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India State of Forest Report 2021 (ISFR)

(Ministry of Environment, Forest and Climate Change)

January 20, 2022

Background

The National Forest Policy of India, 1988 envisaged a goal of achieving 33 per cent of the geographical area of the country under forest & tree cover. The remote sensing based nation-wide Forest Cover mapping at biennial interval, serves as a monitoring mechanism towards achievement of this goal. Periodic forest cover assessment at definite intervals helps in assessing the status of forests in the country and its broad trend.

India State of Forest Report (ISFR)ⁱ is a biennial publication of Forest Survey of India (FSI), an organization under the Ministry of Environment, Forest & Climate Change, Government of India. It is a widely used primary information source across the Central Government, State Governments and forestry professionals of the State Forest Departments, academia, international organisations and other stakeholders. These inputs about the forest resources of the country are used for broad evaluation and formulation of forest related policies, programmes, legislations and other related activities.

The principal mandate of the Forest Survey of India (FSI)ⁱⁱ is to conduct survey and assessment of forest resources in the country. It started as an organization called Pre-Investment Survey of Forest Resources (PISFR) in 1965 as Food and Agriculture Organisation of the United Nations (FAO)/United Nations Development Programme (UNDP)/ Government of India Project. The changing information needs resulted in enlarging the scope of activities of PISFR and it was re-organized as Forest Survey of India in 1981.



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FOREST SURVEY REPORT 2021

The Forest Cover of the country as per current assessment is 7,13,789 sq km which is 21.71% of the geographical area of the country.

There is an increase of 1,540 sq km in forest cover

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MoEF&CC

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Introduction

On January 13, 2022, the Minister for Environment, Forest and Climate Change (MoEFCC), [Shri Bhupender Yadav](#), released the '[India State of Forest Report 2021](#)'ⁱⁱⁱ prepared by the Forest Survey of India (FSI).

The [India State of Forest Report 2021](#) provides information on forest cover, tree cover, mangrove cover, growing stock, carbon stock in India's forests, forest fire monitoring, forest cover in tiger reserve areas, above ground estimates of biomass using SAR data & climate change hotspots in Indian forests.

New Initiatives and Features of the ISFR 2021

- In the present ISFR 2021, FSI has included a new chapter related to the [assessment of forest cover in the Tiger Reserves, Corridors and Lion conservation area of India](#). In this context, the decadal assessment of change in forest cover within Tiger Reserves, Corridors and Lion conservation area helps in assessing the impact of conservation measures and management interventions that have been implemented over the years.
- A new initiative of FSI has also been documented in the form of a chapter, where the 'Above Ground Biomass' has been estimated. FSI, in collaboration with Space Application Centre (SAC), ISRO, Ahmedabad, initiated a [special study for estimation of Above Ground Biomass \(AGB\) at pan-India level, using L- band of Synthetic Aperture Radar \(SAR\) data](#). The results for the States of Assam and Odisha (as well as AGB maps), were presented earlier in ISFR 2019. The interim results for AGB estimates (and AGB maps) for the entire country have been presented as a new chapter in ISFR 2021. The detailed report will be published after completion of the study.

The above are some of the new initiatives which have been undertaken in the SFRI 2021.

[India's Forests vis-à-vis Forest Resources in the World:](#)^{iv}

Table 1.3(a) Top ten 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
	Total	4,85,438	66	

Table 1.3(b) Top ten 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
6.	Turkey	114	0.53
7.	USA	108	0.03
8.	France	83	0.50
9.	Italy	54	0.58
10.	Romania	41	0.62

[Source](#)

Key Findings from the [ISFR-2021](#)

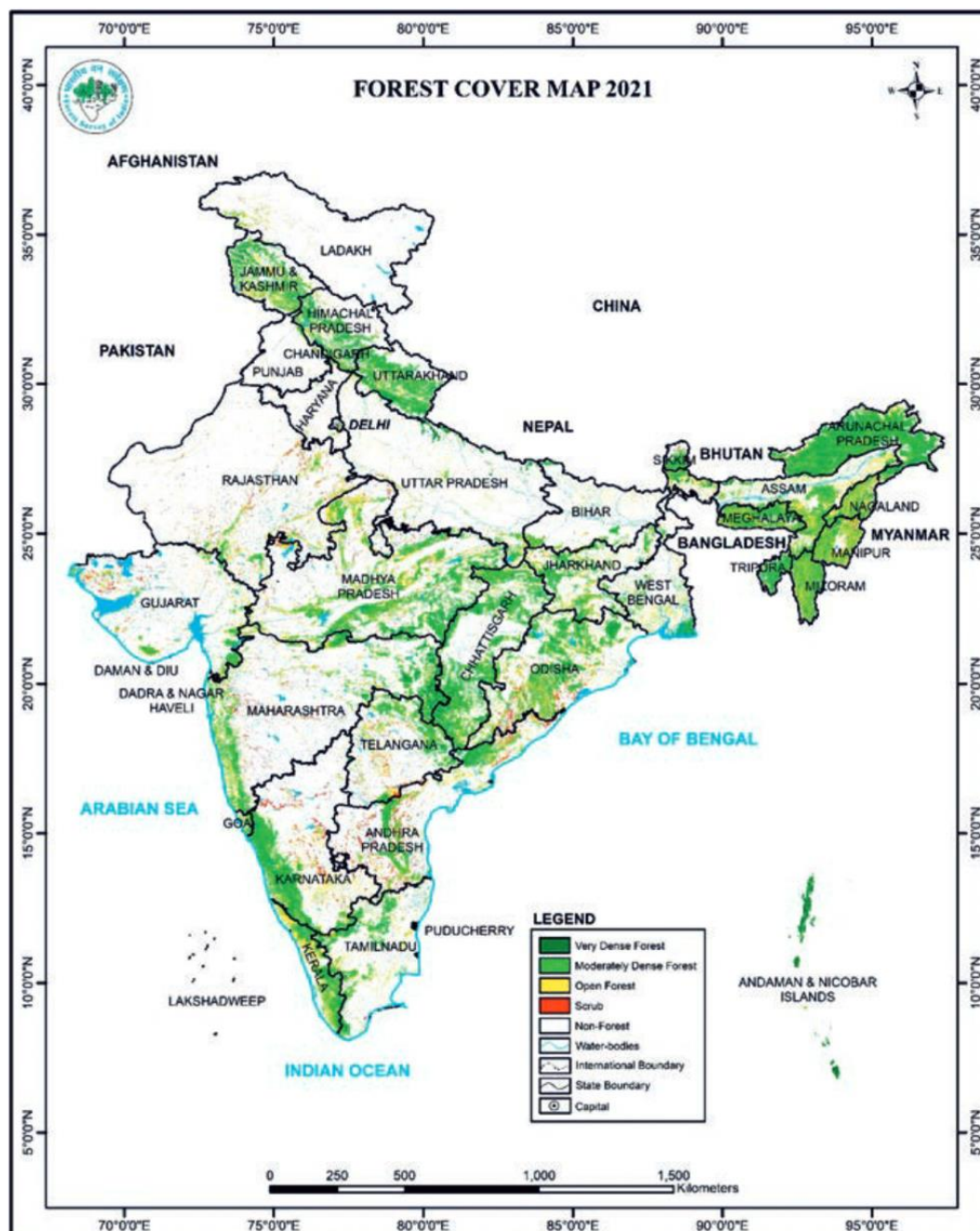
- The [total forest and tree cover of the country](#) is 80.9 million hectare which is [24.62 percent of the geographical area of the country](#). As compared to the assessment of 2019, there is an increase of 2261 sq km in the total forest and tree cover of the country. Out of this, **the increase in the forest cover has been observed as 1540 sq km and that in tree cover is 721 sq km**. To see the forest cover in the States & UTs of the country as per the 2021 assessment and change therein with respect to the previous assessment (2019), click [here](#).

Table 2.3 Forest Cover of India

(in sq km)

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

[Source](#)



[Source](#)

- Increase in forest cover has been observed in open forest followed by very dense forest. Top five states showing increase in forest cover are **Andhra Pradesh (647 sq km)** followed by **Telangana (632 sq km)** and **Odisha (537 sq km)**, **Karnataka (155 sq Km)** and **Jharkhand (110 sq. Km)**.
- **Area-wise, Madhya Pradesh has the largest forest cover in the country** followed by **Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra**. In terms of forest cover as percentage of total geographical area, the top five States are **Mizoram (84.53 per cent)**, **Arunachal Pradesh (79.33 per cent)**, **Meghalaya (76.00 per cent)**, **Manipur (74.34 per cent)** and **Nagaland (73.90 per cent)**.

Table 2.10 Forest Cover in North Eastern States											(in sq km)
2021 Assessment											
State	Geo-Graphical Area	VDF	Per-centage of VDF	MDF	Per-centage of MDF	OF	Per-centage of OF	Total	Per-centage of Forest Cover to GA	Change in forest cover wrt ISFR 2019	Scrub
Arunachal Pradesh	83,743	21,058	25.15	30,176	36.03	15,197	18.15	66,431	79.33	-257	797
Assam	78,438	3,017	3.85	9,991	12.74	15,304	19.51	28,312	36.09	-15	228
Manipur	22,327	905	4.05	6,228	27.90	9,465	42.39	16,598	74.34	-249	1,215
Meghalaya	22,429	560	2.50	9,160	40.84	7,326	32.66	17,046	76.00	-73	663
Mizoram	21,081	157	0.74	5,715	27.11	11,948	56.68	17,820	84.53	-186	1
Nagaland	16,579	1,272	7.67	4,449	26.84	6,530	39.39	12,251	73.90	-235	824
Sikkim	7,096	1,102	15.53	1,551	21.86	688	9.69	3,341	47.08	-1	296
Tripura	10,486	647	6.17	5,212	49.70	1,863	17.77	7,722	73.64	-4	33
Total	2,62,179	28,718	10.95	72,482	27.65	68,321	26.06	1,69,521	64.66	-1,020	4,057

Source

- **17 states/UT's have above 33 per cent of the geographical area under forest cover.** Out of these states and UTs, five states/UTs namely Lakshadweep, Mizoram, Andaman & Nicobar Islands, Arunachal Pradesh and Meghalaya have more than 75 percent forest cover while 12 states/UTs namely Manipur, Nagaland, Tripura, Goa, Kerala, Sikkim, Uttarakhand, Chhattisgarh, Dadra & Nagar Haveli and Daman & Diu, Assam, Odisha, have forest cover between 33 percent to 75 percent.
- **Tree Cover (small patches outside the forests) of the Country is on the rise.** The tree cover of the country is estimated to be 95,748 sq km which is 2.91 percent of the geographical area. There is an increase of 721 sq km in the tree cover of the country as compared to assessment of 2019. To see the state-wise estimates of tree cover, [click here](#).
- **Total Forest and Tree Cover is nearing one-fourth of the total geographical area of the country-** The Total Forest and Tree Cover gives a complete picture of all forests and tree resources of the country. The total Forest and Tree cover of the country as per the current assessment is 8,09,537 sq km which is 24.62% of the geographical area of the country. Total forest and tree cover of the country has increased by 2261 sq km as compared to the last assessment.
- **The country's forests & Trees Outside Forests (TOF) are better stocked as compared to the last assessment.** The total growing stock of wood in the country is estimated as 6167.50 million cubic metres out of which 4388.15 million cubic metres is inside forest areas and 1,779.35 million cubic metres is outside recorded forest areas (TOF). There is a total increase of 251.74 million cubic metres (4.26 per cent) in total growing stock of the country as compared to previous assessment reported in ISFR 2019. Out of this, the increase in growing stock inside the forest is 114.68 million cubic metres (2.68 per cent) and 137.06 million cubic metres (8.35 per cent) outside the forest area. To see the estimates of growing stock in Forests and TOF in the States & UTs, [click here](#).

- **The Stock of Bamboo in the country has increased.** The total number of bamboo culms has increased by 13,882 million as compared to the assessment of 2019. The total estimated green weight of bamboo culms at national level is 402 million tonnes. The present assessment observed an increase of about 124 million tonnes equivalent green weight of bamboo as compared to the previous assessment.
- **Total mangrove cover in the country is 4992 sq km.** An increase of 17 sq Km in mangrove cover has been observed as compared to the previous assessment of 2019. Top three states showing mangrove cover increase are Odisha (8 sq km) followed by Maharashtra (4 sq km) and Karnataka (3 sq km).

Sl. No.	State/UT	Very Dense Mangrove	Moderately Dense Mangrove	Open Mangrove	Total	Change with respect to ISFR 2019
1.	Andhra Pradesh	0	213	192	405	1
2.	Goa	0	21	6	27	1
3.	Gujarat	0	169	1,006	1,175	-2
4.	Karnataka	0	2	11	13	3
5.	Kerala	0	5	4	9	0
6.	Maharashtra	0	90	234	324	4
7.	Odisha	81	94	84	259	8
8.	Tamil Nadu	1	27	17	45	0
9.	West Bengal	994	692	428	2,114	2
10.	A&N Islands	399	168	49	616	0
11.	D&NH and Daman & Diu	0	0	3	3	0
12.	Puducherry	0	0	2	2	0
Total		1,475	1,481	2,036	4,992	17

Source

- **Total carbon stock in country's forest** is estimated to be **7204 million tonnes** and there an **increase of 79.4 million tonnes in the carbon stock of country** as compared to the last assessment of 2019. The **annual increase in the carbon stock is 39.7 million tonnes.**
- **Forest Fire Prone Areas Mapping** - Severe fires occur in many forest types particularly dry deciduous forests, while evergreen, semi-evergreen and montane temperate forests are comparatively less prone. FSI has been monitoring forest fire since 2004.
 - Total Fire prone forest area is **35.47 per cent** of the forest cover as per current assessment.
- **Assessment of Forest Cover and decadal change in 52 Tiger Reserves and Lion Conservation Area of India.**
 - There are **52** tiger reserves, spread across eighteen major states of the country covering a total notified area of **73,972.50** sq km.

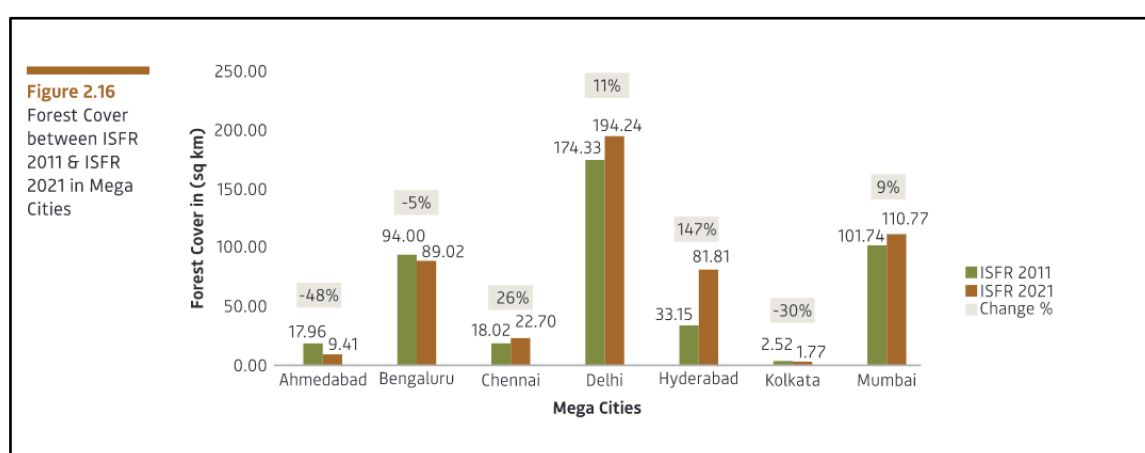
- The current assessment shows that the forests cover in the tiger reserves is **55,666.27** sq km, which is **7.80 per cent** of the country's total forest cover and **74.51%** of the total area of tiger reserves.
 - Gir Wildlife Sanctuary (excluding National Park), has **177.60** sq km of grassland whereas Gir National Park has **33.58** sq km of grassland, summing up to **211.18** sq km, which is **26.11 per cent** of the area of Gir National Park and WLS.
- **Mapping of Climate Change Hotspots in Indian Forests** - Mapping of Climate hotspots over the forest cover in India using computer model-based projection of temperature and rainfall data has been carried out for the three future time periods i.e., year **2030**, **2050** and **2085**. FSI in collaboration with Birla Institute of Technology & Science (BITS) Pilani, Goa Campus has performed this study.

The period **2030** represents near-term timeline that coincides with global short-term climate action horizon. Period **2050** represents the mid-term timeline and coincides with global long-term climate action goals. The period **2085** represents the long-term time horizon.

- By analyzing all the scenarios in the studied periods i.e., **2030**, **2050** and **2085**; it has been observed that **Ladakh, Jammu-Kashmir, Himachal Pradesh and Uttarakhand** are projected to witness highest temperature increase while **Andaman & Nicobar Islands, West Bengal, Goa, Tamil Nadu and Andhra Pradesh** are Projected to witness the least temperature rise over these periods.
 - The North-Eastern States and Upper Malabar Coast of India are projected to experience highest increase in rainfall; whereas, part of North-Eastern States like **Arunachal Pradesh, Sikkim**, North-Western parts of the country Namely **Ladakh, Jammu & Kashmir** and **Himachal Pradesh** are projected to experience least increase and even decline in rainfall.
- **Mapping of Forest Cover in Major Mega Cities**
 - In the current assessment, extent of Forest Cover of seven major cities (as given in the table below) has been measured. The total forest cover in the seven major cities is **509.72** sq km which is **10.21 per cent** of total geographical area of the cities. **Delhi has the largest forest cover (194.24 sq km) followed by Mumbai (110.77 sq km) and Bengaluru (89.02 sq km).** Hyderabad has shown maximum decadal increase of **48.65** sq km in Forest cover followed by Delhi with an increase of **19.91** sq km.

Name	State	Area as per digitized Boundary*	ISFR 2021					
			VDF	MDF	OF	Total Forest Cover	% of total Forest Cover wrt area of digitized boundary	Scrub
Ahmedabad	Gujarat	455.32	0.00	1.59	7.82	9.41	2.07	4.85
Bengaluru	Karnataka	1,307.35	0.00	12.66	76.36	89.02	6.81	14.87
Chennai	Tamil Nadu	430.07	0.00	7.66	15.04	22.70	5.28	1.77
Delhi	Delhi	1,540.63	6.74	56.34	131.15	194.24	12.61	0.45
Hyderabad	Telangana	634.18	0.00	17.68	64.13	81.81	12.90	29.96
Kolkata	West Bengal	186.55	0.00	0.10	1.67	1.77	0.95	0.00
Mumbai	Maharashtra	435.91	0.00	51.13	59.65	110.77	25.41	0.00
	Total	4,990.01	6.74	147.16	355.82	509.72	10.21	51.90

[Source](#)



[Source](#)

Methodology

- In tune with the Government of India's vision of digital India and the need for integration of digital data sets, FSI has adopted using the vector boundary layers of various administrative units up to districts level as provided by Survey of India along with digital open series topo sheets, in order to ensure comprehensive compatibility with the geographical areas as reported in Census, 2011.
- The biennial assessment of forest cover of the country using mid-resolution Satellite data is based on interpretation of Linear Imaging Self-Scanning Sensor 3 (LISS-III) data from Indian Remote Sensing satellite data (Resourcesat-II) with a spatial resolution of 23.5 meters with the scale of interpretation 1:50,000 to monitor forest cover and forest cover changes at District, State and National level.
- This information provides inputs for various global level inventories, reports such as Greenhouse Gas (GHG) Inventory, Growing Stock, Carbon Stock, Forest Reference Level (FRL) and international reporting to [United Nations Framework Convention on Climate Change](#) (UNFCCC) targets under the [Convention on Biological Diversity](#)(CBD),Global Forest Resource Assessment (GFRA) for planning and scientific management of forests.

- Satellite data for the entire country was procured from [National Remote Sensing Centre](#) (NRSC) for the period October to December 2019. The satellite data interpretation is followed by rigorous ground truthing. Information from other collateral sources is also used to improve the accuracy of the interpreted image.
- The accuracy level achieved in the current assessment is significantly high. The accuracy of forest cover classification has been assessed 92.99%. The accuracy of classification between forest and non-forest classes has been assessed 95.79% against internationally accepted accuracy of classification of more than 85%. A rigorous Quality Control (QC)&Quality Assurance (QA) exercise was also carried out.

Other Significant Features of ISFR 2021

- The report also contains information on various parameters State/UT wise. **Special thematic information on forest cover such as hill, tribal districts, and north eastern region has also been given separately in the report.**^v

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

ⁱⁱ<https://fsi.nic.in/>

ⁱⁱⁱ<https://pib.gov.in/PressReleasePage.aspx?PRID=1789635>

^{iv}<https://fsi.nic.in/isfr-2021/chapter-1.pdf>

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Further Reading

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