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Credits

The **India State of Forest Report 2021** by **Forest Survey of India (FSI)** has been referred while preparing this PDF notes. All the facts, information and data has been taken from the original **ISFR 2021** report itself. The facts, information and data has been organised in a reading friendly manner for students so that they can understand it easily.

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Chapter 1 – Introduction

Forest Survey of India (FSI), an organization of the Ministry of Environment, Forest & Climate Change, Government of India has been monitoring India's forest and tree resources through periodic assessments and presenting the findings in its biennial publication 'India State of Forest Report' (ISFR).

The first State of Forest report was brought out in the year 1987. The current report, ISFR 2021 is 17th in the series.

In addition to the regular chapters, this time round, a special chapter on Forest Cover assessment in Tiger reserves and Tiger corridor areas of the country and decadal change in Forest Cover has also been included.

Results of the two special studies namely Above Ground Biomass Estimation using Synthetic Aperture Radar data (carried out in collaboration with ISRO) and Climate hot spots in forest areas studies (carried out in collaboration with BITS Pilani, Goa campus) are also being presented in this report.

India's progress towards achieving the Nationally Determined Contribution commitments are also included as part of chapter on Forest carbon assessment.

Forest Cover and Recorded Forest Area

The 'Forest Cover' refers to all tree patches that have canopy density of more than 10% and area of one hectare or more in size, irrespective of land use, legal status and ownership. It may include orchards, bamboo, and palms etc. and is assessed through remote sensing.

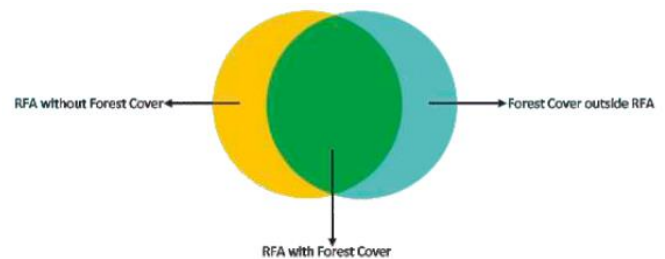
The 'Recorded Forest Area' or 'Forest Area' refers to all the geographical areas recorded as 'Forests' in government records irrespective of the actual trees growing on such lands. RFA mainly comprises of Reserved Forests (RF) and Protected Forests (PF) and Unclassed Forests notified under Indian Forest Act, 1927 or respective State Forest Acts. Additionally, RFA may also include all such areas, which have been recorded as 'Forest' in the revenue records or

have been constituted so under any State Acts or local laws.

Therefore, RFA may have blank areas with tree canopy density of less than 10% such as degraded lands, wetlands, rivers, creeks in mangroves, snow covered areas, glaciers and other snow-covered areas, alpine pastures, cold deserts, grasslands etc.

As per the definition of 'Forest cover' used in ISFR, such blank areas in RFA are excluded from the assessment of Forest cover. On the other hand, there are areas outside the RFA comprising tree patches of more than one hectare in area, with canopy density of 10% and above.

Such areas include plantations on the private and community lands, road, rail, and canal side plantations, rubber, tea and coffee plantations etc. and are included in assessment of Forest cover. Thus, RFA and Forest cover overlap with each other but the two are not coterminous with each other.



RFA (Total) (in sq km)

Top 10 States/UTs	
Madhya Pradesh	94,689
Maharashtra	61,952
Odisha	61,204
Chhattisgarh	59,816
Arunachal Pradesh	51,540
Karnataka	38,284

Uttarakhand	38,000
Himachal Pradesh	37,948
Andhra Pradesh	37,258
Rajasthan	32,863

Bottom 10 States/UTs	
Gujarat	11.14
Rajasthan	9.6
Bihar	7.9
Uttar Pradesh	7.22
Delhi	6.95
Punjab	6.12
Haryana	3.53
Puducherry	2.65
Ladakh	0
Lakshadweep	0

Bottom 10 States/UTs	
Sikkim	5,841
Punjab	3,084
Haryana	1,559
Goa	1,271
Dadra & Nagar Haveli and Daman & Diu	214
Delhi	103
Chandigarh	35
Puducherry	13
Ladakh	7
Lakshadweep	0

National RFA & States Data

	Total RFA (sq km)	RFA (% of GA)
India	7,75,288	23.58

RFA (% of GA)

Top 10 States/UTs	
Sikkim	82.31
Manipur	78.01
Uttarakhand	71.05
Himachal Pradesh	68.16
Arunachal Pradesh	61.55
Tripura	60.02
Nagaland	52.01
Chhattisgarh	44.25
Meghalaya	42.34
Odisha	39.31

States having more RFA (% of GA) than National Total: Sikkim, Manipur, Uttarakhand, Himachal Pradesh, Arunachal Pradesh, Tripura, Nagaland, Chhattisgarh, Meghalaya, Odisha, Jammu & Kashmir, Mizoram, Goa, Assam, Jharkhand, Madhya Pradesh, Kerala, Telangana.

UTs having more RFA (% of GA) than National Total: A & N Islands, Dadra & Nagar Haveli and Daman & Diu and Chandigarh

India's Forests vis-à-vis Forest Resources in the World

The Global Forest Resource Assessment (GFRA) by FAO provides information about the forest resources of almost all countries at five-year intervals.

The latest report of GFRA was published in the year 2020.

Top 10 countries for Forest Area (2020)

Sl. No.	Country	Forest area (000 ha)	% of world forest area	% of country area
1.	Russian Federation	8,15,312	20	49.8
2.	Brazil	4,96,620	12	59.4
3.	Canada	3,46,928	9	38.7
4.	USA	3,09,795	8	33.9
5.	China	2,19,978	5	23.3
6.	Australia	1,34,005	3	17.4
7.	Democratic Republic of the Congo	1,26,155	3	55.6
8.	Indonesia	92,133	2	49.1
9.	Peru	72,330	2	56.5
10.	India	72,160	2	24.3

Top 10 countries for average annual net gain in forest area (2010 – 2020)

Sl. No.	Country	Annual Forest Area Gain	
		Area (000 ha)	% of 2010 forest area
1.	China	1,937	0.93
2.	Australia	446	0.34
3.	India	266	0.38
4.	Chile	149	0.85
5.	Vietnam	126	0.90
5.	Turkey	114	0.53
7.	USA	108	0.03
8.	France	83	0.50
9.	Italy	54	0.58
10.	Romania	41	0.62

India's NDC (Climate Change Contributions)

Paris Agreement is a legally binding international treaty on climate change adopted at COP-21 in Paris on 12 Dec 2015 with a goal to limit global warming to well below 2, preferably 1.5 degrees Celsius, compared to pre-industrial levels.

- **Sustainable Lifestyles** - To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
- **Cleaner Economic Development** - To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.

- **Reducing Emission intensity of Gross Domestic Product (GDP)** - To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
- **Increasing the Share of Non-Fossil Fuel Based Electricity** - To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).
- **Enhancing Carbon Sink (Forests)** - To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.
- **Adaptation** - To better adapt to climate change by enhancing investments in

development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.

- **Mobilizing Finance** - To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
- **Technology Transfer and Capacity Building** - To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies.

Chapter 2 – Forest Cover

Forest Cover

The Forest Cover includes all lands more than one hectare in area with tree canopy density of more than 10 percent.

The Forest Cover reported in the ISFR does not make any distinction between the origin of tree crops (whether natural or manmade) or tree species, and encompasses all types of lands

irrespective of their ownership, land use and legal status.

Thus, all the tree species along with bamboos, fruit bearing trees, coconut palm trees etc. and all the areas including forest, private, community, government or institutional land, meeting the above defined criteria have been termed as Forest Cover.

Forest Cover classified in terms of canopy density classes

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



Very Dense Forest



Moderately Dense Forest



Open Forest



Scrub

Use of Collateral data to aid interpretation

Areas with thick cloud cover, hilly areas with deep hill shadows, mixing of bushy and agricultural vegetation adjoining to forest, water logged areas, forests under senescence during the data period, area under thick haze etc. are quite difficult to interpret.

In such scenarios, the data from collateral sources like Google Earth, Sentinel-2 data of European Space Agency, Landsat 8 data of PSI from United States Geological Survey (USGS) and National Forest Inventory (NFI) of FSI plays a very vital role by facilitating the interpreter with additional information for analysis.

Limitations of the Forest Cover Mapping

Remote sensing data has certain inherent limitations which affect the accuracy of the Forest Cover mapping. Some of the limitations are mentioned below:

- ❑ Land cover features having a geometric dimension less than 23.5 m on the ground are not discernible, hence cannot be captured.

Forest Cover: 2021 Assessment

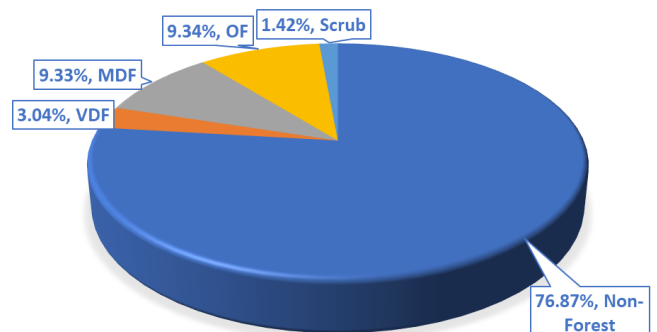
Class	Area	Percentage of Geographical Area
Very Dense Forest	99,779	3.04
Moderately Dense Forest	3,06,890	9.33
Open Forest	3,07,120	9.34
Total Forest Cover	7,13,789	21.71
Scrub	46,539	1.42
Non-Forest	25,27,141	76.87
Total Geographical Area	32,87,469	100.00

The Total Forest Cover of the country, as per the current assessment is 7,13,789 sq km which is 21.71 percent of the total geographic area of the country.

In terms of canopy density classes, area covered by VDF is 99,779 sq km (3.04 percent), MDF is 3,06,890 sq km (9.33 percent) and OF is 3,07,120 sq km (9.34 percent).

In the current assessment, Very Dense Forest and Moderately Dense Forest together constitute 57 percent of the total Forest Cover of the country.

- ❑ Due to cloud cover and shadows in satellite data, considerable ground details may sometimes be obscured. Collateral data helps in the image processing of such areas to a certain extent.
- ❑ Non-availability of appropriate season data and phenological changes in forests sometimes puts constraints on the interpretation of the features owing to poor reflectance of data.
- ❑ Agricultural crops like sugarcane, cotton, etc. adjacent to forests and occurrence of weeds like lantana within forest areas causes mixing of spectral signatures and often make it difficult to interpret and delineate the Forest Cover precisely.
- ❑ Many a times, young plantations and tree species with less chlorophyll or inadequate foliage coupled with edaphic factor, are not discernible on satellite images due to inadequate reflectance.
- ❑ Haze and other atmospheric distortions pose difficulty in interpretation.



State/UT wise Forest Cover

