	Chandigarh	11,400	279	48	424
32	Dadra & Nagar Haveli	49,100	1,203	208	424
33	Daman & Diu	11,100	350	61	546
34	Delhi	1,48,300	3,535	612	413
35	Lakshadweep	3,000	178	31	1,027
36	Puducherry	49,000	927	160	327
	India		87,42,875	15,13,406	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

20.5

S.No.	States/ Union Territories	Geographic Area (in hectare)	2015-16		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	32,282	6,611	41
2	Arunachal Pradesh	83,74,300	1,97,930	40,535	484
3	Assam	78,43,800	64,380	13,185	168
4	Bihar	94,16,300	1,33,074	27,252	289
5	Chhattisgarh	1,35,19,200	3,83,113	78,459	580
6	Goa	3,70,200	15,045	3,081	832
7	Gujarat	1,96,24,400	3,62,975	74,335	379
8	Haryana	44,21,200	4,53,437	92,861	2,100
9	Himachal Pradesh	55,67,300	2,84,367	58,236	1,046
10	Jammu & Kashmir	2,22,23,600	77,320	15,835	71
11	Jharkhand	79,71,600	3,15,895	64,693	812
12	Karnataka	1,91,79,100	1,84,635	37,812	197
13	Kerala	38,85,200	2,39,824	49,114	1,264
14	Madhya Pradesh	3,08,25,200	7,50,062	1,53,607	498
15	Maharashtra	3,07,71,300	12,07,881	2,47,365	804
16	Manipur	22,32,700	32,266	6,608	296
17	Meghalaya	22,42,900	43,284	8,864	395
18	Mizoram	21,08,100	2,35,815	48,293	2,291
19	Nagaland	16,57,900	78,455	16,067	969
20	Odisha	1,55,70,700	2,32,751	47,666	306
21	Punjab	50,36,200	7,59,616	1,55,564	3,089
22	Rajasthan	3,42,23,900	12,88,945	2,63,966	771
23	Sikkim	7,09,600	3,251	666	94
24	Tamil Nadu	1,30,06,000	88,544	18,133	139
25	Telangana	1,12,07,700	27,915	5,717	51
26	Tripura	10,48,600	96,058	19,672	1,876
27	Uttar Pradesh	2,40,92,800	9,23,751	1,89,177	785
28	Uttarakhand	53,48,300	1,87,562	38,411	718
29	West Bengal	88,75,200	2,74,351	56,185	633
30	Andaman & Nicobar Islands	8,24,900	2,454	503	61
31	Chandigarh	11,400	288	59	517
32	Dadra & Nagar Haveli	49,100	1,239	254	517
33	Daman & Diu	11,100	360	74	665
34	Delhi	1,48,300	3,641	746	503
35	Lakshadweep	3,000	183	38	1,251
36	Puducherry	49,000	955	195	399
	India		89,83,905	18,39,836	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

21.2

S.No.	States/ Union Territories	Geographic Area (in hectare)	2016-17		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	50,944	10,810	66
2	Arunachal Pradesh	83,74,300	1,94,255	41,219	492
3	Assam	78,43,800	58,040	12,315	157
4	Bihar	94,16,300	1,97,506	41,909	445
5	Chhattisgarh	1,35,19,200	4,47,308	94,914	702
6	Goa	3,70,200	39,911	8,469	2,288
7	Gujarat	1,96,24,400	3,85,772	81,857	417
8	Haryana	44,21,200	3,88,744	82,487	1,866
9	Himachal Pradesh	55,67,300	4,00,524	84,987	1,527
10	Jammu & Kashmir	2,22,23,600	71,336	15,137	68
11	Jharkhand	79,71,600	3,74,884	79,546	998
12	Karnataka	1,91,79,100	2,89,755	61,483	321
13	Kerala	38,85,200	2,54,723	54,049	1,391
14	Madhya Pradesh	3,08,25,200	7,34,573	1,55,868	506
15	Maharashtra	3,07,71,300	12,27,894	2,60,546	847
16	Manipur	22,32,700	46,445	9,855	441
17	Meghalaya	22,42,900	54,926	11,655	520
18	Mizoram	21,08,100	1,89,608	40,233	1,908
19	Nagaland	16,57,900	97,469	20,682	1,247
20	Odisha	1,55,70,700	3,03,669	64,435	414
21	Punjab	50,36,200	7,85,914	1,66,762	3,311
22	Rajasthan	3,42,23,900	14,24,286	3,02,218	883
23	Sikkim	7,09,600	5,435	1,153	163
24	Tamil Nadu	1,30,06,000	91,178	19,347	149
25	Telangana	1,12,07,700	53,030	11,252	100
26	Tripura	10,48,600	64,415	13,668	1,303
27	Uttar Pradesh	2,40,92,800	10,80,618	2,29,295	952
28	Uttarakhand	53,48,300	1,81,644	38,543	721
29	West Bengal	88,75,200	3,44,377	73,073	823
30	Andaman & Nicobar Islands	8,24,900	3,520	747	91
31	Chandigarh	11,400	637	135	1,185
32	Dadra & Nagar Haveli	49,100	2,098	445	907
33	Daman & Diu	11,100	673	143	1,287
34	Delhi	1,48,300	6,750	1,432	966
35	Lakshadweep	3,000	92	19	648
36	Puducherry	49,000	1,956	415	847
	India		98,54,907	20,91,103	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

14.9

S.No.	States/ Union Territories	Geographic Area (in hectare)	2017-18		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	57,905	8,653	53
2	Arunachal Pradesh	83,74,300	1,96,025	29,294	350
3	Assam	78,43,800	58,126	8,686	111
4	Bihar	94,16,300	1,99,484	29,811	317
5	Chhattisgarh	1,35,19,200	4,46,279	66,692	493
6	Goa	3,70,200	40,724	6,086	1,644
7	Gujarat	1,96,24,400	5,68,663	84,981	433
8	Haryana	44,21,200	3,92,471	58,651	1,327
9	Himachal Pradesh	55,67,300	4,04,698	60,478	1,086
10	Jammu & Kashmir	2,22,23,600	1,35,535	20,254	91
11	Jharkhand	79,71,600	3,78,394	56,547	709
12	Karnataka	1,91,79,100	2,91,946	43,628	227
13	Kerala	38,85,200	2,55,768	38,222	984
14	Madhya Pradesh	3,08,25,200	7,18,373	1,07,353	348
15	Maharashtra	3,07,71,300	16,55,891	2,47,455	804
16	Manipur	22,32,700	59,921	8,955	401
17	Meghalaya	22,42,900	54,063	8,079	360
18	Mizoram	21,08,100	1,91,433	28,608	1,357
19	Nagaland	16,57,900	97,783	14,613	881
20	Odisha	1,55,70,700	3,05,943	45,720	294
21	Punjab	50,36,200	7,91,923	1,18,344	2,350
22	Rajasthan	3,42,23,900	14,36,651	2,14,692	627
23	Sikkim	7,09,600	5,487	820	116
24	Tamil Nadu	1,30,06,000	2,19,802	32,847	253
25	Telangana	1,12,07,700	72,255	10,798	96
26	Tripura	10,48,600	64,276	9,605	916
27	Uttar Pradesh	2,40,92,800	10,89,460	1,62,808	676
28	Uttarakhand	53,48,300	1,82,206	27,229	509
29	West Bengal	88,75,200	3,45,808	51,677	582
30	Andaman & Nicobar Islands	8,24,900	2,787	416	50
31	Chandigarh	11,400	643	96	843
32	Dadra & Nagar Haveli	49,100	2,119	317	645
33	Daman & Diu	11,100	680	102	915
34	Delhi	1,48,300	6,816	1,019	687
35	Lakshadweep	3,000	93	14	461
36	Puducherry	49,000	1,975	295	602
	India		1,07,32,403	16,03,843	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

10.6

S.No.	States/ Union Territories	Geographic Area (in hectare)	2018-19		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	76,881	8,185	50
2	Arunachal Pradesh	83,74,300	3,01,756	32,127	384
3	Assam	78,43,800	61,611	6,559	84
4	Bihar	94,16,300	2,34,769	24,995	265
5	Chhattisgarh	1,35,19,200	5,35,084	56,968	421
6	Goa	3,70,200	61,278	6,524	1,762
7	Gujarat	1,96,24,400	5,59,287	59,545	303
8	Haryana	44,21,200	4,42,670	47,129	1,066
9	Himachal Pradesh	55,67,300	4,15,751	44,263	795
10	Jammu & Kashmir	2,22,23,600	1,50,694	16,044	72
11	Jharkhand	79,71,600	4,43,038	47,168	592
12	Karnataka	1,91,79,100	4,69,717	50,009	261
13	Kerala	38,85,200	2,69,369	28,679	738
14	Madhya Pradesh	3,08,25,200	8,38,264	89,247	290
15	Maharashtra	3,07,71,300	21,02,375	2,23,831	727
16	Manipur	22,32,700	51,229	5,454	244
17	Meghalaya	22,42,900	68,160	7,257	324
18	Mizoram	21,08,100	1,79,432	19,103	906
19	Nagaland	16,57,900	1,30,341	13,877	837
20	Odisha	1,55,70,700	3,93,794	41,926	269
21	Punjab	50,36,200	7,63,960	81,336	1,615
22	Rajasthan	3,42,23,900	14,57,356	1,55,159	453
23	Sikkim	7,09,600	7,029	748	105
24	Tamil Nadu	1,30,06,000	3,29,276	35,057	270
25	Telangana	1,12,07,700	79,996	8,517	76
26	Tripura	10,48,600	75,405	8,028	766
27	Uttar Pradesh	2,40,92,800	12,05,358	1,28,330	533
28	Uttarakhand	53,48,300	2,27,233	24,193	452
29	West Bengal	88,75,200	3,92,452	41,783	471
30	Andaman & Nicobar Islands	8,24,900	10,335	1,100	133
31	Chandigarh	11,400	2,293	244	2,142
32	Dadra & Nagar Haveli	49,100	3,031	323	657
33	Daman & Diu	11,100	833	89	799
34	Delhi	1,48,300	8,830	940	634
35	Lakshadweep	3,000	194	21	689
36	Puducherry	49,000	1,973	210	429
	India		1,23,51,053	13,14,966	

Annexure 6.6

State wise value of timber provisioning service in India (INR in lakh) at constant prices

Forest Rent to GVO - August 17, 2022

11.3

S.No.	States/ Union Territories	Geographic Area (in hectare)	2019-20		
			Value of output of Industrial wood	Value of timber provisioning	Timber Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	71,202	8,066	49
2	Arunachal Pradesh	83,74,300	3,05,336	34,588	413
3	Assam	78,43,800	62,463	7,076	90
4	Bihar	94,16,300	2,37,215	26,872	285
5	Chhattisgarh	1,35,19,200	5,44,902	61,727	457
6	Goa	3,70,200	61,588	6,977	1,885
7	Gujarat	1,96,24,400	5,65,950	64,111	327
8	Haryana	44,21,200	4,47,903	50,739	1,148
9	Himachal Pradesh	55,67,300	4,31,926	48,929	879
10	Jammu & Kashmir	2,22,23,600	1,49,356	16,919	76
11	Jharkhand	79,71,600	4,48,479	50,804	637
12	Karnataka	1,91,79,100	4,74,521	53,754	280
13	Kerala	38,85,200	2,69,789	30,562	787
14	Madhya Pradesh	3,08,25,200	8,15,149	92,340	300
15	Maharashtra	3,07,71,300	21,27,339	2,40,985	783
16	Manipur	22,32,700	50,608	5,733	257
17	Meghalaya	22,42,900	67,576	7,655	341
18	Mizoram	21,08,100	1,81,751	20,589	977
19	Nagaland	16,57,900	1,25,378	14,203	857
20	Odisha	1,55,70,700	3,97,209	44,996	289
21	Punjab	50,36,200	7,74,656	87,753	1,742
22	Rajasthan	3,42,23,900	14,73,604	1,66,930	488
23	Sikkim	7,09,600	7,112	806	114
24	Tamil Nadu	1,30,06,000	3,33,233	37,749	290
25	Telangana	1,12,07,700	81,229	9,202	82
26	Tripura	10,48,600	78,912	8,939	852
27	Uttar Pradesh	2,40,92,800	12,20,134	1,38,217	574
28	Uttarakhand	53,48,300	2,29,627	26,012	486
29	West Bengal	88,75,200	3,80,153	43,064	485
30	Andaman & Nicobar Islands	8,24,900	10,339	1,171	142
31	Chandigarh	11,400	2,321	263	2,306
32	Dadra & Nagar Haveli	49,100	3,067	347	708
33	Daman & Diu	11,100	843	95	860
34	Delhi	1,48,300	8,935	1,012	683
35	Lakshadweep	3,000	196	22	742
36	Puducherry	49,000	1,997	226	462
	India		1,24,42,001	14,09,431	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

20.6

S.No.	States/ Union Territories	Geographic Area (in hectare)	2011-12		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	2,61,363	53,953	331
2	Arunachal Pradesh	8374300	39,063	8,064	96
3	Assam	7843800	2,00,088	41,304	527
4	Bihar	9416300	3,41,273	70,448	748
5	Chhattisgarh	13519200	2,53,487	52,327	387
6	Goa	370200	2,024	418	113
7	Gujarat	19624400	3,69,454	76,265	389
8	Haryana	4421200	37,709	7,784	176
9	Himachal Pradesh	5567300	2,14,665	44,313	796
10	Jammu & Kashmir	22223600	97,975	20,225	91
11	Jharkhand	7971600	2,30,983	47,681	598
12	Karnataka	19179100	4,88,392	1,00,818	526
13	Kerala	3885200	2,54,184	52,470	1,351
14	Madhya Pradesh	30825200	5,81,679	1,20,074	390
15	Maharashtra	30771300	9,59,071	1,97,979	643
16	Manipur	2232700	12,212	2,521	113
17	Meghalaya	2242900	21,549	4,448	198
18	Mizoram	2108100	12,267	2,532	120
19	Nagaland	1657900	16,026	3,308	200
20	Odisha	15570700	5,29,141	1,09,229	702
21	Punjab	5036200	89,211	18,416	366
22	Rajasthan	34223900	7,78,189	1,60,639	469
23	Sikkim	709600	2,349	485	68
24	Tamil Nadu	13006000	3,28,769	67,867	522
25	Telangana	11207700	1,84,773	38,142	340
26	Tripura	1048600	62,103	12,820	1,223
27	Uttar Pradesh	24092800	6,06,552	1,25,209	520
28	Uttarakhand	5348300	1,53,437	31,674	592
29	West Bengal	8875200	3,12,422	64,492	727
30	Andaman & Nicobar Islands	824900	2,180	450	55
31	Chandigarh	11400	347	72	629
32	Dadra & Nagar Haveli	49100	1,999	413	840
33	Daman & Diu	11100	194	40	360
34	Delhi	148300	1,204	249	168
35	Lakshadweep	3000	303	63	2,086
36	Puducherry	49000	3,002	620	1,265
	India		74,49,639	15,37,809	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

18.6

S.No.	States/ Union Territories	Geographic Area (in hectare)	2012-13		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	2,74,675	51,113	314
2	Arunachal Pradesh	8374300	50,249	9,351	112
3	Assam	7843800	2,14,115	39,843	508
4	Bihar	9416300	3,79,933	70,699	751
5	Chhattisgarh	13519200	3,60,862	67,150	497
6	Goa	370200	2,257	420	113
7	Gujarat	19624400	4,65,692	86,657	442
8	Haryana	4421200	48,099	8,950	202
9	Himachal Pradesh	5567300	2,54,357	47,332	850
10	Jammu & Kashmir	22223600	1,03,590	19,276	87
11	Jharkhand	7971600	2,68,636	49,989	627
12	Karnataka	19179100	5,58,578	1,03,942	542
13	Kerala	3885200	2,75,053	51,183	1,317
14	Madhya Pradesh	30825200	7,00,031	1,30,264	423
15	Maharashtra	30771300	10,80,688	2,01,098	654
16	Manipur	2232700	13,532	2,518	113
17	Meghalaya	2242900	25,076	4,666	208
18	Mizoram	2108100	12,830	2,388	113
19	Nagaland	1657900	18,730	3,485	210
20	Odisha	15570700	5,70,644	1,06,187	682
21	Punjab	5036200	95,050	17,687	351
22	Rajasthan	34223900	9,81,593	1,82,658	534
23	Sikkim	709600	2,620	488	69
24	Tamil Nadu	13006000	3,28,658	61,158	470
25	Telangana	11207700	2,03,143	37,802	337
26	Tripura	1048600	75,007	13,958	1,331
27	Uttar Pradesh	24092800	6,64,407	1,23,635	513
28	Uttarakhand	5348300	1,66,590	31,000	580
29	West Bengal	8875200	3,45,159	64,228	724
30	Andaman & Nicobar Islands	824900	2,548	474	57
31	Chandigarh	11400	401	75	655
32	Dadra & Nagar Haveli	49100	2,363	440	896
33	Daman & Diu	11100	250	47	419
34	Delhi	148300	1,183	220	149
35	Lakshadweep	3000	373	69	2,313
36	Puducherry	49000	3,163	589	1,201
	India		85,50,137	15,91,039	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

16.6

S.No.	States/ Union Territories	Geographic Area (in hectare)	2013-14		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	2,93,441	48,657	299
2	Arunachal Pradesh	8374300	56,011	9,288	111
3	Assam	7843800	2,54,722	42,237	538
4	Bihar	9416300	4,21,965	69,969	743
5	Chhattisgarh	13519200	3,82,857	63,484	470
6	Goa	370200	4,993	828	224
7	Gujarat	19624400	5,12,767	85,025	433
8	Haryana	4421200	33,251	5,514	125
9	Himachal Pradesh	5567300	3,01,786	50,041	899
10	Jammu & Kashmir	22223600	1,02,971	17,074	77
11	Jharkhand	7971600	2,85,790	47,389	594
12	Karnataka	19179100	5,89,193	97,698	509
13	Kerala	3885200	3,92,161	65,027	1,674
14	Madhya Pradesh	30825200	7,78,538	1,29,094	419
15	Maharashtra	30771300	12,02,148	1,99,335	648
16	Manipur	2232700	13,810	2,290	103
17	Meghalaya	2242900	28,223	4,680	209
18	Mizoram	2108100	17,050	2,827	134
19	Nagaland	1657900	19,541	3,240	195
20	Odisha	15570700	6,38,356	1,05,850	680
21	Punjab	5036200	94,338	15,643	311
22	Rajasthan	34223900	10,97,679	1,82,013	532
23	Sikkim	709600	2,706	449	63
24	Tamil Nadu	13006000	3,79,868	62,988	484
25	Telangana	11207700	2,15,439	35,723	319
26	Tripura	1048600	94,117	15,606	1,488
27	Uttar Pradesh	24092800	6,62,169	1,09,798	456
28	Uttarakhand	5348300	1,79,028	29,686	555
29	West Bengal	8875200	4,00,407	66,394	748
30	Andaman & Nicobar Islands	824900	2,944	488	59
31	Chandigarh	11400	433	72	630
32	Dadra & Nagar Haveli	49100	2,543	422	859
33	Daman & Diu	11100	288	48	430
34	Delhi	148300	1,080	179	121
35	Lakshadweep	3000	404	67	2,235
36	Puducherry	49000	3,127	519	1,058
	India		94,66,144	15,69,639	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

15.9

S.No.	States/ Union Territories	Geographic Area (in hectare)	2014-15		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	2,78,336	44,232	271
2	Arunachal Pradesh	8374300	60,181	9,564	114
3	Assam	7843800	2,62,552	41,724	532
4	Bihar	9416300	4,72,325	75,060	797
5	Chhattisgarh	13519200	4,17,847	66,403	491
6	Goa	370200	4,771	758	205
7	Gujarat	19624400	5,54,757	88,160	449
8	Haryana	4421200	26,795	4,258	96
9	Himachal Pradesh	5567300	3,22,718	51,285	921
10	Jammu & Kashmir	22223600	1,13,472	18,032	81
11	Jharkhand	7971600	2,96,062	47,049	590
12	Karnataka	19179100	5,91,138	93,941	490
13	Kerala	3885200	3,92,040	62,301	1,604
14	Madhya Pradesh	30825200	7,97,542	1,26,742	411
15	Maharashtra	30771300	10,67,553	1,69,651	551
16	Manipur	2232700	14,280	2,269	102
17	Meghalaya	2242900	31,439	4,996	223
18	Mizoram	2108100	18,215	2,895	137
19	Nagaland	1657900	23,429	3,723	225
20	Odisha	15570700	6,76,737	1,07,544	691
21	Punjab	5036200	1,00,059	15,901	316
22	Rajasthan	34223900	11,86,211	1,88,508	551
23	Sikkim	709600	2,668	424	60
24	Tamil Nadu	13006000	3,71,999	59,117	455
25	Telangana	11207700	2,03,174	32,287	288
26	Tripura	1048600	1,01,343	16,105	1,536
27	Uttar Pradesh	24092800	6,61,593	1,05,137	436
28	Uttarakhand	5348300	1,57,975	25,105	469
29	West Bengal	8875200	3,71,863	59,095	666
30	Andaman & Nicobar Islands	824900	2,970	472	57
31	Chandigarh	11400	462	73	644
32	Dadra & Nagar Haveli	49100	2,615	416	846
33	Daman & Diu	11100	323	51	463
34	Delhi	148300	1,088	173	117
35	Lakshadweep	3000	413	66	2,187
36	Puducherry	49000	2,937	467	953
	India		95,89,883	15,23,983	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

18.4

S.No.	States/ Union Territories	Geographic Area (in hectare)	2015-16		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	2,81,737	51,929	319
2	Arunachal Pradesh	8374300	60,137	11,084	132
3	Assam	7843800	2,72,081	50,150	639
4	Bihar	9416300	5,21,944	96,204	1,022
5	Chhattisgarh	13519200	4,07,298	75,073	555
6	Goa	370200	4,616	851	230
7	Gujarat	19624400	6,16,247	1,13,586	579
8	Haryana	4421200	22,524	4,152	94
9	Himachal Pradesh	5567300	3,71,658	68,503	1,230
10	Jammu & Kashmir	22223600	1,16,687	21,508	97
11	Jharkhand	7971600	2,97,649	54,862	688
12	Karnataka	19179100	6,13,118	1,13,009	589
13	Kerala	3885200	4,72,541	87,098	2,242
14	Madhya Pradesh	30825200	8,47,282	1,56,170	507
15	Maharashtra	30771300	9,56,596	1,76,318	573
16	Manipur	2232700	13,715	2,528	113
17	Meghalaya	2242900	31,016	5,717	255
18	Mizoram	2108100	19,631	3,618	172
19	Nagaland	1657900	25,953	4,784	289
20	Odisha	15570700	7,57,223	1,39,570	896
21	Punjab	5036200	1,17,986	21,747	432
22	Rajasthan	34223900	11,84,073	2,18,246	638
23	Sikkim	709600	2,694	497	70
24	Tamil Nadu	13006000	4,25,111	78,356	602
25	Telangana	11207700	2,08,119	38,360	342
26	Tripura	1048600	1,10,707	20,405	1,946
27	Uttar Pradesh	24092800	6,63,601	1,22,314	508
28	Uttarakhand	5348300	1,57,610	29,050	543
29	West Bengal	8875200	3,77,729	69,622	784
30	Andaman & Nicobar Islands	824900	3,120	575	70
31	Chandigarh	11400	486	90	786
32	Dadra & Nagar Haveli	49100	2,723	502	1,022
33	Daman & Diu	11100	367	68	610
34	Delhi	148300	1,033	190	128
35	Lakshadweep	3000	427	79	2,625
36	Puducherry	49000	2,845	524	1,070
	India		99,68,285	18,37,337	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

18.7

S.No.	States/ Union Territories	Geographic Area (in hectare)	2016-17		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	3,03,023	56,622	347
2	Arunachal Pradesh	8374300	61,937	11,573	138
3	Assam	7843800	2,52,960	47,268	603
4	Bihar	9416300	5,77,263	1,07,866	1,146
5	Chhattisgarh	13519200	3,97,332	74,244	549
6	Goa	370200	4,523	845	228
7	Gujarat	19624400	6,56,489	1,22,670	625
8	Haryana	4421200	11,930	2,229	50
9	Himachal Pradesh	5567300	3,72,751	69,651	1,251
10	Jammu & Kashmir	22223600	1,21,328	22,671	102
11	Jharkhand	7971600	3,27,324	61,163	767
12	Karnataka	19179100	6,15,955	1,15,096	600
13	Kerala	3885200	4,72,847	88,355	2,274
14	Madhya Pradesh	30825200	8,94,095	1,67,068	542
15	Maharashtra	30771300	9,08,666	1,69,791	552
16	Manipur	2232700	15,678	2,930	131
17	Meghalaya	2242900	33,768	6,310	281
18	Mizoram	2108100	23,809	4,449	211
19	Nagaland	1657900	38,410	7,177	433
20	Odisha	15570700	7,48,244	1,39,815	898
21	Punjab	5036200	1,17,436	21,944	436
22	Rajasthan	34223900	12,04,376	2,25,046	658
23	Sikkim	709600	2,696	504	71
24	Tamil Nadu	13006000	4,33,424	80,988	623
25	Telangana	11207700	2,24,408	41,932	374
26	Tripura	1048600	1,52,755	28,543	2,722
27	Uttar Pradesh	24092800	6,73,176	1,25,788	522
28	Uttarakhand	5348300	1,63,639	30,577	572
29	West Bengal	8875200	4,02,995	75,303	848
30	Andaman & Nicobar Islands	824900	3,258	609	74
31	Chandigarh	11400	505	94	828
32	Dadra & Nagar Haveli	49100	2,786	521	1,060
33	Daman & Diu	11100	405	76	682
34	Delhi	148300	987	184	124
35	Lakshadweep	3000	444	83	2,766
36	Puducherry	49000	2,731	510	1,041
	India		1,02,24,352	19,10,495	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

13.6

S.No.	States/ Union Territories	Geographic Area (in hectare)	2017-18		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	3,51,352	47,800	293
2	Arunachal Pradesh	8374300	57,589	7,835	94
3	Assam	7843800	2,31,386	31,479	401
4	Bihar	9416300	6,39,350	86,981	924
5	Chhattisgarh	13519200	4,80,963	65,433	484
6	Goa	370200	4,415	601	162
7	Gujarat	19624400	6,04,020	82,175	419
8	Haryana	4421200	10,013	1,362	31
9	Himachal Pradesh	5567300	3,44,889	46,921	843
10	Jammu & Kashmir	22223600	1,19,210	16,218	73
11	Jharkhand	7971600	2,71,519	36,939	463
12	Karnataka	19179100	6,28,409	85,493	446
13	Kerala	3885200	5,11,617	69,603	1,792
14	Madhya Pradesh	30825200	9,33,941	1,27,059	412
15	Maharashtra	30771300	9,98,193	1,35,800	441
16	Manipur	2232700	27,269	3,710	166
17	Meghalaya	2242900	31,900	4,340	193
18	Mizoram	2108100	21,757	2,960	140
19	Nagaland	1657900	35,521	4,832	291
20	Odisha	15570700	7,11,325	96,773	622
21	Punjab	5036200	1,26,609	17,225	342
22	Rajasthan	34223900	11,96,371	1,62,762	476
23	Sikkim	709600	2,781	378	53
24	Tamil Nadu	13006000	4,23,787	57,655	443
25	Telangana	11207700	2,38,132	32,397	289
26	Tripura	1048600	1,61,956	22,033	2,101
27	Uttar Pradesh	24092800	5,92,537	80,612	335
28	Uttarakhand	5348300	1,41,136	19,201	359
29	West Bengal	8875200	3,72,727	50,708	571
30	Andaman & Nicobar Islands	824900	2,968	404	49
31	Chandigarh	11400	492	67	587
32	Dadra & Nagar Haveli	49100	2,645	360	733
33	Daman & Diu	11100	622	85	763
34	Delhi	148300	1,051	143	96
35	Lakshadweep	3000	417	57	1,889
36	Puducherry	49000	2,821	384	783
	India		1,02,81,690	13,98,784	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

9.2

S.No.	States/ Union Territories	Geographic Area (in hectare)	2018-19		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	3,22,992	29,861	183
2	Arunachal Pradesh	8374300	61,444	5,681	68
3	Assam	7843800	2,48,228	22,949	293
4	Bihar	9416300	7,06,575	65,324	694
5	Chhattisgarh	13519200	4,49,196	41,529	307
6	Goa	370200	4,310	398	108
7	Gujarat	19624400	6,50,941	60,180	307
8	Haryana	4421200	9,955	920	21
9	Himachal Pradesh	5567300	3,44,882	31,885	573
10	Jammu & Kashmir	22223600	1,25,161	11,571	52
11	Jharkhand	7971600	2,81,271	26,004	326
12	Karnataka	19179100	6,73,187	62,237	325
13	Kerala	3885200	5,43,238	50,223	1,293
14	Madhya Pradesh	30825200	9,99,615	92,415	300
15	Maharashtra	30771300	9,30,842	86,057	280
16	Manipur	2232700	22,129	2,046	92
17	Meghalaya	2242900	32,001	2,959	132
18	Mizoram	2108100	41,520	3,839	182
19	Nagaland	1657900	27,060	2,502	151
20	Odisha	15570700	7,18,422	66,419	427
21	Punjab	5036200	1,29,156	11,941	237
22	Rajasthan	34223900	11,81,076	1,09,192	319
23	Sikkim	709600	2,796	258	36
24	Tamil Nadu	13006000	4,71,528	43,593	335
25	Telangana	11207700	1,79,856	16,628	148
26	Tripura	1048600	1,76,916	16,356	1,560
27	Uttar Pradesh	24092800	5,72,504	52,929	220
28	Uttarakhand	5348300	1,73,148	16,008	299
29	West Bengal	8875200	3,92,700	36,305	409
30	Andaman & Nicobar Islands	824900	3,155	292	35
31	Chandigarh	11400	527	49	428
32	Dadra & Nagar Haveli	49100	2,814	260	530
33	Daman & Diu	11100	790	73	658
34	Delhi	148300	998	92	62
35	Lakshadweep	3000	436	40	1,343
36	Puducherry	49000	2,818	261	532
	India		1,04,84,186	9,69,274	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at current prices (INR in lakh)

Forest Rent to GVO - August 17, 2022

9.9

S.No.	States/ Union Territories	Geographic Area (in hectare)	2019-20		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	16296800	3,59,154	35,501	218
2	Arunachal Pradesh	8374300	62,303	6,158	74
3	Assam	7843800	2,64,263	26,121	333
4	Bihar	9416300	7,84,190	77,514	823
5	Chhattisgarh	13519200	5,29,651	52,354	387
6	Goa	370200	4,367	432	117
7	Gujarat	19624400	6,96,382	68,834	351
8	Haryana	4421200	8,960	886	20
9	Himachal Pradesh	5567300	3,85,829	38,138	685
10	Jammu & Kashmir	22223600	1,29,368	12,788	58
11	Jharkhand	7971600	2,85,392	28,210	354
12	Karnataka	19179100	7,37,683	72,917	380
13	Kerala	3885200	5,40,835	53,459	1,376
14	Madhya Pradesh	30825200	11,29,439	1,11,640	362
15	Maharashtra	30771300	9,38,177	92,735	301
16	Manipur	2232700	16,582	1,639	73
17	Meghalaya	2242900	33,233	3,285	146
18	Mizoram	2108100	46,640	4,610	219
19	Nagaland	1657900	19,453	1,923	116
20	Odisha	15570700	7,88,684	77,958	501
21	Punjab	5036200	1,32,044	13,052	259
22	Rajasthan	34223900	11,66,201	1,15,274	337
23	Sikkim	709600	3,031	300	42
24	Tamil Nadu	13006000	5,38,090	53,188	409
25	Telangana	11207700	1,83,086	18,097	161
26	Tripura	1048600	1,99,248	19,695	1,878
27	Uttar Pradesh	24092800	6,45,299	63,785	265
28	Uttarakhand	5348300	1,97,268	19,499	365
29	West Bengal	8875200	4,10,465	40,573	457
30	Andaman & Nicobar Islands	824900	3,310	327	40
31	Chandigarh	11400	543	54	471
32	Dadra & Nagar Haveli	49100	3,009	297	606
33	Daman & Diu	11100	971	96	865
34	Delhi	148300	918	91	61
35	Lakshadweep	3000	463	46	1,524
36	Puducherry	49000	2,977	294	601
	India		1,12,47,509	11,11,769	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

(INR in lakh)

Forest Rent to GVO - August 17, 2022

20.6

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2011-12		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,61,363	53,953	331
2	Arunachal Pradesh	83,74,300	39,063	8,064	96
3	Assam	78,43,800	2,00,088	41,304	527
4	Bihar	94,16,300	3,41,273	70,448	748
5	Chhattisgarh	1,35,19,200	2,53,487	52,327	387
6	Goa	3,70,200	2,024	418	113
7	Gujarat	1,96,24,400	3,69,454	76,265	389
8	Haryana	44,21,200	37,709	7,784	176
9	Himachal Pradesh	55,67,300	2,14,665	44,313	796
10	Jammu & Kashmir	2,22,23,600	97,975	20,225	91
11	Jharkhand	79,71,600	2,30,983	47,681	598
12	Karnataka	1,91,79,100	4,88,392	1,00,818	526
13	Kerala	38,85,200	2,54,184	52,470	1,351
14	Madhya Pradesh	3,08,25,200	5,81,679	1,20,074	390
15	Maharashtra	3,07,71,300	9,59,071	1,97,979	643
16	Manipur	22,32,700	12,212	2,521	113
17	Meghalaya	22,42,900	21,549	4,448	198
18	Mizoram	21,08,100	12,267	2,532	120
19	Nagaland	16,57,900	16,026	3,308	200
20	Odisha	1,55,70,700	5,29,141	1,09,229	702
21	Punjab	50,36,200	89,211	18,416	366
22	Rajasthan	3,42,23,900	7,78,189	1,60,639	469
23	Sikkim	7,09,600	2,349	485	68
24	Tamil Nadu	1,30,06,000	3,28,769	67,867	522
25	Telangana	1,12,07,700	1,84,773	38,142	340
26	Tripura	10,48,600	62,103	12,820	1,223
27	Uttar Pradesh	2,40,92,800	6,06,552	1,25,209	520
28	Uttarakhand	53,48,300	1,53,437	31,674	592
29	West Bengal	88,75,200	3,12,422	64,492	727
30	Andaman & Nicobar Islands	8,24,900	2,180	450	55
31	Chandigarh	11,400	347	72	629
32	Dadra & Nagar Haveli	49,100	1,999	413	840
33	Daman & Diu	11,100	194	40	360
34	Delhi	1,48,300	1,204	249	168
35	Lakshadweep	3,000	303	63	2,086
36	Puducherry	49,000	3,002	620	1,265
	India		74,49,639	15,37,809	

Annexure 6.6

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

19.0

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2012-13		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,56,012	48,666	299
2	Arunachal Pradesh	83,74,300	39,262	7,464	89
3	Assam	78,43,800	2,02,109	38,420	490
4	Bihar	94,16,300	3,52,188	66,949	711
5	Chhattisgarh	1,35,19,200	2,81,431	53,498	396
6	Goa	3,70,200	1,939	369	100
7	Gujarat	1,96,24,400	3,97,236	75,512	385
8	Haryana	44,21,200	32,287	6,138	139
9	Himachal Pradesh	55,67,300	2,13,184	40,525	728
10	Jammu & Kashmir	2,22,23,600	99,465	18,908	85
11	Jharkhand	79,71,600	2,38,841	45,402	570
12	Karnataka	1,91,79,100	4,79,488	91,147	475
13	Kerala	38,85,200	2,53,852	48,255	1,242
14	Madhya Pradesh	3,08,25,200	5,92,376	1,12,607	365
15	Maharashtra	3,07,71,300	9,51,728	1,80,917	588
16	Manipur	22,32,700	11,661	2,217	99
17	Meghalaya	22,42,900	21,372	4,063	181
18	Mizoram	21,08,100	12,407	2,358	112
19	Nagaland	16,57,900	16,075	3,056	184
20	Odisha	1,55,70,700	5,07,676	96,506	620
21	Punjab	50,36,200	88,270	16,779	333
22	Rajasthan	3,42,23,900	7,82,923	1,48,828	435
23	Sikkim	7,09,600	2,236	425	60
24	Tamil Nadu	1,30,06,000	3,16,848	60,231	463
25	Telangana	1,12,07,700	1,83,198	34,825	311
26	Tripura	10,48,600	66,547	12,650	1,206
27	Uttar Pradesh	2,40,92,800	5,96,024	1,13,300	470
28	Uttarakhand	53,48,300	1,44,911	27,546	515
29	West Bengal	88,75,200	3,07,591	58,471	659
30	Andaman & Nicobar Islands	8,24,900	2,280	433	53
31	Chandigarh	11,400	364	69	607
32	Dadra & Nagar Haveli	49,100	2,038	387	789
33	Daman & Diu	11,100	221	42	378
34	Delhi	1,48,300	1,044	198	134
35	Lakshadweep	3,000	324	62	2,051
36	Puducherry	49,000	2,745	522	1,065
	India		74,58,154	14,17,744	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

17.2

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2013-14		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,53,791	43,546	267
2	Arunachal Pradesh	83,74,300	38,782	6,654	79
3	Assam	78,43,800	2,04,173	35,032	447
4	Bihar	94,16,300	3,64,009	62,457	663
5	Chhattisgarh	1,35,19,200	2,59,569	44,537	329
6	Goa	3,70,200	1,874	322	87
7	Gujarat	1,96,24,400	4,16,582	71,477	364
8	Haryana	44,21,200	31,525	5,409	122
9	Himachal Pradesh	55,67,300	2,19,813	37,716	677
10	Jammu & Kashmir	2,22,23,600	1,02,249	17,544	79
11	Jharkhand	79,71,600	2,42,632	41,631	522
12	Karnataka	1,91,79,100	4,65,364	79,847	416
13	Kerala	38,85,200	2,53,417	43,481	1,119
14	Madhya Pradesh	3,08,25,200	5,87,150	1,00,744	327
15	Maharashtra	3,07,71,300	9,51,926	1,63,332	531
16	Manipur	22,32,700	11,351	1,948	87
17	Meghalaya	22,42,900	22,155	3,801	169
18	Mizoram	21,08,100	12,641	2,169	103
19	Nagaland	16,57,900	14,536	2,494	150
20	Odisha	1,55,70,700	5,08,638	87,272	560
21	Punjab	50,36,200	85,816	14,724	292
22	Rajasthan	3,42,23,900	7,81,512	1,34,092	392
23	Sikkim	7,09,600	2,102	361	51
24	Tamil Nadu	1,30,06,000	3,00,731	51,600	397
25	Telangana	1,12,07,700	1,79,101	30,730	274
26	Tripura	10,48,600	71,649	12,294	1,172
27	Uttar Pradesh	2,40,92,800	5,80,210	99,553	413
28	Uttarakhand	53,48,300	1,61,409	27,695	518
29	West Bengal	88,75,200	3,13,156	53,732	605
30	Andaman & Nicobar Islands	8,24,900	2,308	396	48
31	Chandigarh	11,400	381	65	573
32	Dadra & Nagar Haveli	49,100	2,053	352	717
33	Daman & Diu	11,100	242	42	374
34	Delhi	1,48,300	951	163	110
35	Lakshadweep	3,000	328	56	1,877
36	Puducherry	49,000	2,519	432	882
	India		74,46,643	12,77,699	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

17.3

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2014-15		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,49,997	43,275	266
2	Arunachal Pradesh	83,74,300	39,991	6,923	83
3	Assam	78,43,800	2,01,811	34,934	445
4	Bihar	94,16,300	3,75,764	65,045	691
5	Chhattisgarh	1,35,19,200	2,63,641	45,637	338
6	Goa	3,70,200	1,822	315	85
7	Gujarat	1,96,24,400	4,31,102	74,624	380
8	Haryana	44,21,200	26,734	4,628	105
9	Himachal Pradesh	55,67,300	2,23,878	38,754	696
10	Jammu & Kashmir	2,22,23,600	1,06,563	18,446	83
11	Jharkhand	79,71,600	2,51,649	43,561	546
12	Karnataka	1,91,79,100	4,52,561	78,339	408
13	Kerala	38,85,200	2,53,357	43,857	1,129
14	Madhya Pradesh	3,08,25,200	5,80,284	1,00,448	326
15	Maharashtra	3,07,71,300	8,29,819	1,43,643	467
16	Manipur	22,32,700	11,570	2,003	90
17	Meghalaya	22,42,900	24,176	4,185	187
18	Mizoram	21,08,100	13,667	2,366	112
19	Nagaland	16,57,900	15,250	2,640	159
20	Odisha	1,55,70,700	5,47,638	94,797	609
21	Punjab	50,36,200	83,380	14,433	287
22	Rajasthan	3,42,23,900	8,00,904	1,38,638	405
23	Sikkim	7,09,600	2,006	347	49
24	Tamil Nadu	1,30,06,000	2,89,103	50,044	385
25	Telangana	1,12,07,700	1,75,739	30,421	271
26	Tripura	10,48,600	77,101	13,346	1,273
27	Uttar Pradesh	2,40,92,800	5,73,412	99,259	412
28	Uttarakhand	53,48,300	1,54,018	26,661	498
29	West Bengal	88,75,200	3,09,943	53,652	605
30	Andaman & Nicobar Islands	8,24,900	2,329	403	49
31	Chandigarh	11,400	399	69	606
32	Dadra & Nagar Haveli	49,100	2,076	359	732
33	Daman & Diu	11,100	269	47	419
34	Delhi	1,48,300	932	161	109
35	Lakshadweep	3,000	331	57	1,909
36	Puducherry	49,000	2,325	402	821
	India		73,75,539	12,76,718	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

20.5

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2015-16		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,44,353	50,042	307
2	Arunachal Pradesh	83,74,300	38,890	7,964	95
3	Assam	78,43,800	2,04,658	41,912	534
4	Bihar	94,16,300	3,87,400	79,337	843
5	Chhattisgarh	1,35,19,200	2,43,435	49,854	369
6	Goa	3,70,200	1,756	360	97
7	Gujarat	1,96,24,400	4,50,768	92,314	470
8	Haryana	44,21,200	23,264	4,764	108
9	Himachal Pradesh	55,67,300	2,46,693	50,521	907
10	Jammu & Kashmir	2,22,23,600	1,08,860	22,294	100
11	Jharkhand	79,71,600	2,49,920	51,182	642
12	Karnataka	1,91,79,100	4,45,592	91,254	476
13	Kerala	38,85,200	2,53,209	51,855	1,335
14	Madhya Pradesh	3,08,25,200	5,77,958	1,18,361	384
15	Maharashtra	3,07,71,300	8,40,009	1,72,027	559
16	Manipur	22,32,700	11,522	2,360	106
17	Meghalaya	22,42,900	22,825	4,674	208
18	Mizoram	21,08,100	12,778	2,617	124
19	Nagaland	16,57,900	14,925	3,057	184
20	Odisha	1,55,70,700	5,69,372	1,16,603	749
21	Punjab	50,36,200	83,375	17,075	339
22	Rajasthan	3,42,23,900	8,08,506	1,65,576	484
23	Sikkim	7,09,600	1,918	393	55
24	Tamil Nadu	1,30,06,000	2,81,179	57,583	443
25	Telangana	1,12,07,700	1,72,303	35,286	315
26	Tripura	10,48,600	83,034	17,005	1,622
27	Uttar Pradesh	2,40,92,800	5,59,290	1,14,538	475
28	Uttarakhand	53,48,300	1,53,548	31,445	588
29	West Bengal	88,75,200	2,94,018	60,213	678
30	Andaman & Nicobar Islands	8,24,900	2,350	481	58
31	Chandigarh	11,400	415	85	746
32	Dadra & Nagar Haveli	49,100	2,113	433	881
33	Daman & Diu	11,100	301	62	555
34	Delhi	1,48,300	841	172	116
35	Lakshadweep	3,000	335	69	2,283
36	Puducherry	49,000	2,157	442	901
	India		73,93,867	15,14,208	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

21.2

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2016-17		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,35,157	49,898	306
2	Arunachal Pradesh	83,74,300	39,029	8,282	99
3	Assam	78,43,800	2,10,070	44,575	568
4	Bihar	94,16,300	3,99,866	84,847	901
5	Chhattisgarh	1,35,19,200	2,84,906	60,454	447
6	Goa	3,70,200	1,702	361	98
7	Gujarat	1,96,24,400	4,76,555	1,01,120	515
8	Haryana	44,21,200	19,785	4,198	95
9	Himachal Pradesh	55,67,300	2,34,912	49,846	895
10	Jammu & Kashmir	2,22,23,600	1,12,141	23,795	107
11	Jharkhand	79,71,600	2,69,926	57,275	718
12	Karnataka	1,91,79,100	4,27,211	90,649	473
13	Kerala	38,85,200	2,53,080	53,701	1,382
14	Madhya Pradesh	3,08,25,200	5,75,193	1,22,050	396
15	Maharashtra	3,07,71,300	7,79,721	1,65,448	538
16	Manipur	22,32,700	13,067	2,773	124
17	Meghalaya	22,42,900	24,141	5,122	228
18	Mizoram	21,08,100	14,736	3,127	148
19	Nagaland	16,57,900	18,976	4,026	243
20	Odisha	1,55,70,700	5,93,165	1,25,863	808
21	Punjab	50,36,200	82,042	17,408	346
22	Rajasthan	3,42,23,900	8,16,300	1,73,210	506
23	Sikkim	7,09,600	1,804	383	54
24	Tamil Nadu	1,30,06,000	2,76,898	58,755	452
25	Telangana	1,12,07,700	1,66,060	35,236	314
26	Tripura	10,48,600	89,570	19,006	1,812
27	Uttar Pradesh	2,40,92,800	5,57,728	1,18,344	491
28	Uttarakhand	53,48,300	1,54,499	32,783	613
29	West Bengal	88,75,200	2,90,635	61,669	695
30	Andaman & Nicobar Islands	8,24,900	2,384	506	61
31	Chandigarh	11,400	432	92	804
32	Dadra & Nagar Haveli	49,100	2,117	449	915
33	Daman & Diu	11,100	331	70	634
34	Delhi	1,48,300	758	161	108
35	Lakshadweep	3,000	339	72	2,400
36	Puducherry	49,000	1,993	423	863
	India		74,27,232	15,75,977	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

14.9

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2017-18		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,75,838	41,221	253
2	Arunachal Pradesh	83,74,300	36,924	5,518	66
3	Assam	78,43,800	2,03,464	30,406	388
4	Bihar	94,16,300	4,15,247	62,054	659
5	Chhattisgarh	1,35,19,200	3,47,404	51,916	384
6	Goa	3,70,200	1,736	259	70
7	Gujarat	1,96,24,400	4,69,882	70,219	358
8	Haryana	44,21,200	11,845	1,770	40
9	Himachal Pradesh	55,67,300	2,22,075	33,187	596
10	Jammu & Kashmir	2,22,23,600	1,11,066	16,598	75
11	Jharkhand	79,71,600	2,29,319	34,269	430
12	Karnataka	1,91,79,100	4,16,293	62,211	324
13	Kerala	38,85,200	2,58,251	38,593	993
14	Madhya Pradesh	3,08,25,200	5,95,627	89,010	289
15	Maharashtra	3,07,71,300	8,65,069	1,29,275	420
16	Manipur	22,32,700	23,742	3,548	159
17	Meghalaya	22,42,900	23,725	3,546	158
18	Mizoram	21,08,100	13,156	1,966	93
19	Nagaland	16,57,900	18,327	2,739	165
20	Odisha	1,55,70,700	5,76,473	86,148	553
21	Punjab	50,36,200	79,022	11,809	234
22	Rajasthan	3,42,23,900	7,94,615	1,18,747	347
23	Sikkim	7,09,600	1,851	277	39
24	Tamil Nadu	1,30,06,000	2,60,265	38,894	299
25	Telangana	1,12,07,700	1,57,369	23,517	210
26	Tripura	10,48,600	91,110	13,615	1,298
27	Uttar Pradesh	2,40,92,800	5,22,423	78,071	324
28	Uttarakhand	53,48,300	1,29,187	19,306	361
29	West Bengal	88,75,200	2,97,165	44,408	500
30	Andaman & Nicobar Islands	8,24,900	2,171	325	39
31	Chandigarh	11,400	443	66	581
32	Dadra & Nagar Haveli	49,100	2,178	325	663
33	Daman & Diu	11,100	546	82	735
34	Delhi	1,48,300	785	117	79
35	Lakshadweep	3,000	335	50	1,671
36	Puducherry	49,000	2,086	312	636
	India		74,57,018	11,14,372	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

10.6

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2018-19		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,69,333	28,675	176
2	Arunachal Pradesh	83,74,300	40,326	4,293	51
3	Assam	78,43,800	2,16,246	23,023	294
4	Bihar	94,16,300	4,28,029	45,571	484
5	Chhattisgarh	1,35,19,200	2,73,530	29,122	215
6	Goa	3,70,200	1,726	184	50
7	Gujarat	1,96,24,400	4,82,472	51,367	262
8	Haryana	44,21,200	3,940	419	9
9	Himachal Pradesh	55,67,300	2,20,471	23,473	422
10	Jammu & Kashmir	2,22,23,600	1,13,604	12,095	54
11	Jharkhand	79,71,600	2,10,171	22,376	281
12	Karnataka	1,91,79,100	3,96,337	42,196	220
13	Kerala	38,85,200	2,59,215	27,598	710
14	Madhya Pradesh	3,08,25,200	5,99,237	63,798	207
15	Maharashtra	3,07,71,300	7,32,986	78,038	254
16	Manipur	22,32,700	19,398	2,065	92
17	Meghalaya	22,42,900	24,064	2,562	114
18	Mizoram	21,08,100	12,992	1,383	66
19	Nagaland	16,57,900	18,440	1,963	118
20	Odisha	1,55,70,700	5,72,061	60,905	391
21	Punjab	50,36,200	77,172	8,216	163
22	Rajasthan	3,42,23,900	7,82,650	83,326	243
23	Sikkim	7,09,600	1,808	192	27
24	Tamil Nadu	1,30,06,000	2,56,013	27,257	210
25	Telangana	1,12,07,700	1,55,235	16,527	147
26	Tripura	10,48,600	98,806	10,519	1,003
27	Uttar Pradesh	2,40,92,800	5,01,879	53,433	222
28	Uttarakhand	53,48,300	1,55,367	16,541	309
29	West Bengal	88,75,200	2,96,798	31,599	356
30	Andaman & Nicobar Islands	8,24,900	2,277	242	29
31	Chandigarh	11,400	461	49	430
32	Dadra & Nagar Haveli	49,100	2,261	241	490
33	Daman & Diu	11,100	676	72	649
34	Delhi	1,48,300	725	77	52
35	Lakshadweep	3,000	342	36	1,214
36	Puducherry	49,000	2,012	214	437
	India		72,29,059	7,69,648	

State wise value of non-timber forest resources service (Firewood+ NTFP) at constant prices

Forest Rent to GVO - August 17, 2022

11.3

S.No.	States/ Union Territories	Geographic Area (in hectare)*	2019-20		
			Value of output of non-timber forest products	Value of non-timber forest resources	NTFP Provisioning Service (INR/ha/yr)
1	Andhra Pradesh	1,62,96,800	2,63,181	29,813	183
2	Arunachal Pradesh	83,74,300	38,587	4,371	52
3	Assam	78,43,800	2,19,132	24,823	316
4	Bihar	94,16,300	4,42,367	50,111	532
5	Chhattisgarh	1,35,19,200	3,01,937	34,203	253
6	Goa	3,70,200	1,706	193	52
7	Gujarat	1,96,24,400	4,95,880	56,173	286
8	Haryana	44,21,200	1,524	173	4
9	Himachal Pradesh	55,67,300	2,41,452	27,352	491
10	Jammu & Kashmir	2,22,23,600	1,16,187	13,162	59
11	Jharkhand	79,71,600	2,02,018	22,885	287
12	Karnataka	1,91,79,100	3,84,571	43,564	227
13	Kerala	38,85,200	2,59,871	29,438	758
14	Madhya Pradesh	3,08,25,200	6,14,643	69,627	226
15	Maharashtra	3,07,71,300	6,93,545	78,565	255
16	Manipur	22,32,700	14,836	1,681	75
17	Meghalaya	22,42,900	23,958	2,714	121
18	Mizoram	21,08,100	13,236	1,499	71
19	Nagaland	16,57,900	11,624	1,317	79
20	Odisha	1,55,70,700	5,73,712	64,990	417
21	Punjab	50,36,200	74,806	8,474	168
22	Rajasthan	3,42,23,900	7,56,510	85,697	250
23	Sikkim	7,09,600	1,772	201	28
24	Tamil Nadu	1,30,06,000	2,48,307	28,128	216
25	Telangana	1,12,07,700	1,52,869	17,317	155
26	Tripura	10,48,600	1,04,941	11,888	1,134
27	Uttar Pradesh	2,40,92,800	4,88,637	55,353	230
28	Uttarakhand	53,48,300	1,39,903	15,848	296
29	West Bengal	88,75,200	2,95,504	33,475	377
30	Andaman & Nicobar Islands	8,24,900	2,309	262	32
31	Chandigarh	11,400	479	54	476
32	Dadra & Nagar Haveli	49,100	2,371	269	547
33	Daman & Diu	11,100	837	95	854
34	Delhi	1,48,300	667	76	51
35	Lakshadweep	3,000	351	40	1,326
36	Puducherry	49,000	1,962	222	454
	India		71,86,189	8,14,052	

Forest carbon stock and carbon stock per hectare in India 2019-20

States/UTs	Carbon Stock						Carbon Stock per hectare					
	Total	AGB	BGB	Dead Wood	Litter	SOC	Total	AGB	BGB	Dead Wood	Litter	SOC
			'000 tonnes				per hectare stock in tonnes					
Andhra Pradesh	2,30,222	63,951	25,064	979	3,171	1,37,057	77.30	21.47	8.42	0.33	1.06	46.02
Arunachal Pradesh	10,23,843	3,40,351	1,02,229	9,163	11,802	5,60,298	154.12	51.23	15.39	1.38	1.78	84.34
Assam	2,71,372	87,070	21,495	1,875	4,890	1,56,042	95.85	30.75	7.59	0.66	1.73	55.12
Bihar	56,881	14,743	5,249	231	785	35,873	77.05	19.97	7.11	0.31	1.06	48.60
Chhattisgarh	4,96,437	1,52,714	48,947	2,520	8,487	2,83,769	89.09	27.41	8.78	0.45	1.52	50.93
Delhi	1,202	263	78	5	17	839	61.62	13.49	3.99	0.24	0.87	43.03
Goa	25,244	8,863	2,606	232	448	13,095	112.48	39.49	11.61	1.03	2.00	58.35
Gujarat	1,07,766	28,602	9,814	502	1,634	67,214	72.20	19.16	6.58	0.34	1.09	45.03
Haryana	10,232	2,326	836	41	139	6,890	63.82	14.50	5.22	0.26	0.87	42.97
Himachal Pradesh	2,58,071	1,14,269	31,880	2,657	3,328	1,05,937	167.10	73.99	20.64	1.72	2.15	68.60
Jammu & Kashmir	3,70,870	1,63,897	45,864	3,386	4,951	1,52,772	173.41	76.63	21.45	1.58	2.32	71.43
Jharkhand	1,84,811	51,017	20,819	774	2,536	1,09,665	77.92	21.51	8.78	0.33	1.07	46.23
Karnataka	3,76,395	1,22,741	36,716	2,890	6,380	2,07,668	97.19	31.69	9.48	0.75	1.65	53.62
Kerala	2,05,523	61,802	17,440	1,534	3,198	1,21,549	96.7	29.08	8.21	0.72	1.50	57.19
Madhya Pradesh	6,09,250	1,71,587	67,160	2,676	8,653	3,59,174	78.63	22.14	8.67	0.35	1.12	46.35
Maharashtra	4,51,606	1,37,831	42,353	2,316	7,928	2,61,178	88.91	27.13	8.34	0.46	1.56	51.42
Manipur	1,76,931	47,590	14,101	880	2,652	1,11,708	106.60	28.67	8.50	0.53	1.60	67.30
Meghalaya	1,83,388	55,241	15,820	1,238	3,075	1,08,014	107.59	32.41	9.28	0.73	1.80	63.37
Mizoram	1,58,638	48,157	10,622	758	3,140	95,961	89.02	27.02	5.96	0.43	1.76	53.85
Nagaland	1,34,932	39,339	10,618	854	2,006	82,115	110.15	32.11	8.67	0.70	1.64	67.03
Odisha	4,44,830	1,31,015	40,441	2,252	7,671	2,63,451	85.28	25.12	7.75	0.43	1.47	50.51
Punjab	13,558	3,420	1,284	56	175	8,623	73.43	18.52	6.95	0.31	0.95	46.70
Rajasthan	1,10,774	26,714	10,803	462	1,476	71,319	66.52	16.04	6.49	0.28	0.89	42.82

States/UTs	Carbon Stock						Carbon Stock per hectare					
	Total	AGB	BGB	Dead Wood	Litter	SOC	Total	AGB	BGB	Dead Wood	Litter	SOC
			'000 tonnes				per hectare stock in tonnes					
Sikkim	55,539	18,024	5,466	498	607	30,944	166.24	53.95	16.36	1.49	1.82	92.62
Tamil Nadu	2,14,613	60,459	20,671	1,198	3,102	1,29,183	81.22	22.88	7.82	0.45	1.17	48.90
Telangana	1,61,986	44,413	18,415	675	2,169	96,314	76.36	20.94	8.68	0.32	1.02	45.40
Tripura	74,974	24,349	5,358	477	1,486	43,304	97.09	31.53	6.94	0.62	1.92	56.08
Uttar Pradesh	1,17,241	32,543	10,234	534	1,825	72,105	79.12	21.96	6.91	0.36	1.23	48.66
Uttarakhand	3,78,159	1,59,674	42,893	3,561	5,184	1,66,847	155.59	65.70	17.65	1.46	2.13	68.65
West Bengal	1,55,261	45,365	14,119	726	2,162	92,889	92.24	26.95	8.39	0.43	1.28	55.19
Andaman and Nicobar Islands	1,09,836	47,560	15,450	1,432	1,808	43,586	162.86	70.52	22.91	2.12	2.68	64.63
Chandigarh	183	47	15	1	3	117	79.85	20.49	6.62	0.30	1.17	51.27
Dadra and Nagar Haveli & Daman and Diu	1,980	558	129	11	38	1,244	86.93	24.49	5.68	0.48	1.68	54.60
Ladakh	30,702	13,293	3,836	269	317	12,987	135.11	58.50	16.88	1.18	1.39	57.16
Lakshadweep	210	46	10	1	3	150	77.63	17.12	3.77	0.25	1.15	55.34
Puducherry	386	76	17	1	5	287	72.46	14.25	3.25	0.24	0.96	53.76
Total	72,03,846	23,19,910	7,18,852	47,665	1,07,251	40,10,168	100.92	32.50	10.07	0.67	1.50	56.18

Source: India State of Forest Report 2021

Note: *Biodiversity data have been collected from 8,500 sub-plots spread in all the States/UTs among sixteen type groups. The total number of species gives the observed number in these sub-plots.

Annexure 6.8

(at current price)

State wise value of Carbon Retention service during the year 2015-16

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2015-16	Value of Carbon Retention during the year 2015-16	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (7) * 3.67	9=(80 * (8))	10=(66 * (9))	11=((10) * (3/100))	12	
1	Andhra Pradesh	1,62,96,800	1,00,539	38,585	568	4,527	1,18,471	2,62,690	26,26,90,000	96,40,72,300	77,24,38,00,699	51,23,80,53,07,371	1,53,71,41,59,221	15,37,142	9,432
2	Arunachal Pradesh	83,74,300	2,43,462	53,378	4,305	16,231	6,77,163	9,94,539	99,45,39,000	3,64,99,58,130	2,92,44,34,59,222	1,93,98,62,27,36,256	5,81,95,86,82,088	58,19,587	69,493
3	Assam	78,43,800	47,343	10,824	1,093	5,240	1,12,352	1,76,852	17,68,52,000	64,90,46,840	52,00,32,00,126	34,49,52,30,73,658	1,03,48,56,92,210	10,34,857	13,193
4	Bihar	94,16,300	19,063	6,707	138	625	28,864	55,397	5,53,97,000	20,33,06,990	16,28,94,46,981	10,80,52,62,57,613	32,41,57,87,728	3,24,158	3,443
5	Chhattisgarh	1,35,19,200	2,06,678	68,159	2,588	7,628	2,75,927	5,60,980	56,09,80,000	2,05,87,96,600	1,64,95,57,55,133	1,09,41,99,36,09,687	3,28,25,98,08,291	32,82,598	24,281
6	Goa	3,70,200	5,153	1,512	250	417	11,684	19,016	1,90,16,000	6,97,88,720	5,59,16,40,771	3,70,90,97,48,087	11,12,72,92,443	1,11,273	30,058
7	Gujarat	1,96,24,400	32,668	11,719	322	993	64,995	1,10,697	11,06,97,000	40,62,57,990	32,55,03,71,183	21,59,16,05,16,617	64,77,48,15,498	6,47,748	3,301
8	Haryana	44,21,200	3,736	1,269	20	74	7,312	12,411	1,24,11,000	4,55,48,370	3,64,94,45,394	2,42,07,82,96,356	7,26,23,48,891	72,623	1,643
9	Himachal Pradesh	55,67,300	70,655	18,691	739	2,511	83,186	1,75,782	17,57,82,000	64,51,19,940	51,68,85,67,416	34,28,65,25,73,529	1,02,85,95,77,206	10,28,596	18,476
10	Jammu & Kashmir	2,22,23,600	1,12,919	30,083	1,004	3,529	1,28,391	2,75,926	27,59,26,000	1,01,26,48,420	81,13,58,36,734	53,81,97,53,44,480	1,61,45,92,60,334	16,14,593	7,265
11	Jharkhand	79,71,600	86,006	33,173	438	1,298	1,01,967	2,22,882	22,28,82,000	81,79,76,940	65,53,82,87,667	43,47,34,46,82,011	1,30,42,03,40,460	13,04,203	16,361
12	Karnataka	1,91,79,100	1,28,098	35,045	2,545	19,745	2,89,652	4,75,085	47,50,85,000	1,74,35,61,950	1,39,69,83,93,753	92,66,59,95,82,977	2,77,99,79,87,489	27,79,980	14,495
13	Kerala	38,85,200	74,166	19,245	1,058	7,436	1,53,976	2,55,881	25,58,81,000	93,90,83,270	75,24,16,19,272	49,90,99,48,07,017	1,49,72,98,44,211	14,97,298	38,539
14	Madhya Pradesh	3,08,25,200	2,66,040	1,01,516	1,654	7,741	3,18,713	6,95,664	69,56,64,000	2,55,30,86,880	2,04,55,94,85,969	1,35,69,02,39,26,859	4,07,07,07,17,806	40,70,707	13,206
15	Maharashtra	3,07,71,300	1,42,651	48,947	1,986	9,385	2,90,052	4,93,021	49,30,21,000	1,80,93,87,070	1,44,97,24,61,321	96,16,44,37,79,532	2,88,49,33,13,386	28,84,933	9,375
16	Manipur	22,32,700	27,253	8,821	530	3,909	1,02,578	1,43,091	14,30,91,000	52,51,43,970	42,07,58,02,984	27,91,01,00,31,737	83,73,03,00,952	8,37,303	37,502
17	Meghalaya	22,42,900	25,168	6,835	881	5,184	1,17,772	1,55,840	15,58,40,000	57,19,32,800	45,82,46,37,028	30,39,68,10,65,517	91,19,04,31,966	9,11,904	40,657
18	Mizoram	21,08,100	15,359	3,173	633	2,652	73,224	95,041	9,50,41,000	34,88,00,470	27,94,67,35,933	18,53,78,80,39,963	55,61,36,41,199	5,56,136	26,381
19	Nagaland	16,57,900	16,151	4,150	666	2,432	1,01,661	1,25,060	12,50,60,000	45,89,70,200	36,77,38,00,736	24,39,31,28,46,853	73,17,93,85,406	7,31,794	44,140

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2015-16	Value of Carbon Retention during the year 2015-16	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (7) * 3.67	9=(80 * (8))	10=(66 * (9))	11=((10)* (3/100))	12	
20	Odisha	1,55,70,700	1,52,525	50,407	2,108	9,087	2,38,776	4,52,903	45,29,03,000	1,66,21,54,010	1,33,17,57,93,018	88,33,93,65,60,676	2,65,01,80,96,820	26,50,181	17,020
21	Punjab	50,36,200	5,095	1,883	26	63	8,971	16,038	1,60,38,000	5,88,59,460	4,71,59,62,068	3,12,82,34,40,251	9,38,47,03,208	93,847	1,863
22	Rajasthan	3,42,23,900	32,558	12,736	216	721	43,429	89,660	8,96,60,000	32,90,52,200	26,36,44,56,853	17,48,83,08,79,968	52,46,49,26,399	5,24,649	1,533
23	Sikkim	7,09,600	13,379	3,735	211	585	30,624	48,534	4,85,34,000	17,81,19,780	14,27,13,86,894	9,46,66,24,79,683	28,39,98,74,390	2,83,999	40,022
24	Tamil Nadu	1,30,06,000	84,067	29,252	1,006	5,579	1,09,434	2,29,338	22,93,38,000	84,16,70,460	67,43,66,69,704	44,73,26,98,67,836	1,34,19,80,96,035	13,41,981	10,318
25	Telangana	1,12,07,700	72,498	28,388	333	3,117	80,639	1,84,975	18,49,75,000	67,88,58,250	54,39,17,62,283	36,07,96,33,28,375	1,08,23,88,99,851	10,82,389	9,658
26	Tripura	10,48,600	15,674	3,224	556	1,613	42,341	63,408	6,34,08,000	23,27,07,360	18,64,50,75,620	12,36,78,19,36,616	37,10,34,58,098	3,71,035	35,384
27	Uttar Pradesh	2,40,92,800	47,752	14,264	444	1,824	60,850	1,25,134	12,51,34,000	45,92,41,780	36,79,55,60,382	24,40,75,62,27,236	73,22,26,86,817	7,32,227	3,039
28	Uttarakhand	53,48,300	1,05,173	26,961	1,316	5,665	1,45,549	2,84,664	28,46,64,000	1,04,47,16,880	83,70,52,39,187	55,52,41,12,60,487	1,66,57,23,37,815	16,65,723	31,145
29	West Bengal	88,75,200	45,382	13,916	434	2,585	1,00,884	1,63,201	16,32,01,000	59,89,47,670	47,98,91,33,647	31,83,25,84,03,320	95,49,77,52,100	9,54,978	10,760
30	Andaman & Nicobar Islands	8,24,900	39,426	11,901	2,048	3,702	57,996	1,15,073	11,50,73,000	42,23,17,910	33,83,71,30,754	22,44,51,50,10,602	67,33,54,50,318	6,73,355	81,629
31	Chandigarh	11,400	61	19	0	2	122	204	2,04,000	7,48,680	5,99,86,049	3,97,90,48,623	11,93,71,459	1,194	10,471
32	Dadra & Nagar Haveli	49,100	447	106	10	35	827	1,425	14,25,000	52,29,750	41,90,20,199	27,79,48,24,938	83,38,44,748	8,338	16,983
33	Daman & Diu	11,100	11	2	0	2	76	91	91,000	3,33,970	2,67,58,483	1,77,49,67,768	5,32,49,033	532	4,797
34	Delhi	1,48,300	230	52	2	11	653	948	9,48,000	34,79,160	27,87,58,701	18,49,08,73,011	55,47,26,190	5,547	3,741
35	Lakshadweep	3,000	55	0	1	5	100	161	1,61,000	5,90,870	4,73,41,931	3,14,03,27,590	9,42,09,828	942	31,403
36	Puducherry	49,000	108	23	1	8	311	451	4,51,000	16,55,170	13,26,16,217	8,79,68,18,279	26,39,04,548	2,639	5,386
	India		22,37,549	6,98,701	30,130	1,36,161	39,79,522	70,82,063	7,08,20,63,000	25,99,11,71,210	20,82,47,54,00,312	13,81,36,63,24,81,375	41,44,09,89,74,441	4,14,40,990	

Notes: India's country-level social cost of a tCO₂ = US\$ 80 in the year 2015-16 and the average annual exchange rate of US\$ to INR for the year was 66. A rate of 3% return has been assumed for estimating the value of carbon retention service.

Annexure 6.8

(at constant price)

State wise value of Carbon Retention service during the year 2015-16

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass	Below ground biomass	Dead wood	Litter	Soil Organic Carbon	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2015-16	Value of Carbon Retention during the year 2015-16	Carbon Retention Service (per hectare)
			(AGB)	(BGB)	(in '000 tonnes)	(in '000 tonnes)	(SOC)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			(in '000 tonnes)	(in '000 tonnes)			(in '000 tonnes)			(India's country-level social cost of a tCO ₂ = US\$ 80)	(Exchange rate: 1 US\$ = 51.16 INR)	(after applying 3% rate of return)			
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (7) * 3.67	9=(80 * (8))	10=(66 * (9))	11=((10) * (3/100))	12	
1	Andhra Pradesh	1,62,96,800	1,00,539	38,585	568	4,527	1,18,471	2,62,690	26,26,90,000	96,40,72,300	77,24,38,00,699	39,51,79,28,43,748	1,18,55,37,85,312	11,85,538	7,275
2	Arunachal Pradesh	83,74,300	2,43,462	53,378	4,305	16,231	6,77,163	9,94,539	99,45,39,000	3,64,99,58,130	2,92,44,34,59,222	1,49,61,40,73,73,820	4,48,84,22,21,215	44,88,422	53,598
3	Assam	78,43,800	47,343	10,824	1,093	5,240	1,12,352	1,76,852	17,68,52,000	64,90,46,840	52,00,32,00,126	26,60,48,37,18,461	79,81,45,11,554	7,98,145	10,175
4	Bihar	94,16,300	19,063	6,707	138	625	28,864	55,397	5,53,97,000	20,33,06,990	16,28,94,46,981	8,33,36,81,07,523	25,00,10,43,226	2,50,010	2,655
5	Chhattisgarh	1,35,19,200	2,06,678	68,159	2,588	7,628	2,75,927	5,60,980	56,09,80,000	2,05,87,96,600	1,64,95,57,55,133	84,39,13,64,32,624	2,53,17,40,92,979	25,31,741	18,727
6	Goa	3,70,200	5,153	1,512	250	417	11,684	19,016	1,90,16,000	6,97,88,720	5,59,16,40,771	2,86,06,83,41,835	8,58,20,50,255	85,821	23,182
7	Gujarat	1,96,24,400	32,668	11,719	322	993	64,995	1,10,697	11,06,97,000	40,62,57,990	32,55,03,71,183	16,65,27,69,89,700	49,95,83,09,691	4,99,583	2,546
8	Haryana	44,21,200	3,736	1,269	20	74	7,312	12,411	1,24,11,000	4,55,48,370	3,64,94,45,394	1,86,70,56,26,342	5,60,11,68,790	56,012	1,267
9	Himachal Pradesh	55,67,300	70,655	18,691	739	2,511	83,186	1,75,782	17,57,82,000	64,51,19,940	51,68,85,67,416	26,44,38,71,08,987	79,33,16,13,270	7,93,316	14,250
10	Jammu & Kashmir	2,22,23,600	1,12,919	30,083	1,004	3,529	1,28,391	2,75,926	27,59,26,000	1,01,26,48,420	81,13,58,36,734	41,50,90,94,07,302	1,24,52,72,82,219	12,45,273	5,603
11	Jharkhand	79,71,600	86,006	33,173	438	1,298	1,01,967	2,22,882	22,28,82,000	81,79,76,940	65,53,82,87,667	33,52,93,87,97,062	1,00,58,81,63,912	10,05,882	12,618
12	Karnataka	1,91,79,100	1,28,098	35,045	2,545	19,745	2,89,652	4,75,085	47,50,85,000	1,74,35,61,950	1,39,69,83,93,753	71,46,96,98,24,402	2,14,40,90,94,732	21,44,091	11,179
13	Kerala	38,85,200	74,166	19,245	1,058	7,436	1,53,976	2,55,881	25,58,81,000	93,90,83,270	75,24,16,19,272	38,49,36,12,41,963	1,15,48,08,37,259	11,54,808	29,723
14	Madhya Pradesh	3,08,25,200	2,66,040	1,01,516	1,654	7,741	3,18,713	6,95,664	69,56,64,000	2,55,30,86,880	2,04,55,94,85,969	1,04,65,26,33,02,194	3,13,95,78,99,066	31,39,579	10,185
15	Maharashtra	3,07,71,300	1,42,651	48,947	1,986	9,385	2,90,052	4,93,021	49,30,21,000	1,80,93,87,070	1,44,97,24,61,321	74,16,79,11,21,161	2,22,50,37,33,635	22,25,037	7,231
16	Manipur	22,32,700	27,253	8,821	530	3,909	1,02,578	1,43,091	14,30,91,000	52,51,43,970	42,07,58,02,984	21,52,59,80,80,646	64,57,79,42,419	6,45,779	28,924
17	Meghalaya	22,42,900	25,168	6,835	881	5,184	1,17,772	1,55,840	15,58,40,000	57,19,32,800	45,82,46,37,028	23,44,38,84,30,354	70,33,16,52,911	7,03,317	31,357
18	Mizoram	21,08,100	15,359	3,173	633	2,652	73,224	95,041	9,50,41,000	34,88,00,470	27,94,67,35,933	14,29,75,50,10,327	42,89,26,50,310	4,28,927	20,347
19	Nagaland	16,57,900	16,151	4,150	666	2,432	1,01,661	1,25,060	12,50,60,000	45,89,70,200	36,77,38,00,736	18,81,34,76,45,663	56,44,04,29,370	5,64,404	34,043

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass	Below ground biomass	Dead wood	Litter	Soil Organic Carbon	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2015-16	Value of Carbon Retention during the year 2015-16	Carbon Retention Service (per hectare)
			(AGB)	(BGB)	(in '000 tonnes)	(in '000 tonnes)	(SOC)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			(in '000 tonnes)	(in '000 tonnes)			(in '000 tonnes)				(India's country-level social cost of a tCO ₂ = US\$ 80)	(Exchange rate: 1 US\$ = 51.16 INR)	(after applying 3% rate of return)		
	1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (7) * 3.67	9=(80 * (8))	10=(66 * (9))	11=((10) * (3/100))	12			
20	Odisha	1,55,70,700	1,52,525	50,407	2,108	9,087	2,38,776	4,52,903	45,29,03,000	1,66,21,54,010	1,33,17,57,93,018	68,13,27,35,70,795	2,04,39,82,07,124	20,43,982	13,127
21	Punjab	50,36,200	5,095	1,883	26	63	8,971	16,038	1,60,38,000	5,88,59,460	4,71,59,62,068	2,41,26,86,19,392	7,23,80,58,582	72,381	1,437
22	Rajasthan	3,42,23,900	32,558	12,736	216	721	43,429	89,660	8,96,60,000	32,90,52,200	26,36,44,56,853	13,48,80,56,12,587	40,46,41,68,378	4,04,642	1,182
23	Sikkim	7,09,600	13,379	3,735	211	585	30,624	48,534	4,85,34,000	17,81,19,780	14,27,13,86,894	7,30,12,41,53,483	21,90,37,24,604	2,19,037	30,868
24	Tamil Nadu	1,30,06,000	84,067	29,252	1,006	5,579	1,09,434	2,29,338	22,93,38,000	84,16,70,460	67,43,66,69,704	34,50,06,00,22,078	1,03,50,18,00,662	10,35,018	7,958
25	Telangana	1,12,07,700	72,498	28,388	333	3,117	80,639	1,84,975	18,49,75,000	67,88,58,250	54,39,17,62,283	27,82,68,25,58,424	83,48,04,76,753	8,34,805	7,448
26	Tripura	10,48,600	15,674	3,224	556	1,613	42,341	63,408	6,34,08,000	23,27,07,360	18,64,50,75,620	9,53,88,20,68,737	28,61,64,62,062	2,86,165	27,290
27	Uttar Pradesh	2,40,92,800	47,752	14,264	444	1,824	60,850	1,25,134	12,51,34,000	45,92,41,780	36,79,55,60,382	18,82,46,08,69,122	56,47,38,26,074	5,64,738	2,344
28	Uttarakhand	53,48,300	1,05,173	26,961	1,316	5,665	1,45,549	2,84,664	28,46,64,000	1,04,47,16,880	83,70,52,39,187	42,82,36,00,36,822	1,28,47,08,01,105	12,84,708	24,021
29	West Bengal	88,75,200	45,382	13,916	434	2,585	1,00,884	1,63,201	16,32,01,000	59,89,47,670	47,98,91,33,647	24,55,12,40,77,401	73,65,37,22,322	7,36,537	8,299
30	Andaman & Nicobar Islands	8,24,900	39,426	11,901	2,048	3,702	57,996	1,15,073	11,50,73,000	42,23,17,910	33,83,71,30,754	17,31,10,76,09,382	51,93,32,28,281	5,19,332	62,957
31	Chandigarh	11,400	61	19	0	2	122	204	2,04,000	7,48,680	5,99,86,049	3,06,88,86,292	9,20,66,589	921	8,076
32	Dadra & Nagar Haveli	49,100	447	106	10	35	827	1,425	14,25,000	52,29,750	41,90,20,199	21,43,70,73,365	64,31,12,201	6,431	13,098
33	Daman & Diu	11,100	11	2	0	2	76	91	91,000	3,33,970	2,67,58,483	1,36,89,63,983	4,10,68,919	411	3,700
34	Delhi	1,48,300	230	52	2	11	653	948	9,48,000	34,79,160	27,87,58,701	14,26,12,95,123	42,78,38,854	4,278	2,885
35	Lakshadweep	3,000	55	0	1	5	100	161	1,61,000	5,90,870	4,73,41,931	2,42,20,13,201	7,26,60,396	727	24,220
36	Puducherry	49,000	108	23	1	8	311	451	4,51,000	16,55,170	13,26,16,217	6,78,46,45,676	20,35,39,370	2,035	4,154
	India		22,37,549	6,98,701	30,130	1,36,161	39,79,522	70,82,063	7,08,20,63,000	25,99,11,71,210	20,82,47,54,00,312	10,65,39,44,14,79,977	31,96,18,32,44,399	3,19,61,832	

Notes: India's country-level social cost of a tCO₂ = US\$ 80 in the year 2015-16 and the average annual exchange rate of US\$ to INR for the year 2011-12 was 51. A rate of 3% return has been assumed for estimating the value of carbon retention service

Annexure 6.8

(at current price)

State wise value of Carbon Retention service during the year 2017-18

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2017-18	Value of Carbon Retention during the year 2017-18	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (7) * 3.67	9=(80 * (8))	10=(66 * (9))	11=((10)* (3/100))	12	
												(India's country-level social cost of a tCO ₂ = US\$ 86)	(Exchange rate: 1 US\$ = 65 INR)	(after applying 3% rate of return)	
1	Andhra Pradesh	1,62,96,800	60,972	24,206	629	3,074	1,30,647	2,19,528	21,95,28,000	80,56,67,760	69,28,74,27,360	45,06,73,83,53,947	1,35,20,21,50,618	13,52,022	8,296
2	Arunachal Pradesh	83,74,300	3,30,856	1,00,379	7,816	15,436	5,96,836	10,51,323	1,05,13,23,000	3,85,83,55,410	3,31,81,85,65,260	2,15,82,83,99,40,628	6,47,48,51,98,219	64,74,852	77,318
3	Assam	78,43,800	85,844	21,148	1,102	7,223	1,54,832	2,70,149	27,01,49,000	99,14,46,830	85,26,44,27,380	55,45,94,79,40,947	1,66,37,84,38,228	16,63,784	21,211
4	Bihar	94,16,300	15,007	5,428	127	746	33,931	55,239	5,52,39,000	20,27,27,130	17,43,45,33,180	11,34,01,35,19,613	34,02,04,05,588	3,40,204	3,613
5	Chhattisgarh	1,35,19,200	1,45,912	46,908	1,858	9,969	2,75,603	4,80,250	48,02,50,000	1,76,25,17,500	1,51,57,65,05,000	98,59,15,73,48,871	2,95,77,47,20,466	29,57,747	21,878
6	Goa	3,70,200	9,010	2,617	172	665	12,874	25,338	2,53,38,000	9,29,90,460	7,99,71,79,560	5,20,16,93,47,019	15,60,50,80,411	1,56,051	42,153
7	Gujarat	1,96,24,400	27,737	9,636	315	1,556	68,003	1,07,247	10,72,47,000	39,35,96,490	33,84,92,98,140	22,01,69,71,33,148	66,05,09,13,994	6,60,509	3,366
8	Haryana	44,21,200	2,455	929	18	137	6,927	10,466	1,04,66,000	3,84,10,220	3,30,32,78,920	2,14,85,88,04,400	6,44,57,64,132	64,458	1,458
9	Himachal Pradesh	55,67,300	1,10,045	30,745	2,559	2,711	1,06,300	2,52,360	25,23,60,000	92,61,61,200	79,64,98,63,200	51,80,75,36,66,967	1,55,42,26,10,009	15,54,226	27,917
10	Jammu & Kashmir	2,22,23,600	1,70,222	47,806	3,813	3,706	1,64,648	3,90,195	39,01,95,000	1,43,20,15,650	1,23,15,33,45,900	80,10,39,85,46,054	2,40,31,19,56,382	24,03,120	10,813
11	Jharkhand	79,71,600	48,994	19,899	423	2,826	1,05,870	1,78,012	17,80,12,000	65,33,04,040	56,18,41,47,440	36,54,44,73,04,502	1,09,63,34,19,135	10,96,334	13,753
12	Karnataka	1,91,79,100	1,28,882	38,742	1,993	8,931	2,05,215	3,83,763	38,37,63,000	1,40,84,10,210	1,21,12,32,78,060	78,78,35,46,10,462	2,36,35,06,38,314	23,63,506	12,323
13	Kerala	38,85,200	67,979	19,070	1,017	5,001	1,19,889	2,12,956	21,29,56,000	78,15,48,520	67,21,31,72,720	43,71,82,03,27,717	1,31,15,46,09,832	13,11,546	33,757
14	Madhya Pradesh	3,08,25,200	1,65,067	64,630	1,535	8,156	3,49,339	5,88,727	58,87,27,000	2,16,06,28,090	1,85,81,40,15,740	1,20,86,10,54,21,194	3,62,58,31,62,636	36,25,832	11,763
15	Maharashtra	3,07,71,300	1,31,249	40,380	1,586	10,687	2,56,606	4,40,508	44,05,08,000	1,61,66,64,360	1,39,03,31,34,960	90,43,28,51,33,652	2,71,29,85,54,010	27,12,986	8,817
16	Manipur	22,32,700	44,723	13,317	508	3,924	1,16,251	1,78,723	17,87,23,000	65,59,13,410	56,40,85,53,260	36,69,04,35,79,099	1,10,07,13,07,373	11,00,713	49,300
17	Meghalaya	22,42,900	52,302	14,963	731	4,328	1,08,642	1,80,966	18,09,66,000	66,41,45,220	57,11,64,88,920	37,15,09,06,16,961	1,11,45,27,18,509	11,14,527	49,691
18	Mizoram	21,08,100	44,973	9,925	451	4,516	96,689	1,56,554	15,65,54,000	57,45,53,180	49,41,15,73,480	32,13,93,13,26,590	96,41,79,39,798	9,64,179	45,737
19	Nagaland	16,57,900	35,850	9,612	522	2,897	86,646	1,35,527	13,55,27,000	49,73,84,090	42,77,50,31,740	27,82,26,34,42,000	83,46,79,03,260	8,34,679	50,346

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2017-18	Value of Carbon Retention during the year 2017-18	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (7) * 3.67	9=(80 * (8))	10=(66 * (9))	11=((10) * (3/100))	12	
20	Odisha	1,55,70,700	1,26,656	39,066	1,647	9,062	2,55,857	4,32,288	43,22,88,000	1,58,64,96,960	1,36,43,87,38,560	88,74,53,49,54,771	2,66,23,60,48,643	26,62,360	17,099
21	Punjab	50,36,200	3,529	1,367	25	125	8,298	13,344	1,33,44,000	4,89,72,480	4,21,16,33,280	2,73,94,18,96,228	8,21,82,56,887	82,183	1,632
22	Rajasthan	3,42,23,900	26,155	10,865	191	928	70,224	1,08,363	10,83,63,000	39,76,92,210	34,20,15,30,060	22,24,60,77,41,376	66,73,82,32,241	6,67,382	1,950
23	Sikkim	7,09,600	17,645	5,372	505	664	32,994	57,180	5,71,80,000	20,98,50,600	18,04,71,51,600	11,73,86,07,33,386	35,21,58,22,002	3,52,158	49,628
24	Tamil Nadu	1,30,06,000	62,092	21,433	776	4,107	1,28,374	2,16,782	21,67,82,000	79,55,89,940	68,42,07,34,840	44,50,36,51,19,006	1,33,51,09,53,570	13,35,110	10,265
25	Telangana	1,12,07,700	41,389	17,227	333	2,031	90,862	1,51,842	15,18,42,000	55,72,60,140	47,92,43,72,040	31,17,19,76,47,407	93,51,59,29,422	9,35,159	8,344
26	Tripura	10,48,600	25,061	5,513	297	2,169	43,017	76,057	7,60,57,000	27,91,29,190	24,00,51,10,340	15,61,39,07,97,466	46,84,17,23,924	4,68,417	44,671
27	Uttar Pradesh	2,40,92,800	32,498	10,374	372	1,893	70,553	1,15,690	11,56,90,000	42,45,82,300	36,51,40,77,800	23,75,02,53,27,831	71,25,07,59,835	7,12,508	2,957
28	Uttarakhand	53,48,300	1,52,540	40,975	2,948	4,904	1,69,545	3,70,912	37,09,12,000	1,36,12,47,040	1,17,06,72,45,440	76,14,53,36,19,124	2,28,43,60,08,574	22,84,360	42,712
29	West Bengal	88,75,200	40,388	12,193	447	2,533	92,144	1,47,705	14,77,05,000	54,20,77,350	46,61,86,52,100	30,32,26,82,69,058	90,96,80,48,072	9,09,680	10,250
30	Andaman & Nicobar Islands	8,24,900	49,468	15,823	1,116	2,912	43,347	1,12,666	11,26,66,000	41,34,84,220	35,55,96,42,920	23,12,94,49,70,053	69,38,83,49,102	6,93,883	84,117
31	Chandigarh	11,400	57	18	0	3	111	189	1,89,460	6,95,318	5,97,97,365	3,88,94,65,802	11,66,83,974	1,167	10,235
32	Dadra & Nagar Haveli	49,100	500	113	7	47	1,133	1,800	18,00,000	66,06,000	56,81,16,000	36,95,25,93,916	1,10,85,77,817	11,086	22,578
33	Daman & Diu	11,100	35	10	0	2	105	152	1,52,270	5,58,831	4,80,59,457	3,12,59,84,153	9,37,79,525	938	8,449
34	Delhi	1,48,300	277	98	2	21	838	1,236	12,36,000	45,36,120	39,01,06,320	25,37,41,14,489	76,12,23,435	7,612	5,133
35	Lakshadweep	3,000	67	15	0	5	149	236	2,36,470	8,67,845	7,46,34,661	4,85,45,44,380	14,56,36,331	1,456	48,545
36	Puducherry	49,000	97	22	1	7	276	403	4,02,630	14,77,652	12,70,78,081	8,26,56,79,382	24,79,70,381	2,480	5,061
	India		22,56,533	7,00,824	35,843	1,27,902	40,03,575	71,24,677	7,12,46,76,830	26,14,75,63,966	22,48,69,05,01,085	14,62,64,04,98,21,597	43,87,92,14,94,648	4,38,79,215	

Notes: India's country-level social cost of a t CO₂ = US\$ 86 in the year 2017-18 and the average annual exchange rate of US\$ to INR for the year was 65. A rate of 3% return has been assumed for estimating the value of carbon retention service.

Annexure 6.8

State wise value of Carbon Retention service during the year 2017-18

(at constant price)

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2017-18	Value of Carbon Retention during the year 2017-18	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(in INR)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (Carbon content * 3.67)	9=(86 * (8))	10=(51.16 * (9))	11=((10)* (3/100))	12	
1	Andhra Pradesh	1,62,96,800	60,972	24,206	629	3,074	1,30,647	2,19,528	21,95,28,000	80,56,67,760	69,28,74,27,360	35,44,74,47,83,738	1,06,34,23,43,512	10,63,423	6,525
2	Arunachal Pradesh	83,74,300	3,30,856	1,00,379	7,816	15,436	5,96,836	10,51,323	1,05,13,23,000	3,85,83,55,410	3,31,81,85,65,260	1,69,75,83,77,98,702	5,09,27,51,33,961	50,92,751	60,814
3	Assam	78,43,800	85,844	21,148	1,102	7,223	1,54,832	2,70,149	27,01,49,000	99,14,46,830	85,26,44,27,380	43,62,12,81,04,761	1,30,86,38,43,143	13,08,638	16,684
4	Bihar	94,16,300	15,007	5,428	127	746	33,931	55,239	5,52,39,000	20,27,27,130	17,43,45,33,180	8,91,95,07,17,489	26,75,85,21,525	2,67,585	2,842
5	Chhattisgarh	1,35,19,200	1,45,912	46,908	1,858	9,969	2,75,603	4,80,250	48,02,50,000	1,76,25,17,500	1,51,57,65,05,000	77,54,65,39,95,800	2,32,63,96,19,874	23,26,396	17,208
6	Goa	3,70,200	9,010	2,617	172	665	12,874	25,338	2,53,38,000	9,29,90,460	7,99,71,79,560	4,09,13,57,06,290	12,27,40,71,189	1,22,741	33,155
7	Gujarat	1,96,24,400	27,737	9,636	315	1,556	68,003	1,07,247	10,72,47,000	39,35,96,490	33,84,92,98,140	17,31,73,00,92,842	51,95,19,02,785	5,19,519	2,647
8	Haryana	44,21,200	2,455	929	18	137	6,927	10,466	1,04,66,000	3,84,10,220	3,30,32,78,920	1,68,99,57,49,547	5,06,98,72,486	50,699	1,147
9	Himachal Pradesh	55,67,300	1,10,045	30,745	2,559	2,711	1,06,300	2,52,360	25,23,60,000	92,61,61,200	79,64,98,63,200	40,74,88,70,01,312	1,22,24,66,10,039	12,22,466	21,958
10	Jammu & Kashmir	2,22,23,600	1,70,222	47,806	3,813	3,706	1,64,648	3,90,195	39,01,95,000	1,43,20,15,650	1,23,15,33,45,900	63,00,52,51,76,244	1,89,01,57,55,287	18,90,158	8,505
11	Jharkhand	79,71,600	48,994	19,899	423	2,826	1,05,870	1,78,012	17,80,12,000	65,33,04,040	56,18,41,47,440	28,74,38,09,83,030	86,23,14,29,491	8,62,314	10,817
12	Karnataka	1,91,79,100	1,28,882	38,742	1,993	8,931	2,05,215	3,83,763	38,37,63,000	1,40,84,10,210	1,21,12,32,78,060	61,96,66,69,05,550	1,85,90,00,07,166	18,59,000	9,693
13	Kerala	38,85,200	67,979	19,070	1,017	5,001	1,19,889	2,12,956	21,29,56,000	78,15,48,520	67,21,31,72,720	34,38,62,59,16,355	1,03,15,87,77,491	10,31,588	26,552
14	Madhya Pradesh	3,08,25,200	1,65,067	64,630	1,535	8,156	3,49,339	5,88,727	58,87,27,000	2,16,06,28,090	1,85,81,40,15,740	95,06,24,50,45,258	2,85,18,73,51,358	28,51,874	9,252
15	Maharashtra	3,07,71,300	1,31,249	40,380	1,586	10,687	2,56,606	4,40,508	44,05,08,000	1,61,66,64,360	1,39,03,31,34,960	71,12,93,51,84,554	2,13,38,80,55,537	21,33,881	6,935
16	Manipur	22,32,700	44,723	13,317	508	3,924	1,16,251	1,78,723	17,87,23,000	65,59,13,410	56,40,85,53,260	28,85,86,15,84,782	86,57,58,47,543	8,65,758	38,776
17	Meghalaya	22,42,900	52,302	14,963	731	4,328	1,08,642	1,80,966	18,09,66,000	66,41,45,220	57,11,64,88,920	29,22,07,95,73,147	87,66,23,87,194	8,76,624	39,084

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2017-18	Value of Carbon Retention during the year 2017-18	Carbon Retention Service (per hectare)	
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)		(INR in lakh)
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (Carbon content * 3.67)	9=(86 * (8))	10=(51.16 * (9))	11=((10) * (3/100))	12		
18	Mizoram	21,08,100	44,973	9,925	451	4,516	96,689	1,56,554	15,65,54,000	57,45,53,180	49,41,15,73,480	25,27,89,60,99,237	75,83,68,82,977	7,58,369	35,974	
19	Nagaland	16,57,900	35,850	9,612	522	2,897	86,646	1,35,527	13,55,27,000	49,73,84,090	42,77,50,31,740	21,88,37,06,23,818	65,65,11,18,715	6,56,511	39,599	
20	Odisha	1,55,70,700	1,26,656	39,066	1,647	9,062	2,55,857	4,32,288	43,22,88,000	1,58,64,96,960	1,36,43,87,38,560	69,80,20,58,64,730	2,09,40,61,75,942	20,94,062	13,449	
21	Punjab	50,36,200	3,529	1,367	25	125	8,298	13,344	1,33,44,000	4,89,72,480	4,21,16,33,280	2,15,46,71,58,605	6,46,40,14,758	64,640	1,284	
22	Rajasthan	3,42,23,900	26,155	10,865	191	928	70,224	1,08,363	10,83,63,000	39,76,92,210	34,20,15,30,060	17,49,75,02,77,870	52,49,25,08,336	5,24,925	1,534	
23	Sikkim	7,09,600	17,645	5,372	505	664	32,994	57,180	5,71,80,000	20,98,50,600	18,04,71,51,600	9,23,29,22,75,856	27,69,87,68,276	2,76,988	39,034	
24	Tamil Nadu	1,30,06,000	62,092	21,433	776	4,107	1,28,374	2,16,782	21,67,82,000	79,55,89,940	68,42,07,34,840	35,00,40,47,94,414	1,05,01,21,43,832	10,50,121	8,074	
25	Telangana	1,12,07,700	41,389	17,227	333	2,031	90,862	1,51,842	15,18,42,000	55,72,60,140	47,92,43,72,040	24,51,81,08,73,566	73,55,43,26,207	7,35,543	6,563	
26	Tripura	10,48,600	25,061	5,513	297	2,169	43,017	76,057	7,60,57,000	27,91,29,190	24,00,51,10,340	12,28,10,14,44,994	36,84,30,43,350	3,68,430	35,135	
27	Uttar Pradesh	2,40,92,800	32,498	10,374	372	1,893	70,553	1,15,690	11,56,90,000	42,45,82,300	36,51,40,77,800	18,68,06,02,20,248	56,04,18,06,607	5,60,418	2,326	
28	Uttarakhand	53,48,300	1,52,540	40,975	2,948	4,904	1,69,545	3,70,912	37,09,12,000	1,36,12,47,040	1,17,06,72,45,440	59,89,16,02,76,710	1,79,67,48,08,301	17,96,748	33,595	
29	West Bengal	88,75,200	40,388	12,193	447	2,533	92,144	1,47,705	14,77,05,000	54,20,77,350	46,61,86,52,100	23,85,01,02,41,436	71,55,03,07,243	7,15,503	8,062	
30	Andaman & Nicobar Islands	8,24,900	49,468	15,823	1,116	2,912	43,347	1,12,666	11,26,66,000	41,34,84,220	35,55,96,42,920	18,19,23,13,31,787	54,57,69,39,954	5,45,769	66,162	
31	Chandigarh	11,400	57	18	0	3	111	189	1,89,460	6,95,318	5,97,97,365	3,05,92,33,204	9,17,76,996	918	8,051	
32	Dadra & Nagar Haveli	49,100	500	113	7	47	1,133	1,800	18,00,000	66,06,000	56,81,16,000	29,06,48,14,560	87,19,44,437	8,719	17,759	
33	Daman & Diu	11,100	35	10	0	2	105	152	1,52,270	5,58,831	4,80,59,457	2,45,87,21,841	7,37,61,655	738	6,645	
34	Delhi	1,48,300	277	98	2	21	838	1,236	12,36,000	45,36,120	39,01,06,320	19,95,78,39,331	59,87,35,180	5,987	4,037	
35	Lakshadweep	3,000	67	15	0	5	149	236	2,36,470	8,67,845	7,46,34,661	3,81,83,09,277	11,45,49,278	1,145	38,183	
36	Puducherry	49,000	97	22	1	7	276	403	4,02,630	14,77,652	12,70,78,081	6,50,13,14,603	19,50,39,438	1,950	3,980	
	India		22,56,533	7,00,824	35,843	1,27,902	40,03,575	71,24,677	7,12,46,76,830	26,14,75,63,966	22,48,69,05,01,085	11,50,43,00,60,35,488	34,51,29,01,81,065	3,45,12,902		

Notes: India's country-level social cost of a t CO₂ = US\$ 86 in the year 2017-18 and the average annual exchange rate of US\$ to INR for the year 2011-12 was 51. A rate of 3% return has been assumed for estimating the value of carbon retention service.

Annexure 6.8

(at current price)

State wise value of Carbon Retention service during the year 2019-20

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2021	Value of Carbon Retention during the year 2021	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (Carbon content * 3.67)	9=(91 * (8))	10=(75.38 * (9))	11=((10)* (3/100))	12=(11)/10000	
												(India's country-level social cost of a tCO ₂ = US\$ 91)	(Exchange rate: 1 US\$ = 65 INR)	(after applying 3% rate of return)	
1	Andhra Pradesh	1,62,96,800	63,951	25,064	979	3,171	1,37,057	2,30,222	23,02,22,000	84,49,14,740	77,28,97,18,405	58,26,55,49,82,713	1,74,79,66,49,481	17,47,966	10,726
2	Arunachal Pradesh	83,74,300	3,40,351	1,02,229	9,163	11,802	5,60,298	10,23,843	1,02,38,43,000	3,75,75,03,810	3,43,72,27,42,227	2,59,11,84,82,73,256	7,77,35,54,48,198	77,73,554	92,826
3	Assam	78,43,800	87,070	21,495	1,875	4,890	1,56,042	2,71,372	27,13,72,000	99,59,35,240	91,10,45,22,865	68,67,99,64,50,247	2,06,03,98,93,507	20,60,399	26,268
4	Bihar	94,16,300	14,743	5,249	231	785	35,873	56,881	5,68,81,000	20,87,53,270	19,09,59,87,667	14,39,56,82,16,642	43,18,70,46,499	4,31,870	4,586
5	Chhattisgarh	1,35,19,200	1,52,714	48,947	2,520	8,487	2,83,769	4,96,437	49,64,37,000	1,82,19,23,790	1,66,66,29,42,446	1,25,64,03,59,12,958	3,76,92,10,77,389	37,69,211	27,880
6	Goa	3,70,200	8,863	2,606	232	448	13,095	25,244	2,52,44,000	9,26,45,480	8,47,48,70,566	6,38,88,57,44,992	19,16,65,72,350	1,91,666	51,774
7	Gujarat	1,96,24,400	28,602	9,814	502	1,634	67,214	1,07,766	10,77,66,000	39,55,01,220	36,17,90,08,929	27,27,38,71,49,217	81,82,16,14,477	8,18,216	4,169
8	Haryana	44,21,200	2,326	836	41	139	6,890	10,232	1,02,32,000	3,75,51,440	3,43,50,68,754	2,58,95,57,49,594	7,76,86,72,488	77,687	1,757
9	Himachal Pradesh	55,67,300	1,14,269	31,880	2,657	3,328	1,05,937	2,58,071	25,80,71,000	94,71,20,570	86,63,91,34,915	65,31,36,91,60,826	1,95,94,10,74,825	19,59,411	35,195
10	Jammu & Kashmir*	2,22,23,600	1,63,897	45,864	3,386	4,951	1,52,772	3,70,870	37,08,70,000	1,36,10,92,900	1,24,50,78,13,610	93,86,13,35,86,011	2,81,58,40,07,580	28,15,840	13,719
11	Jharkhand	79,71,600	51,017	20,819	774	2,536	1,09,665	1,84,811	18,48,11,000	67,82,56,370	62,04,44,18,640	46,77,27,43,39,160	1,40,31,82,30,175	14,03,182	17,602
12	Karnataka	1,91,79,100	1,22,741	36,716	2,890	6,380	2,07,668	3,76,395	37,63,95,000	1,38,13,69,650	1,26,36,26,56,736	95,25,96,26,04,435	2,85,77,88,78,133	28,57,789	14,901
13	Kerala	38,85,200	61,802	17,440	1,534	3,198	1,21,549	2,05,523	20,55,23,000	75,42,69,410	68,99,78,14,265	52,01,46,23,26,416	1,56,04,38,69,792	15,60,439	40,164
14	Madhya Pradesh	3,08,25,200	1,71,587	67,160	2,676	8,653	3,59,174	6,09,250	60,92,50,000	2,23,59,47,500	2,04,53,63,21,196	1,54,19,15,46,56,018	4,62,57,46,39,681	46,25,746	15,006
15	Maharashtra	3,07,71,300	1,37,831	42,353	2,316	7,928	2,61,178	4,51,606	45,16,06,000	1,65,73,94,020	1,51,61,23,59,245	1,14,29,43,41,52,787	3,42,88,30,24,584	34,28,830	11,143
16	Manipur	22,32,700	47,590	14,101	880	2,652	1,11,708	1,76,931	17,69,31,000	64,93,36,770	59,39,89,59,123	44,77,84,39,92,522	1,34,33,53,19,776	13,43,353	60,167
17	Meghalaya	22,42,900	55,241	15,820	1,238	3,075	1,08,014	1,83,388	18,33,88,000	67,30,33,960	61,56,66,91,623	46,41,26,04,58,035	1,39,23,78,13,741	13,92,378	62,079
18	Mizoram	21,08,100	48,157	10,622	758	3,140	95,961	1,58,638	15,86,38,000	58,22,01,460	53,25,76,65,854	40,14,87,70,72,337	1,20,44,63,12,170	12,04,463	57,135
19	Nagaland	16,57,900	39,339	10,618	854	2,006	82,115	1,34,932	13,49,32,000	49,52,00,440	45,29,91,29,900	34,14,91,56,76,727	1,02,44,74,70,302	10,24,475	61,794

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2021	Value of Carbon Retention during the year 2021	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (Carbon content * 3.67)	9=(91 * (8))	10=(75.38 * (9))	11=((10) * (3/100))	12=(11)/10000	
20	Odisha	1,55,70,700	1,31,015	40,441	2,252	7,671	2,63,451	4,44,830	44,48,30,000	1,63,25,26,100	1,49,33,75,32,634	1,12,57,94,43,01,414	3,37,73,83,29,042	33,77,383	21,691
21	Punjab	50,36,200	3,420	1,284	56	175	8,623	13,558	1,35,58,000	4,97,57,860	4,55,16,67,530	3,43,13,15,53,264	10,29,39,46,598	1,02,939	2,044
22	Rajasthan	3,42,23,900	26,714	10,803	462	1,476	71,319	1,10,774	11,07,74,000	40,65,40,580	37,18,88,49,313	28,03,51,48,75,446	84,10,54,46,263	8,41,054	2,458
23	Sikkim	7,09,600	18,024	5,466	498	607	30,944	55,539	5,55,39,000	20,38,28,130	18,64,54,53,825	14,05,60,43,17,506	42,16,81,29,525	4,21,681	59,425
24	Tamil Nadu	1,30,06,000	60,459	20,671	1,198	3,102	1,29,183	2,14,613	21,46,13,000	78,76,29,710	72,04,94,92,820	54,31,51,58,60,799	1,62,94,54,75,824	16,29,455	12,528
25	Telangana	1,12,07,700	44,413	18,415	675	2,169	96,314	1,61,986	16,19,86,000	59,44,88,620	54,38,16,50,431	40,99,60,96,61,239	1,22,98,82,89,837	12,29,883	10,974
26	Tripura	10,48,600	24,349	5,358	477	1,486	43,304	74,974	7,49,74,000	27,51,54,580	25,17,01,37,292	18,97,47,34,52,902	56,92,42,03,587	5,69,242	54,286
27	Uttar Pradesh	2,40,92,800	32,543	10,234	534	1,825	72,105	1,17,241	11,72,41,000	43,02,74,470	39,35,99,38,996	29,67,18,44,25,156	89,01,55,32,755	8,90,155	3,695
28	Uttarakhand	53,48,300	1,59,674	42,893	3,561	5,184	1,66,847	3,78,159	37,81,59,000	1,38,78,43,530	1,26,95,48,63,664	95,70,60,66,56,652	2,87,11,81,99,700	28,71,182	53,684
29	West Bengal	88,75,200	45,365	14,119	726	2,162	92,889	1,55,261	15,52,61,000	56,98,07,870	52,12,39,45,450	39,29,41,05,39,266	1,17,88,23,16,178	11,78,823	13,282
30	Andaman & Nicobar Islands	8,24,900	47,560	15,450	1,432	1,808	43,586	1,09,836	10,98,36,000	40,30,98,120	36,87,39,45,630	27,79,77,55,77,839	83,39,32,67,335	8,33,933	1,01,095
31	Chandigarh	11,400	47	15	1	3	117	183	1,83,000	6,71,610	6,14,36,433	4,63,14,40,791	13,89,43,224	1,389	12,188
32	Dadra & Nagar Haveli and Daman & Diu	60,200	558	129	11	38	1,244	1,980	19,80,000	72,66,600	66,47,22,061	50,11,06,70,856	1,50,33,20,126	15,033	30,618
33	Delhi	1,48,300	263	78	5	17	839	1,202	12,02,000	44,11,340	40,35,33,292	30,42,07,20,388	91,26,21,612	9,126	6,154
34	Ladakh*		13,293	3,836	269	317	12,987	30,702	3,07,02,000	11,26,76,340	10,30,72,20,572	7,77,01,90,99,301	23,31,05,72,979	2,33,106	
35	Lakshadweep	3,000	46	10	1	3	150	210	2,10,000	7,70,700	7,05,00,825	5,31,47,68,121	15,94,43,044	1,594	53,148
36	Puducherry	49,000	76	17	1	5	287	386	3,86,000	14,16,620	12,95,87,230	9,76,90,49,975	29,30,71,499	2,931	5,981
	India		23,19,910	7,18,852	47,665	1,07,251	40,10,168	72,03,846	7,20,38,46,000	26,43,81,14,820	24,18,46,23,04,964	18,23,17,95,74,75,806	54,69,53,87,24,274	5,46,95,387	

Note: *Geographical Area and Carbon Retention Service per hectare combined for Jammu and Kashmir and Ladakh.

91 India's country-level social cost of a tCO₂ in the year 2019-20

75 Average annual exchange rate of US\$ to INR for the year.

A rate of 3% return has been assumed for estimating the value of carbon retention service.

Annexure 6.8

State wise value of Carbon Retention service during the year 2019-20

(at constant price)

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2021	Value of Carbon Retention during the year 2021	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (Carbon content * 3.67)	9=(91 * (8))	10=(51.16 * (9))	11=((10)* (3/100))	12=(11)/100000	
1	Andhra Pradesh	1,62,96,800	63,951	25,064	979	3,171	1,37,057	2,30,222	23,02,22,000	84,49,14,740	77,28,97,18,405	39,54,14,19,93,603	1,18,62,42,59,808	11,86,243	7,279
2	Arunachal Pradesh	83,74,300	3,40,351	1,02,229	9,163	11,802	5,60,298	10,23,843	1,02,38,43,000	3,75,75,03,810	3,43,72,27,42,227	1,75,84,85,54,92,337	5,27,54,56,64,770	52,75,457	62,996
3	Assam	78,43,800	87,070	21,495	1,875	4,890	1,56,042	2,71,372	27,13,72,000	99,59,35,240	91,10,45,22,865	46,60,90,73,89,772	1,39,82,72,21,693	13,98,272	17,826
4	Bihar	94,16,300	14,743	5,249	231	785	35,873	56,881	5,68,81,000	20,87,53,270	19,09,59,87,667	9,76,95,07,29,027	29,30,85,21,871	2,93,085	3,113
5	Chhattisgarh	1,35,19,200	1,52,714	48,947	2,520	8,487	2,83,769	4,96,437	49,64,37,000	1,82,19,23,790	1,66,66,29,42,446	85,26,47,61,35,549	2,55,79,42,84,066	25,57,943	18,921
6	Goa	3,70,200	8,863	2,606	232	448	13,095	25,244	2,52,44,000	9,26,45,480	8,47,48,70,566	4,33,57,43,78,150	13,00,72,31,345	1,30,072	35,136
7	Gujarat	1,96,24,400	28,602	9,814	502	1,634	67,214	1,07,766	10,77,66,000	39,55,01,220	36,17,90,08,929	18,50,91,80,96,805	55,52,75,42,904	5,55,275	2,830
8	Haryana	44,21,200	2,326	836	41	139	6,890	10,232	1,02,32,000	3,75,51,440	3,43,50,68,754	1,75,73,81,17,463	5,27,21,43,524	52,721	1,192
9	Himachal Pradesh	55,67,300	1,14,269	31,880	2,657	3,328	1,05,937	2,58,071	25,80,71,000	94,71,20,570	86,63,91,34,915	44,32,45,81,42,277	1,32,97,37,44,268	13,29,737	23,885
10	Jammu & Kashmir*	2,22,23,600	1,63,897	45,864	3,386	4,951	1,52,772	3,70,870	37,08,70,000	1,36,10,92,900	1,24,50,78,13,610	63,69,81,97,44,280	1,91,09,45,92,328	19,10,946	9,311
11	Jharkhand	79,71,600	51,017	20,819	774	2,536	1,09,665	1,84,811	18,48,11,000	67,82,56,370	62,04,44,18,640	31,74,19,24,57,627	95,22,57,73,729	9,52,258	11,946
12	Karnataka	1,91,79,100	1,22,741	36,716	2,890	6,380	2,07,668	3,76,395	37,63,95,000	1,38,13,69,650	1,26,36,26,56,736	64,64,71,35,18,614	1,93,94,14,05,558	19,39,414	10,112
13	Kerala	38,85,200	61,802	17,440	1,534	3,198	1,21,549	2,05,523	20,55,23,000	75,42,69,410	68,99,78,14,265	35,29,92,81,77,808	1,05,89,78,45,334	10,58,978	27,257
14	Madhya Pradesh	3,08,25,200	1,71,587	67,160	2,676	8,653	3,59,174	6,09,250	60,92,50,000	2,23,59,47,500	2,04,53,63,21,196	1,04,64,07,81,92,366	3,13,92,23,45,771	31,39,223	10,184
15	Maharashtra	3,07,71,300	1,37,831	42,353	2,316	7,928	2,61,178	4,51,606	45,16,06,000	1,65,73,94,020	1,51,61,23,59,245	77,56,48,82,98,960	2,32,69,46,48,969	23,26,946	7,562
16	Manipur	22,32,700	47,590	14,101	880	2,652	1,11,708	1,76,931	17,69,31,000	64,93,36,770	59,39,89,59,123	30,38,85,07,48,713	91,16,55,22,461	9,11,655	40,832
17	Meghalaya	22,42,900	55,241	15,820	1,238	3,075	1,08,014	1,83,388	18,33,88,000	67,30,33,960	61,56,66,91,623	31,49,75,19,43,441	94,49,25,58,303	9,44,926	42,130
18	Mizoram	21,08,100	48,157	10,622	758	3,140	95,961	1,58,638	15,86,38,000	58,22,01,460	53,25,76,65,854	27,24,66,21,85,114	81,73,98,65,553	8,17,399	38,774
19	Nagaland	16,57,900	39,339	10,618	854	2,006	82,115	1,34,932	13,49,32,000	49,52,00,440	45,29,91,29,900	23,17,50,34,85,683	69,52,51,04,570	6,95,251	41,936

S. No.	States/ Union Territories	Geographic Area (in hectare)	Above ground biomass (AGB)	Below ground biomass (BGB)	Dead wood	Litter	Soil Organic Carbon (SOC)	Total carbon stock	Carbon Content	Carbon Dioxide	Value of Carbon Stock	Value of Carbon Stock	Value of Carbon Retention during the year 2021	Value of Carbon Retention during the year 2021	Carbon Retention Service (per hectare)
			(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in '000 tonnes)	(in tonnes)	(in tonnes)	(in US\$)	(in INR)	(in INR)	(INR in lakh)	
			1	2	3	4	5	6=(1)+(2)+(3)+(4)+(5)	7=(Total carbon stock * 1000)	8= (Carbon content * 3.67)	9=(91 * (8))	10=(51.16 * (9))	11=((10)* (3/100))	12=(11)/100000	
20	Odisha	1,55,70,700	1,31,015	40,441	2,252	7,671	2,63,451	4,44,830	44,48,30,000	1,63,25,26,100	1,49,33,75,32,634	76,40,10,81,69,569	2,29,20,32,45,087	22,92,032	14,720
21	Punjab	50,36,200	3,420	1,284	56	175	8,623	13,558	1,35,58,000	4,97,57,860	4,55,16,67,530	2,32,86,33,10,845	6,98,58,99,325	69,859	1,387
22	Rajasthan	3,42,23,900	26,714	10,803	462	1,476	71,319	1,10,774	11,07,74,000	40,65,40,580	37,18,88,49,313	19,02,58,15,30,868	57,07,74,45,926	5,70,774	1,668
23	Sikkim	7,09,600	18,024	5,466	498	607	30,944	55,539	5,55,39,000	20,38,28,130	18,64,54,53,825	9,53,90,14,17,687	28,61,70,42,531	2,86,170	40,328
24	Tamil Nadu	1,30,06,000	60,459	20,671	1,198	3,102	1,29,183	2,14,613	21,46,13,000	78,76,29,710	72,04,94,92,820	36,86,05,20,52,685	1,10,58,15,61,581	11,05,816	8,502
25	Telangana	1,12,07,700	44,413	18,415	675	2,169	96,314	1,61,986	16,19,86,000	59,44,88,620	54,38,16,50,431	27,82,16,52,36,058	83,46,49,57,082	8,34,650	7,447
26	Tripura	10,48,600	24,349	5,358	477	1,486	43,304	74,974	7,49,74,000	27,51,54,580	25,17,01,37,292	12,87,70,42,23,873	38,63,11,26,716	3,86,311	36,841
27	Uttar Pradesh	2,40,92,800	32,543	10,234	534	1,825	72,105	1,17,241	11,72,41,000	43,02,74,470	39,35,99,38,996	20,13,65,44,79,034	60,40,96,34,371	6,04,096	2,507
28	Uttarakhand	53,48,300	1,59,674	42,893	3,561	5,184	1,66,847	3,78,159	37,81,59,000	1,38,78,43,530	1,26,95,48,63,664	64,95,01,08,25,026	1,94,85,03,24,751	19,48,503	36,432
29	West Bengal	88,75,200	45,365	14,119	726	2,162	92,889	1,55,261	15,52,61,000	56,98,07,870	52,12,39,45,450	26,66,66,10,49,200	79,99,98,31,476	7,99,998	9,014
30	Andaman & Nicobar Islands	8,24,900	47,560	15,450	1,432	1,808	43,586	1,09,836	10,98,36,000	40,30,98,120	36,87,39,45,630	18,86,47,10,58,411	56,59,41,31,752	5,65,941	68,607
31	Chandigarh	11,400	47	15	1	3	117	183	1,83,000	6,71,610	6,14,36,433	3,14,30,87,910	9,42,92,637	943	8,271
32	Dadra & Nagar Haveli and Daman & Diu	60,200	558	129	11	38	1,244	1,980	19,80,000	72,66,600	66,47,22,061	34,00,71,80,666	1,02,02,15,420	10,202	20,778
33	Delhi	1,48,300	263	78	5	17	839	1,202	12,02,000	44,11,340	40,35,33,292	20,64,47,63,213	61,93,42,896	6,193	4,176
34	Ladakh*		13,293	3,836	269	317	12,987	30,702	3,07,02,000	11,26,76,340	10,30,72,20,572	5,27,31,74,04,451	15,81,95,22,134	1,58,195	
35	Lakshadweep	3,000	46	10	1	3	150	210	2,10,000	7,70,700	7,05,00,825	3,60,68,22,192	10,82,04,666	1,082	36,068
36	Puducherry	49,000	76	17	1	5	287	386	3,86,000	14,16,620	12,95,87,230	6,62,96,82,696	19,88,90,481	1,989	4,059
	India		23,19,910	7,18,852	47,665	1,07,251	40,10,168	72,03,846	7,20,38,46,000	26,43,81,14,820	24,18,46,23,04,964	12,37,28,53,15,21,972	37,11,85,59,45,659	3,71,18,559	

Note: 91 India's country-level social cost of a t CO₂ in the year 2019-20. 51 Average annual exchange rate of US\$ to INR for the year 2011-12. A rate of 3% return has been assumed for estimating the value of carbon retention service.

*Geographical Area and Carbon Retention Service per hectare combined for Jammu and Kashmir and Ladakh.

Agro-Biodiversity Hotspots of India

S. No.	Agro-Biodiversity Region	Districts
1	Cold Desert	Western Himalyas covering Ladakh and Kargil. Upper reaches of Lahaul-Spiti districts of Himachal Pradesh.
2	Western Himalayan	The agrobiodiversity hotspot area covers the districts of Srinagar, Anantnag, Udhampur, Riasi, Kathua in Jammu & Kashmir, all the districts of Himachal Pradesh except the cold arid region and all the districts of Uttarakhand.
3	Eastern Himalayan	The hotspot area includes all the districts of Arunachal Pradesh, Sikkim and Darjeeling district of West Bengal.
4	Brahmaputra Valley	The hotspot area includes the following districts: Dhubri, Kokrajhar, Bongaigaon, Baretta, Nalbari, Goalpara, Kamrup, Golaghat, Darrang, Morigaon, Nagaon, Sonitpur, Jorhat, Lakhimpur, Sibsagar, Dibrugarh, Dhemaji and Tinsukia.
5	Khasia-Jaintia-Garo Hills	The hotspot area includes all the seven districts, i.e. East Garo Hills, West Garo Hills, South Garo Hills, East Khasi Hills, West Khasi Hills, Jaintia Hills and Ri-Bhoi.
6	North-Eastern Hills	The hotspot area includes all the districts of Manipur, Mizoram, Nagaland, Tripura and the adjoining Cachar and North Cachar districts of Assam.
7	Arid Western	The hotspots are comprising of the following districts of Rajasthan: Sikar, Nagaur, Pali, Hanumangarh, Ganganagar, Jalore, Sirohi, Jodhpur, parts of Jaisalmer and Bikaner, Udaipur, Dungarpur, Churu, and Jhunjhunun.
8	Malwa Plateau and Central Highlands	The hotspot area comprises the following districts of Shadol; Raisen, Bhopal, Sehore, Shajapur, Indore, Ujjain, Mandasaur, Rajgarh, Hoshangabad, Narsinghpur, Jabalpur, Mandla, Umaria.
9	Kathiawar	The hotspot includes the following districts of Gujarat: Ahemdabad, Surendranagar, Jamnagar, Rajkot, Porbandar, Junagadh, Amreli, Bhavnagar, Bharuch, Surat, Navsari, Valsad, Banaskantha and Anand.
10	Bundelkhand	The hotspot areas include the districts of Jhansi, Banda, Chitrakoot, Hamirpur, Jalaun and Lalitpur in Uttar Pradesh and Damoha, Datia, Panna, Sagar, Tikamagarh and Chattarpur in Madhya Pradesh.
11	Upper Gangetic Plains	The hotspot area includes the districts of Hardoi, Sitapur, Barabanki, Lucknow, Unnao, Rae Bareilly, Kanpur, Kannauj of Central Uttar Pradesh and the districts of Maharajganj, Sidharatnagar, Kushinagar, Deoria, Sant Kabir Nagar, Gorakhpur, Basti of North-Eastern Uttar Pradesh.
12	Lower Gangetic Plains	The hotspot area includes the districts of Paschim Champaran, Purbi Champaran, Gopalganj, Siwan, Sitamarhi, Muzaffarpur, Saran, Buxar, Bhojpur, Patna, Rohatas, Jahanabad, Vaishali, Samastipur, Darbangha, Madhubani, Sitamarhi, Sheohar in North Bihar.
13	Gangetic delta	The Gangetic delta agrobiodiversity region broadly includes the deltaic 24-Parganas districts, but also the districts of Hoogly, Howrah, Nadia, Bardhaman, Birbhum and Murshidabad which

S. No.	Agro-Biodiversity Region	Districts
		flank on both sides of the river Hoogly flowing into the Bay of Bengal. The hotspot area are the districts of South 24 Parganas, North 24 Parganas, Howrah, Hoogly, Nadia, Bardhaman, Birbhum and Murshidabad.
14	Chotanagpur	The Chotanagpur region constitutes south and eastern plateau of Jharkhand and contiguous districts in Odisha. It is generally referred as Chotanagpur Plateau, which comprises all the districts of Jharkhand, Mayurbhanj and Sundargarh districts of Odisha. The hotspot areas are the districts of Singhbhum, Gumla, Ranchi, Lohardaga, Palamu and Hazaribag and Santhal Pargana in Jharkhand and Mayurbhanj district in Odisha.
15	Bastar	The hotspot areas are the following districts: Bastar, Bilaspur, Durg, Jashpur, Kabirdham, Kanker, Kirba, Korla, Mahasamund, Kondaigaon, and Rajnandgoan.
16	Koraput	The Koraput agrobiodiversity region forms part of Northern Eastern Ghats in southwestern Odisha and north-eastern districts of Andhra Pradesh (Visakhapatnam, Vijanagaram, Srikakulam). The hotspot area includes the districts of Malkangiri, Sonabeda, Jeypore, Koraput, Nabrangpur, Kalahandi, Bolngir, Rauagada and districts of north eastern Andhra Pradesh i.e. Srikakulam, Vijanagaram, Visakhapatnam.
17	Southern Eastern Ghats	The hotspots are the districts of Chittoor, Ananthapur, Cuddapah, Kurnool in Andhra Pradesh and districts of Bellary, Raichur and Kolar in Karnataka.
18	Kaveri	The hotspot area consists of the districts of Chengalput, South Arcot, North Arcot, Tiruvannamalai, Tiruchirapalli, Pudukottai, Thiruarur, Vellore, Kanchipuram, Dharmapuri, Salem, Namakkal, Karur and Dindigal.
19	Deccan	The hotspot includes the districts of Jalna, Hingoli, Parbhani, Beed, Nanded, Latur, Osmanabad, Solapur, Sangli, Gondia, Gadchiroli in Maharashtra and the districts of Adilabad, Karimnagar, Warangal and Khamman in Andhra Pradesh and districts of Bidar and Gulbarga in Karnataka.
20	Konkan	The hotspot area includes coastal districts of Thane, Raigad, Ratnagiri, Sindhudurg and part of Sahyadri districts of Pune, Satara and Kolhapur of Maharashtra, all the districts of Goa and uttar Kannda district of Karnataka.
21	Malabar	The hotspot areas are the districts of Kasargod, Kannur, Wayanad, Kozikode, Malappuram, Palakkad, Thrissur, Idukki, Ernakulam, Alappuza, Kollam, Kottayam, Pathanamthitta & Thiruvananthpuram in Kerala, Udhagamandalam (Nilgiri) and Kanyakumari districts of Tamil Nadu and districts of Dakshin Kannada, Kodagu and Udipi in Karnataka.
22	Islands	Andaman & Nicobar Islands and Lakshadweep

Source: Protection of Plant Varieties and Farmers' Right Authority, Ministry of Agriculture and Farmers Welfare, Government of India as on 04/07/2022

Annexure 7.2

State-wise Count of IUCN Red List Species

Sr. No.	State/UTs	Species Richness Count								
		Amphibians			Mammals			Reptiles		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
1	Andhra Pradesh	23	23	23	123	123	124	84	128	130
2	Arunachal Pradesh	76	76	77	197	197	198	72	133	139
3	Assam	61	61	61	181	181	181	72	151	154
4	Bihar	25	25	25	125	125	126	56	112	113
5	Chhattisgarh	23	23	23	80	80	82	48	82	83
6	Goa	31	31	31	107	107	108	64	95	96
7	Gujrat	18	18	18	119	119	119	73	125	126
8	Haryana	11	11	11	92	92	94	29	69	70
9	Himachal Pradesh	17	17	17	125	125	125	29	73	74
10	Jharkhand	20	20	20	81	81	82	57	95	96
11	Karnataka	82	81	81	146	146	147	108	155	156
12	Kerala	103	103	103	141	141	142	145	187	188
13	Madhya Pradesh	16	16	16	91	91	93	56	100	102
14	Maharashtra	44	44	44	131	131	132	103	156	158
15	Manipur	42	43	43	146	146	147	63	112	114
16	Meghalaya	53	53	53	144	144	145	62	134	137
17	Mizoram	27	27	27	130	130	131	55	112	114
18	Nagaland	53	54	54	139	139	140	62	115	118
19	Odisha	24	24	24	111	111	113	83	130	131

Sr. No.	State/UTs	Species Richness Count								
		Amphibians			Mammals			Reptiles		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
20	Punjab	11	11	11	89	89	91	26	64	64
21	Rajasthan	10	10	10	88	88	89	36	96	96
22	Sikkim	25	24	24	161	162	162	40	92	94
23	Tamil Nadu	80	80	80	148	148	149	167	225	227
24	Telangana	21	21	21	81	81	83	49	81	82
25	Tripura	24	24	24	98	98	99	47	107	109
26	Uttar Pradesh	20	20	20	122	122	123	52	108	109
27	Uttarakhand	23	23	23	142	142	143	39	89	90
28	West Bengal	53	53	53	213	213	214	109	188	191
29	Andaman and Nicobar Islands	14	14	14	54	53	53	40	81	82
30	Chandigarh	10	10	10	57	57	57	16	48	48
31	Dadra & Nagar Haveli and Daman & Diu	15	15	15	96	96	97	58	84	85
32	Delhi	10	10	10	48	48	52	20	53	53
33	Jammu and Kashmir	14	14	14	122	122	124	29	69	69
34	Ladakh	14	14	14	103	103	104	20	42	42
35	Lakshadweep									
36	Puducherry	19	19	19	103	103	105	70	99	100

Sr. No.	State/UT's	Species Richness Count								
		Marine (Mangrove)			Plant (Magnolias)			Fresh Water Group		
								Crabs		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
1	Andhra Pradesh	22	22	22				11	11	11
2	Arunachal Pradesh	2	2	2	6	6	6	32	32	32
3	Assam	2	2	2	5	5	5	34	34	34
4	Bihar	2	2	2	1	1	1	15	15	15
5	Chhattisgarh	2	2	2				6	6	6
6	Goa	20	20	20				5	5	5
7	Gujrat	12	12	12				6	6	6
8	Haryana	2	2	2				9	9	9
9	Himachal Pradesh	2	2	2				9	9	9
10	Jharkhand	2	2	2	1	1	1	9	9	9
11	Karnataka	22	22	22	1	1	1	13	13	13
12	Kerala	23	23	23	1	1	1	29	29	29
13	Madhya Pradesh	2	2	2				6	6	6
14	Maharashtra	21	21	21				11	11	11
15	Manipur	2	2	2	2	2	2	21	21	21
16	Meghalaya	2	2	2	2	2	2	19	19	19
17	Mizoram	2	2	2	1	1	1	17	17	17
18	Nagaland	2	2	2	5	5	5	26	26	26
19	Odisha	34	34	34				10	10	10
20	Punjab	2	2	2				8	8	8
21	Rajasthan	2	2	2				6	6	6
22	Sikkim	2	2	2	1	1	1	12	12	12
23	Tamil Nadu	26	26	26	1	1	1	29	29	29
24	Telangana	2	2	2				5	5	5
25	Tripura	2	2	2				12	12	12

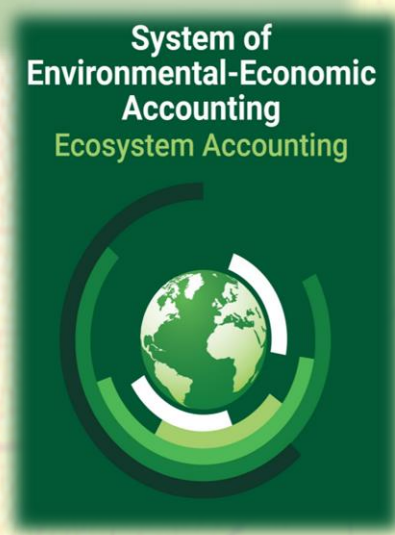
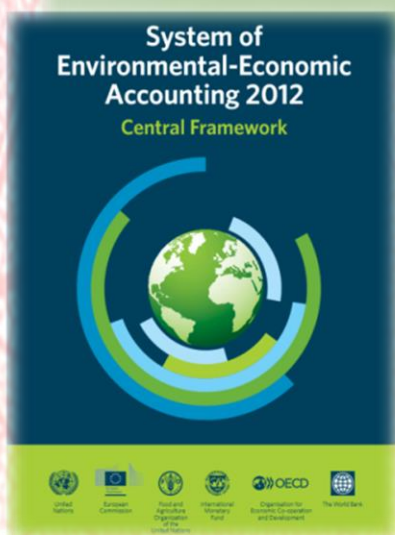
Sr. No.	State/UT's	Species Richness Count								
		Marine (Mangrove)			Plant (Magnolias)			Fresh Water Group		
								Crabs		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
26	Uttar Pradesh	2	2	2				10	10	10
27	Uttarakhand	2	2	2				10	10	10
28	West Bengal	35	35	35	2	2	2	24	24	24
29	Andaman and Nicobar Islands	34	34	34				2	2	2
30	Chandigarh	2	2	2				5	5	5
31	Dadra & Nagar Haveli and Daman & Diu	12	12	12				3	3	3
32	Delhi	2	2	2				6	6	6
33	Jammu and Kashmir	2	2	2				6	6	6
34	Ladakh	2	2	2				6	6	6
35	Lakshadweep									
36	Puducherry	24	24	24				9	9	9

Sr. No.	State/UT's	Species Richness Count								
		Fresh Water Group								
		Crayfish			Fish			Molluscs		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
1	Andhra Pradesh				185	185	191	72	72	72
2	Arunachal Pradesh	2	2	2	156	156	159	129	129	129
3	Assam	2	2	2	149	149	153	158	158	158
4	Bihar				119	119	121	124	124	124
5	Chhattisgarh				86	86	88	87	87	87
6	Goa				131	131	137	47	47	47
7	Gujrat				128	128	136	53	53	53
8	Haryana	1	1	1	58	58	59	64	64	64
9	Himachal Pradesh	2	2	2	69	69	74	74	74	74
10	Jharkhand				102	102	103	103	103	103
11	Karnataka				226	226	232	66	66	66
12	Kerala				250	250	256	49	49	49
13	Madhya Pradesh				76	76	77	69	69	69
14	Maharashtra				171	171	177	69	69	69
15	Manipur				149	149	150	129	129	129
16	Meghalaya	1	1	1	106	106	108	105	105	105
17	Mizoram				106	106	108	152	152	152
18	Nagaland				126	126	128	128	128	128
19	Odisha				172	172	179	105	105	105
20	Punjab	1	1	1	54	54	56	39	39	39
21	Rajasthan				67	67	69	62	62	62
22	Sikkim	2	2	2	105	105	106	124	124	124
23	Tamil Nadu				274	274	281	60	60	60
24	Telangana				104	104	106	59	59	59
25	Tripura				111	111	114	111	111	111

Sr. No.	State/UT's	Species Richness Count								
		Fresh Water Group								
		Crayfish			Fish			Molluscs		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
26	Uttar Pradesh				107	107	109	96	96	96
27	Uttarakhand	2	2	2	96	96	101	92	92	92
28	West Bengal	2	2	2	212	212	221	151	151	151
29	Andaman and Nicobar Islands				89	89	97	38	38	38
30	Chandigarh				41	41	42	32	32	32
31	Dadra & Nagar Haveli and Daman & Diu				109	109	115	43	43	43
32	Delhi				50	50	51	57	57	57
33	Jammu and Kashmir				60	60	69	36	36	36
34	Ladakh	3	3	3	62	62	69	51	51	51
35	Lakshadweep									
36	Puducherry				182	182	188	53	53	53

Sr. No.	State/UT's	Species Richness Count								
		Fresh Water Group								
		Odonata			Plants			Shrimp		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
1	Andhra Pradesh	61	63	63	255	255	255	18	18	18
2	Arunachal Pradesh	117	118	118	121	121	121	12	12	12
3	Assam	144	147	147	120	120	120	21	21	21
4	Bihar	111	114	114	108	108	108	15	15	15
5	Chhattisgarh	71	75	75	198	198	198	16	16	16
6	Goa	63	67	67	237	237	237	13	13	13
7	Gujrat	55	58	58	213	213	213	10	10	10
8	Haryana	65	67	67	80	80	80	9	9	9
9	Himachal Pradesh	67	72	72	89	89	89	9	9	9
10	Jharkhand	94	95	95	92	92	92	17	17	17
11	Karnataka	117	124	124	348	348	348	27	27	27
12	Kerala	119	126	126	333	333	333	38	38	38
13	Madhya Pradesh	65	68	68	218	218	218	14	14	14
14	Maharashtra	77	82	82	291	291	291	22	22	22
15	Manipur	107	108	108	117	117	117	11	11	11
16	Meghalaya	113	113	113	104	104	104	17	17	17
17	Mizoram	108	109	109	118	118	118	16	16	16
18	Nagaland	115	117	117	118	118	118	12	12	12
19	Odisha	87	92	92	203	203	203	12	12	12
20	Punjab	57	59	59	86	86	86	4	4	4
21	Rajasthan	62	63	63	89	89	89	9	9	9
22	Sikkim	120	121	121	109	109	109	10	10	10
23	Tamil Nadu	119	124	124	344	344	344	31	31	31
24	Telangana	61	63	63	231	231	231	13	13	13
25	Tripura	87	89	89	102	102	102	9	9	9

Sr. No.	State/UT's	Species Richness Count								
		Fresh Water Group								
		Odonata			Plants			Shrimp		
		2021-2	2021-3	2022-1	2021-2	2021-3	2022-1	2021-2	2021-3	2022-1
26	Uttar Pradesh	99	101	101	97	97	97	12	12	12
27	Uttarakhand	90	91	91	96	96	96	9	9	9
28	West Bengal	137	139	139	122	122	122	21	21	21
29	Andaman and Nicobar Islands	49	56	56	70	70	70	9	9	9
30	Chandigarh	49	51	51	69	69	69	4	4	4
31	Dadra & Nagar Haveli and Daman & Diu	49	50	50	192	192	192	9	9	9
32	Delhi	56	57	57	77	77	77	7	7	7
33	Jammu and Kashmir	52	55	55	79	79	79	4	4	4
34	Ladakh	52	53	53	87	87	87	5	5	5
35	Lakshadweep									
36	Puducherry	60	61	61	263	263	263	13	13	13



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