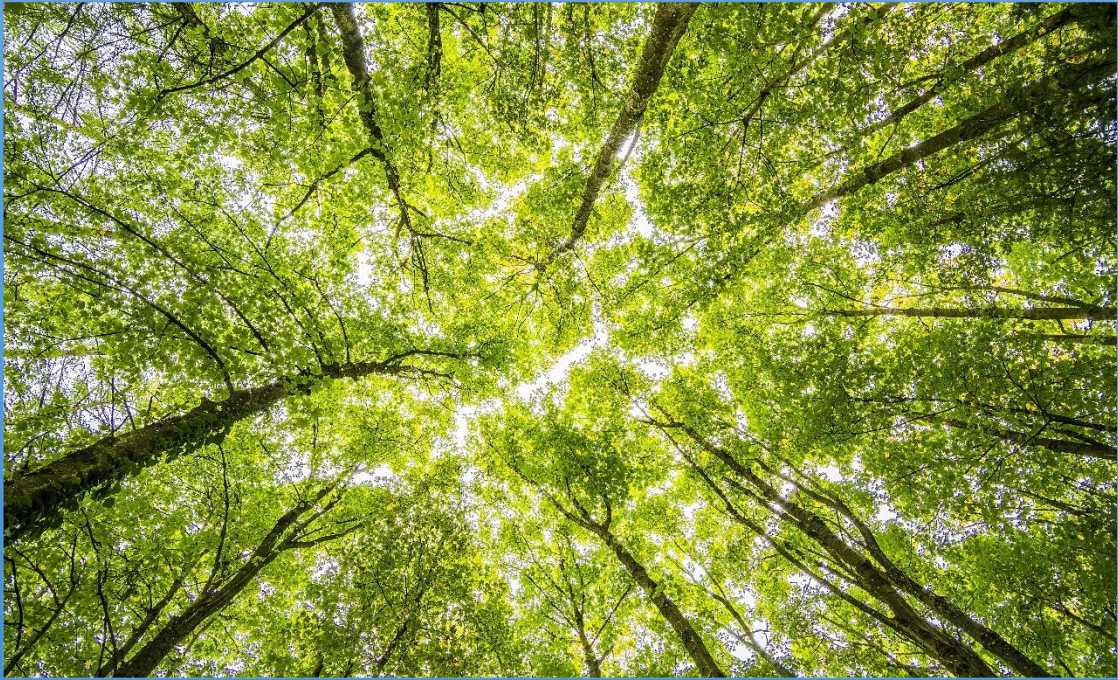


FOREST ECOSYSTEM



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

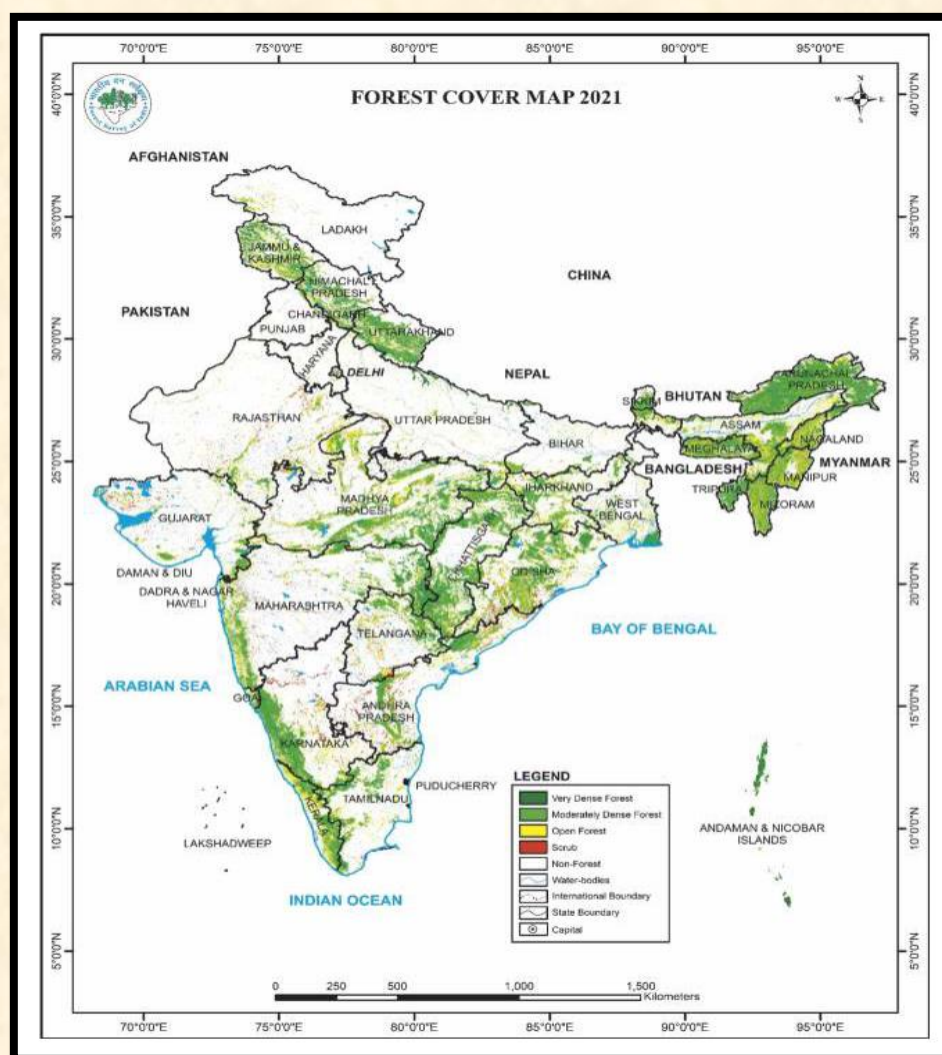
6.7 The System of Environmental-Economic Accounting (SEEA) prescribes the framework for compilation of the extent and the condition accounts to understand the quality and the quantity of the forest with 'ecosystem condition' representing both quality and biophysical state measures that are required to 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

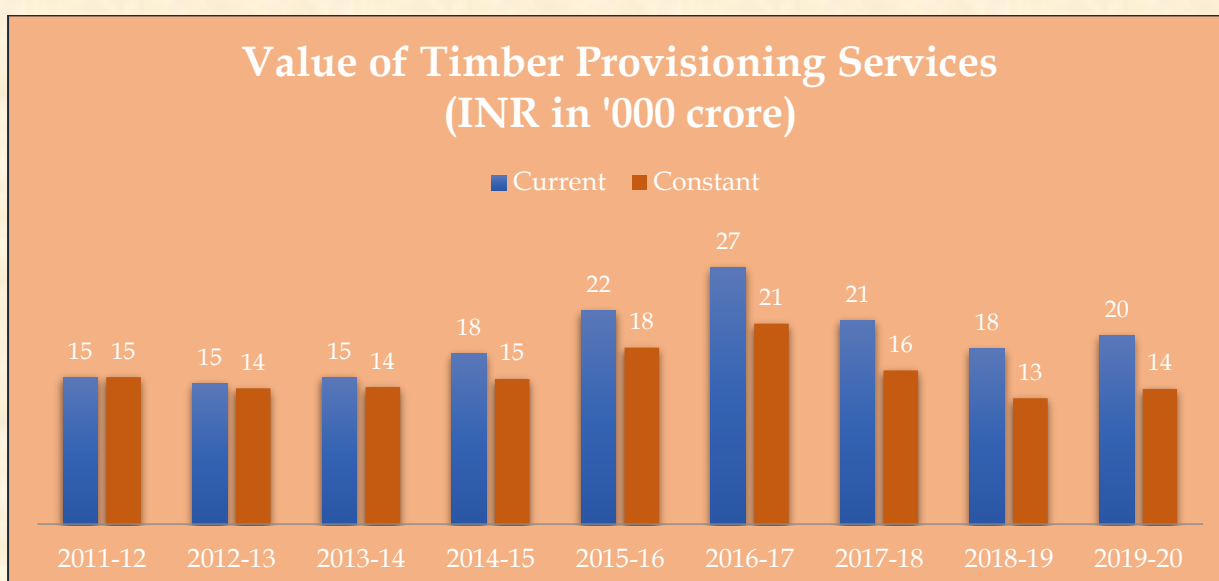
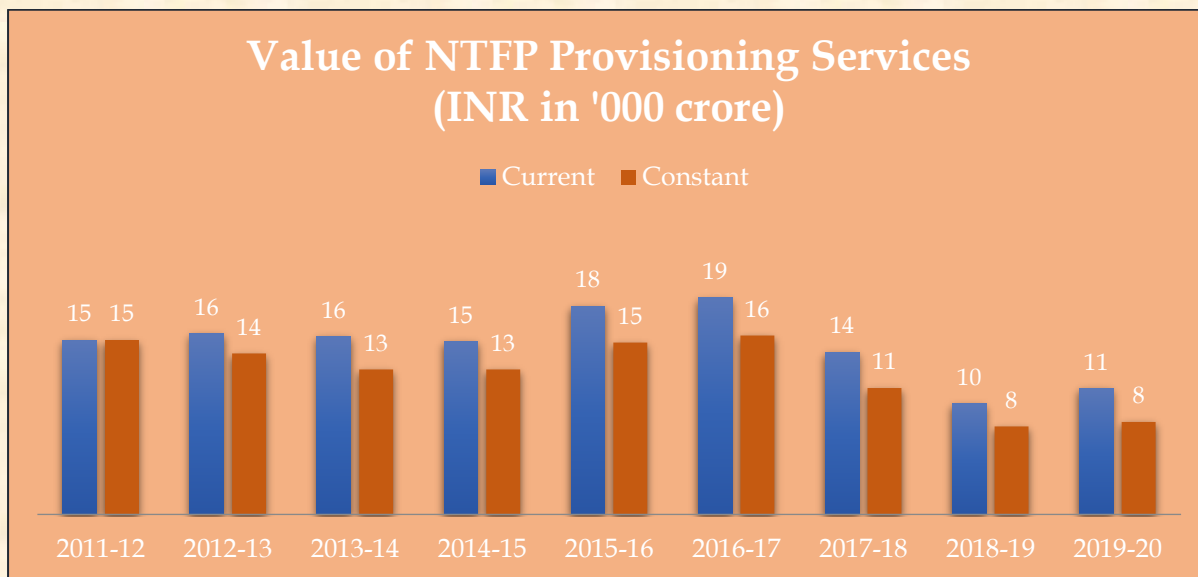


Figure 6.3: Value of NTFP Provisioning Services at Current and Constant Prices



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

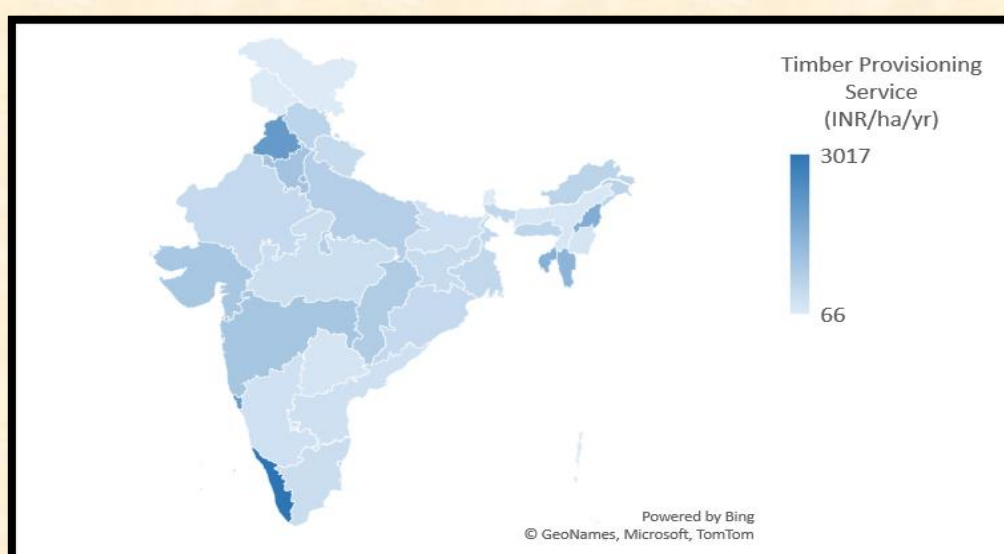
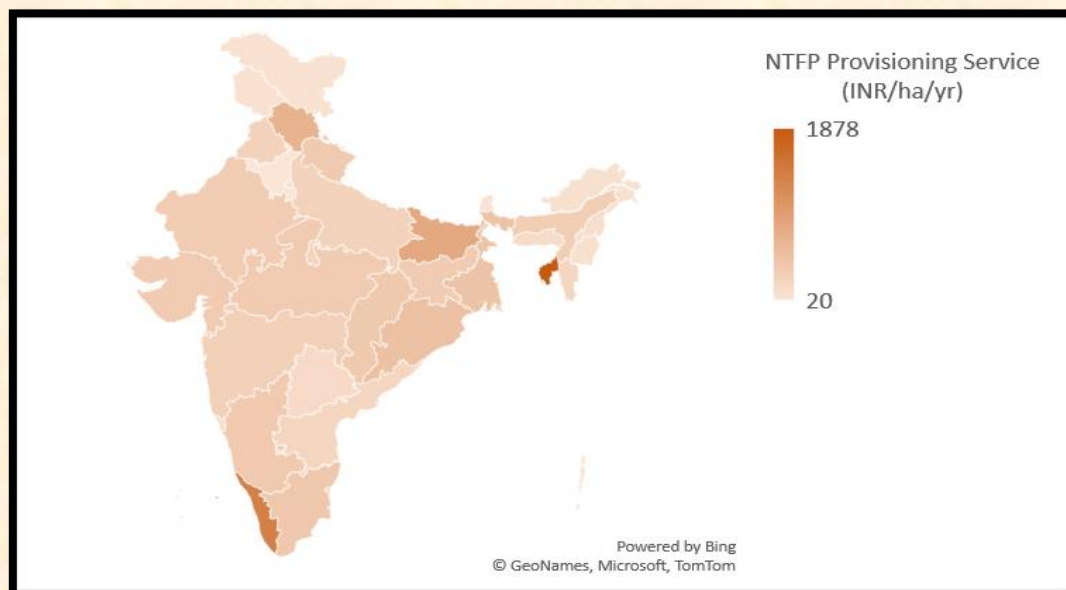


Figure 6.5: State-wise Value of NTFP Provisioning Services per hectare (at Current Price)- 2019-20



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

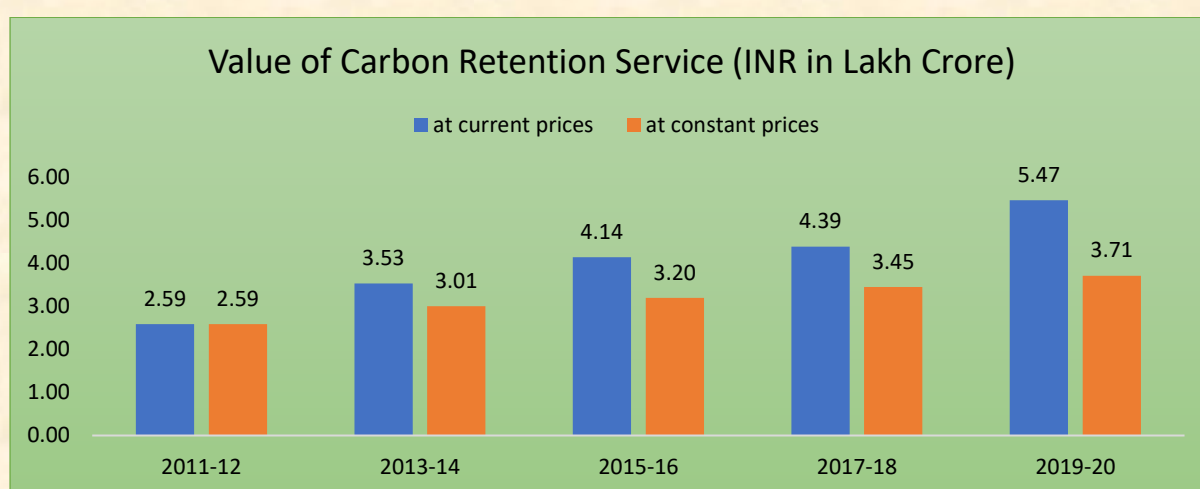
⁹ Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, et al. 2003. Good practice guidance for land use, land-use change and forestry. Institute for Global Environmental Strategies, Hayama, Japan

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

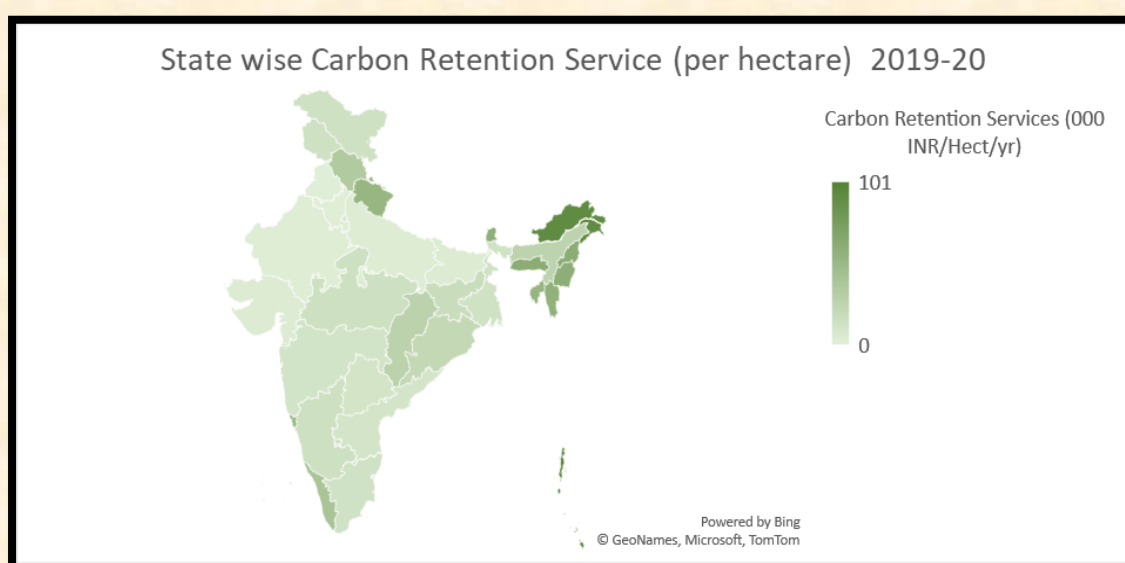
6.34 During the year 2019-20, it has been observed that value of timber provisioning services is about 0.13% of India's GDP, while that of NTFP provisioning service is 0.08% of India's GDP. Value of carbon retention service obtained using social cost of carbon approach during the year 2019-20 is equivalent 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.
