11.16
MAHARASHTRA

11.16.1 Introduction

Situated in the western peninsular region of the country, Maharashtra has geographical area of 3,07,713 sq km, which is 9.36% of the geographical area of the country. The State lies between 15°35' N to 22°02' N latitude and 72°36' E to 80°54' E longitude and state is bordered by Gujarat & Madhya Pradesh in the north, Chhattisgarh in the east, Telangana, Karnataka and Goa in the south and Arabian sea on the west. The State has three physiographic zones namely Deccan Plateau, Western Ghats and West Coast. It experiences a tropical monsoon climate with hot, rainy and cold weather seasons and dry summers. The annual rainfall ranges between 400 mm to 6,000 mm and the annual temperature varies from 25°C to 27°C. The State is drained by number of rivers which include Godavari, Bhima, Narmada, Tapti, Koyna and Krishna. The State has 35 districts, amongst which 12 are tribal and 7 are hill districts. As per the 2011 census, Maharashtra has a population of 112.37 million accounting to 9.28% of India's population. The rural and urban population constitutes 54.78% and 45.22% respectively. The tribal population of the State is 9.35%. The population density of the State is 365 per sq km, which is close to the national average. The 19th Livestock census 2012 has reported a total livestock population of 32.48 million in the State.

TABLE 11.16.1 Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	30,771	
Reporting area for land utilization	30,758	100.00
Forests	5,201	16.91
Not available for land cultivation	3,209	10.43
Permanent pastures and other grazing lands	1,249	4.06
Land under misc. tree crops and groves	249	0.81
Culturable wasteland	919	2.99
Fallow land other than current fallows	1,188	3.86
Current fallows	1,399	4.55
Net area sown	17,344	56.39

Source: Land Use Statistics, Ministry of Agriculture, GOI, (2014-15)

11.16.1.1 A Brief Overview of Forestry Scenario

Maharashtra, the third largest State in the country is ranked second among the States in terms of the recorded forest area. Western Ghats of the State have very rich biodiversity. As per the Champion & Seth Classification of Forest Types (1968), the forests in Maharashtra belong to six Forest Type Groups which are further divided into 17 Forest Types. The high rural population of the State depends on the forests considerably for livelihood and basic needs. The State forest department encourages the village communities and other stakeholders to participate in plantation activities. Several initiatives have been undertaken by the State Forest Department like training the farming communities; the concept of easy farming through 'Maharashtra Green Tube Channel' wherein the farmers could learn the advance technologies of agriculture and forestry related activities through online media.

In a first of its kind, a 24-hour toll free helpline number 1926 called 'Hello Forest' has been set up to provide information regarding plantations, protection and mass awareness. The Forest Department has created a mobile application called 'My Plants' to record details of the plantations such as numbers, species and location into the Forest Department's data base. To encourage public participation, the SFD has initiated the 'Maharashtra Harit Sena or Green Army, which is a body of dedicated volunteers to participate in the plantation, protection, and related activities.

Recorded Forest Area (RFA) in the State is 61,579 sq km of which 49,546 sq Km is Reserved Forests, 6,733 sq km is Protected Forest and 5,300 sq km is Unclassed Forests. In Maharashtra, during the period 1st January 2015 to 5th February 2019, a total of 3797.16 hectares of forestland was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019). As per the information received from the SFD, a total area of 1,47,814 ha has been notified as reserved forests during 2014 to 2019.

Six National Parks, 48 Wildlife Sanctuaries and 6 Conservation Reserves constitute the Protected Area network of the State covering 3.03% of its geographical area.
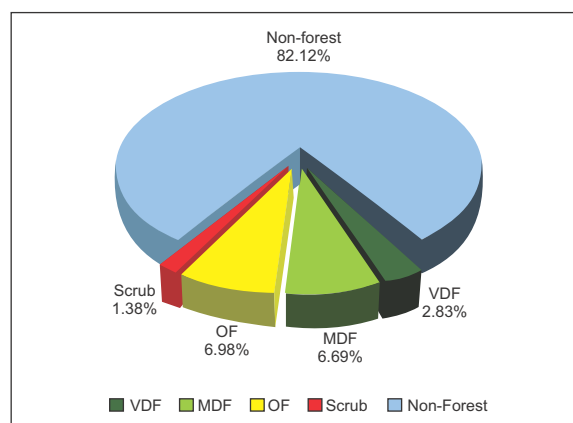
11.16.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Oct 2017 to Jan 2018, the Forest Cover in the State is 50,777.56 sq km which is 16.50 % of the State's geographical area. In terms of forest canopy density classes, the State has 8,720.53 sq km under Very Dense Forest(VDF), 20,572.35 sq km under Moderately Dense Forest (MDF) and 21,484.68 sq km under Open Forest (OF). Forest Cover in the State has increased by 95.56 sq km as compared to the previous assessment reported in ISFR 2017.

TABLE 11.16.2 Forest Cover of Maharashtra

(in sq km)

Class	Area	% of GA
VDF	8,720.53	2.83
MDF	20,572.35	6.69
OF	21,484.68	6.98
Total	**50,777.56**	**16.50**
Scrub	4,256.49	1.38

FIGURE 11.16.1 Forest Cover of Maharashtra

11.16.2.1 Forest Cover inside and outside Recorded Forest Area (or Green Wash)

The State has reported extent of recorded forest area (RFA) 61,579 sq km which is 20.01% of its geographical area. The reserved, protected and unclassed forests are 80.46%, 10.93% and 8.61% of the recorded forest area in the State respectively. However as the digitized boundary of recorded forest area from the state covers 56,373.92 sq km and the analysis of forest cover inside and outside this area is depicted below.

TABLE 11.16.3 Forest Cover inside and outside Recorded Forest Area or (Green Wash) in Maharashtra

(in sq km)

Forest Cover inside the Recorded Forest Area (or Green Wash)				Forest Cover outside the Recorded Forest Area (or Green Wash)			
VDF	MDF	OF	Total	VDF	MDF	OF	Total
8,200	14,477	11,962	34,639	521	6,095	9,523	16,139
23.67%	41.80%	34.53%		3.23%	37.77%	59.00%	

*in case of Maharashtra RFA boundaries have been used.

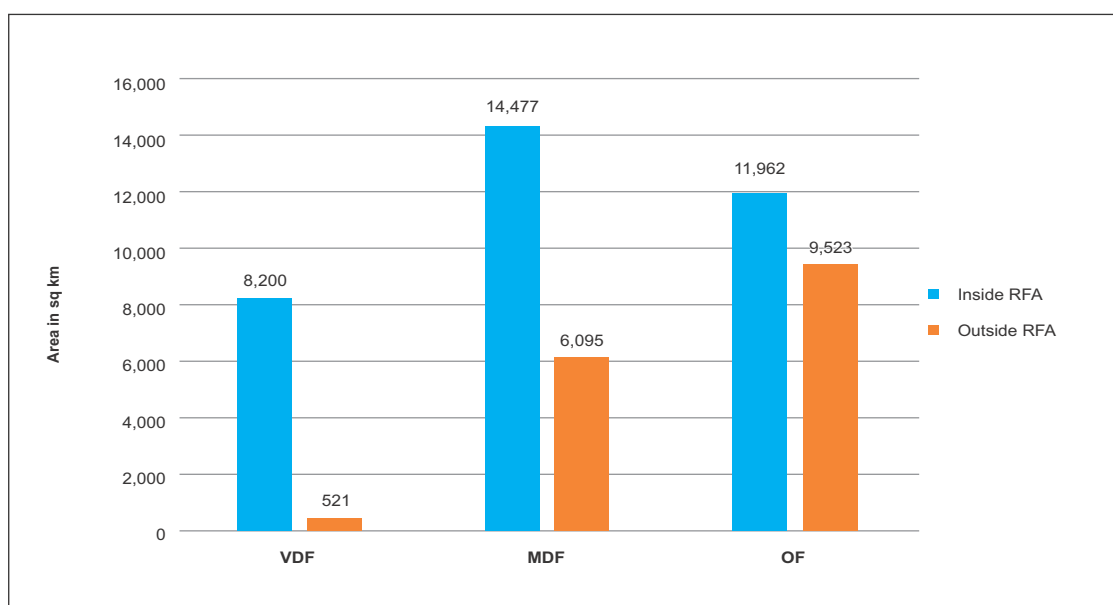**FIGURE 11.16.2** Forest Cover inside and outside RFA in Maharashtra

Maharashtra

TABLE 11.16.4 District- wise Forest Cover in Maharashtra   (in sq km)

District	Geographical Area (GA)	2019 Assessment				% of GA	Change wrt 2017 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Ahmadnagar[T]	17,048	0.00	68.82	198.07	266.89	1.57	-3.11	557.39
Akola	5,673	11.00	108.44	220.93	340.37	6.00	1.37	16.00
Amravati[T]	12,210	618.89	1,461.53	1,087.35	3,167.77	25.94	-0.23	112.76
Aurangabad	10,131	20.00	106.26	441.67	567.93	5.61	-2.07	171.29
Bhandara	4,087	170.86	563.13	264.93	998.92	24.44	-7.08	18.57
Bid	10,693	0.00	13.00	151.03	164.03	1.53	-10.97	362.79
Buldana	9,661	25.00	143.95	422.65	591.60	6.12	-3.40	162.00
Chandrapur[T]	11,443	1,323.03	1,559.44	1,171.99	4,054.46	35.43	-32.54	44.23
DhuleT	7,195	0.00	68.57	232.70	301.27	4.19	-6.73	111.37
Gadchiroli[T]	14,412	4,699.29	3,307.73	1,909.92	9,916.94	68.81	-87.06	24.58
Gondiya	5,234	888.61	732.23	317.75	1,938.59	37.04	15.59	32.25
Hingoli	4,827	0.00	9.00	101.01	110.01	2.28	-0.99	49.23
Jalgaon[T]	11,765	51.00	347.94	747.90	1,146.84	9.75	2.84	94.51
Jalna	7,694	0.00	9.65	26.83	36.48	0.47	-1.52	51.21
Kolhapur[H]	7,685	64.00	1,020.44	701.88	1,786.32	23.24	-9.68	102.83
Latur	7,157	0.00	0.04	12.98	13.02	0.18	1.02	19.67
Mumbai	157	0.00	0.00	3.00	3.00	1.91	0.00	0.00
Mumbai Suburban	446	0.00	67.00	72.86	139.86	31.36	-0.14	0.43
Nagpur[T]	9,892	401.06	902.56	696.76	2,000.38	20.22	-18.62	73.68
Nanded	10,528	58.00	442.91	435.85	936.76	8.90	2.76	123.08
Nandurbar[T]	5,955	0.00	404.15	791.84	1,195.99	20.08	3.99	30.00
Nashik[TH]	15,530	0.00	346.34	730.21	1,076.55	6.93	8.55	337.66
Osmanabad	7,569	0.00	2.08	47.58	49.66	0.66	2.66	47.43
Parbhani	6,214	0.00	3.57	36.86	40.43	0.65	-7.57	47.78
Pune[TH]	15,643	0.00	760.93	949.93	1,710.86	10.94	2.86	508.03
Raigarh[H]	7,152	13.00	1,250.34	1,676.12	2,939.46	41.10	22.46	77.60
Ratnagiri[H]	8,208	33.00	1,892.01	2,287.89	4,212.90	51.33	46.90	3.36
Sangli	8,572	0.00	95.00	55.13	150.13	1.75	0.13	171.03
Satara[H]	10,480	117.00	569.68	591.69	1,278.37	12.20	2.37	365.70
Sindhudurg[H]	5,207	88.82	1,391.73	1,347.43	2,827.98	54.31	138.98	32.27
Solapur	14,895	0.00	5.50	44.17	49.67	0.33	1.67	60.72
Thane[T]	9,558	0.00	1,300.11	1,697.98	2,998.09	31.37	35.09	261.07
Wardha	6,309	9.97	410.03	441.95	861.95	13.66	-1.05	55.93
Washim	4,901	5.00	101.89	189.87	296.76	6.06	-2.24	31.65
Yavatmal[T]	13,582	123.00	1,106.35	1,377.97	2,607.32	19.20	1.32	98.39
Total	**3,07,713**	**8,720.53**	**20,572.35**	**21,484.68**	**50,777.56**	**16.50**	**95.56**	**4,256.49**

TABLE 11.16.5 Forest Cover Change Matrix for Maharashtra

(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	**MDF**	**OF**	**Scrub**	**NF**	
Very Dense Forest	8,719	2	3	0	12	**8,736**
Moderately Dense Forest	2	20,541	13	4	92	**20,652**
Open Forest	0	1	20,853	57	383	**21,294**
Scrub	0	0	13	4,102	45	**4,160**
Non Forest	0	28	603	93	2,52,147	**2,52,871**
Total ISFR 2019	**8,721**	**20,572**	**21,485**	**4,256**	**2,52,679**	**3,07,713**
Net Change	-15	-80	191	96	-192	

Main reasons for the increase in forest cover in the State are plantation and conservation activities.

TABLE 11.16.6 Altitude-wise Forest Cover in Maharashtra

(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total		Scrub
0-500	2,37,017	7,591	15,456	16,128	39,175	(77.15%)	1,339
500-1000	66,142	1,082	4,733	5,053	10,868	(21.40%)	2,812
1000-2000	4,554	48	383	304	735	(1.45%)	105
Total	**3,07,713**	**8,721**	**20,572**	**21,485**	**50,778**		**4,256**

(based on SRTM, Digital Elevation Model, 30 m, 2016)

TABLE 11.16.7 Forest Cover in different slope classes in Maharashtra

(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total		Scrub
0-5	2,58,651	6,161	9,322	10,359	25,842	(50.89%)	1,538
5-10	23,811	1,212	3,932	4,376	9,520	(18.75%)	1,043
10-15	11,555	665	2,970	2,923	6,558	(12.92%)	724
15-20	6,633	378	2,045	1,816	4,239	(8.35%)	467
20-25	3,707	184	1,223	1,065	2,472	(4.87%)	275
25-30	1,896	78	637	549	1,264	(2.49%)	138
>30	1,459	43	443	397	883	(1.73%)	71
Total	**3,07,713**	**8,721**	**20,572**	**21,485**	**50,778**		**4,256**

(based on SRTM, Digital Elevation Model, 30 m, 2016)

Maharashtra

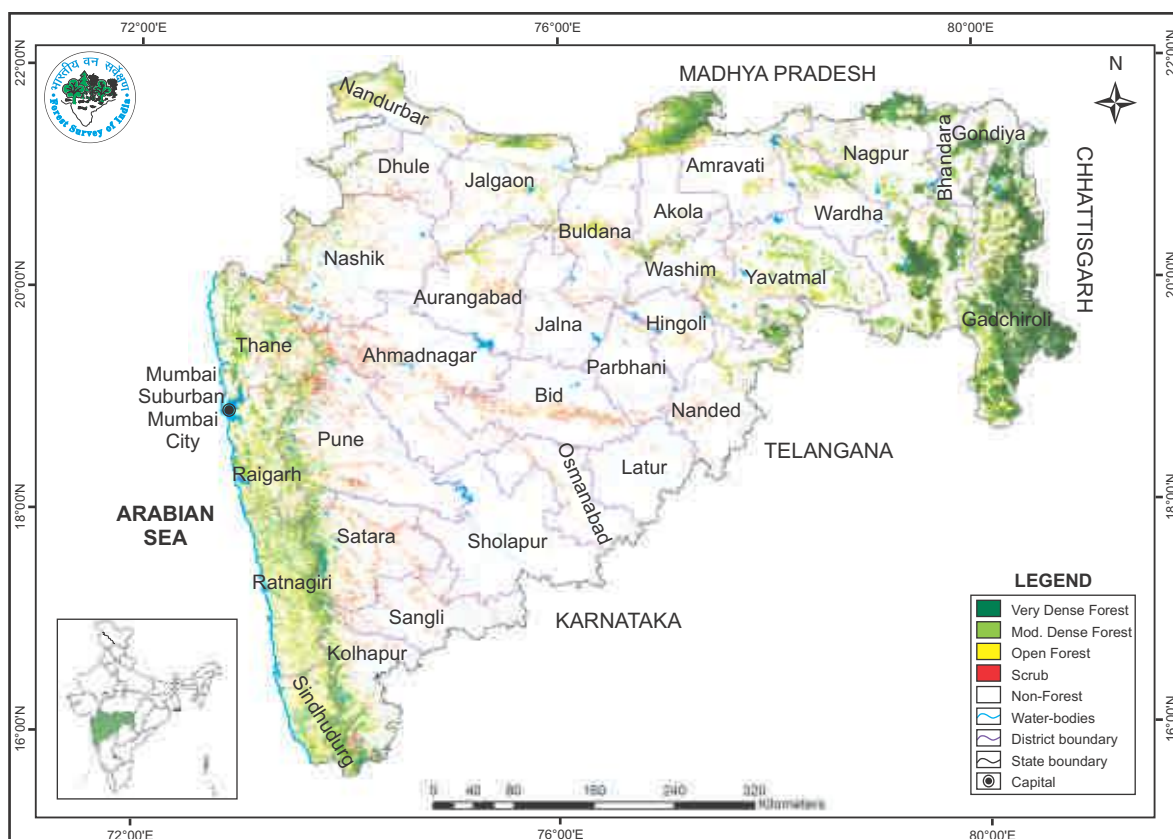**FIGURE 11.16.3** Forest Cover Map of Maharashtra

TABLE 11.16.8 Wetlands inside the Recorded Forest Area (or Green Wash) in Maharashtra
(in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	7	459
Waterlogged	5	37
River/Stream	674	29,451
Sub - Total	**686**	**29,947**
Inland Wetlands -Man-made		
Reservoir/Barrage	247	46,610
Tank/Pond	4,008	26,447
Waterlogged	2	2
Sub - Total	**4,257**	**73,062**
Coastal Wetlands - Natural		
Creek	54	1,116
Sand/Beach	26	139
Intertidal mud flat	157	1,360
Salt Marsh	18	268
Mangrove	177	7,499
Sub -Total	**432**	**10,382**
Wetlands (<2.25 ha)	3,446	3,446
Total	**8,821**	**1,16,837**

Total Recorded Forest (or Green Wash) Area (in ha)	56,37,392
% of Wetland area inside Recorded Forest (or Green Wash) Area	**2.07%**

(analysis based on the National Wetland Atlas: India, 2011)

11.16.3 Forest Types & Biodiversity

Forest Type Maps of 2011 have been refined in the recently completed exercise by FSI. Percentage area under different forest types of Maharashtra as per the Champion & Seth classification (1968), according to the latest exercise are presented in the following table.

TABLE 11.16.9   Percentage area under different forest types of in Maharashtra

Sl.No.	Forest Type	% of Forest cover
1	2A/C2 West Coast Semi-Evergreen Forest	11.87
2	3B/C2 Southern Moist Mixed Deciduous Forest	21.01
3	3B/C1b Moist Teak Forest	10.71
4	4B/TS2 Mangrove Forest	0.50
5	4B/TS1 Mangrove Scrub	0.05
6	4A/L1 Littoral Forest	0.01
7	4E/RS1 Riparian Fringing Forest	0.00
8	5A/C3 Southern Dry Mixed Deciduous Forest	26.30
9	5A/C1b Dry Teak Forest	17.40
10	5/DS1 Dry Deciduous Scrub	7.53
11	5/E9 Dry Bamboo Brake	0.46
12	5/E2 Boswellia Forest	0.12
13	5/E4 Hardwickia Forest	0.11
14	5/E3 Babul Forest	0.03
15	5/E5 Butea Forest	0.02
16	6A/C1 Southern Thorn Forest	0.41
17	8A/C2 Western Sub Tropical Hill Forest	1.19
18	Plantation/ TOF	2.28
	Total	**100.00**

11.16.3.1 Assessment of Biodiversity in Maharashtra

Findings of the Rapid Assessment of Biodiversity carried out at the national level for natural forests during September 2018 to May 2019 as part of the forest type mapping exercise is summarized below in table 11.16.10 and table 11.16.11 in respect of Maharashtra.

TABLE 11.16.10   Assessment of Biodiversity in Maharashtra

Plant Type	Number of Species
Tree	170
Shrub	135
Herb	54

TABLE 11.16.11   Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Maharashtra

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1	Group 2- Tropical Semi-Evergreen Forests	3.38	2.65	2.44
2	Group 3- Tropical Moist Deciduous Forests	3.57	2.60	2.09
3	Group 4- Littoral and Swamp Forests	0.56	0.77	*
4	Group 5- Tropical Dry Deciduous Forests	3.03	2.83	2.76
5	Group 6- Tropical Thorn Forests	1.51	2.51	1.96
6	Group 8- Subtropical Broadleaved Hill Forests	0.78	2.40	1.07

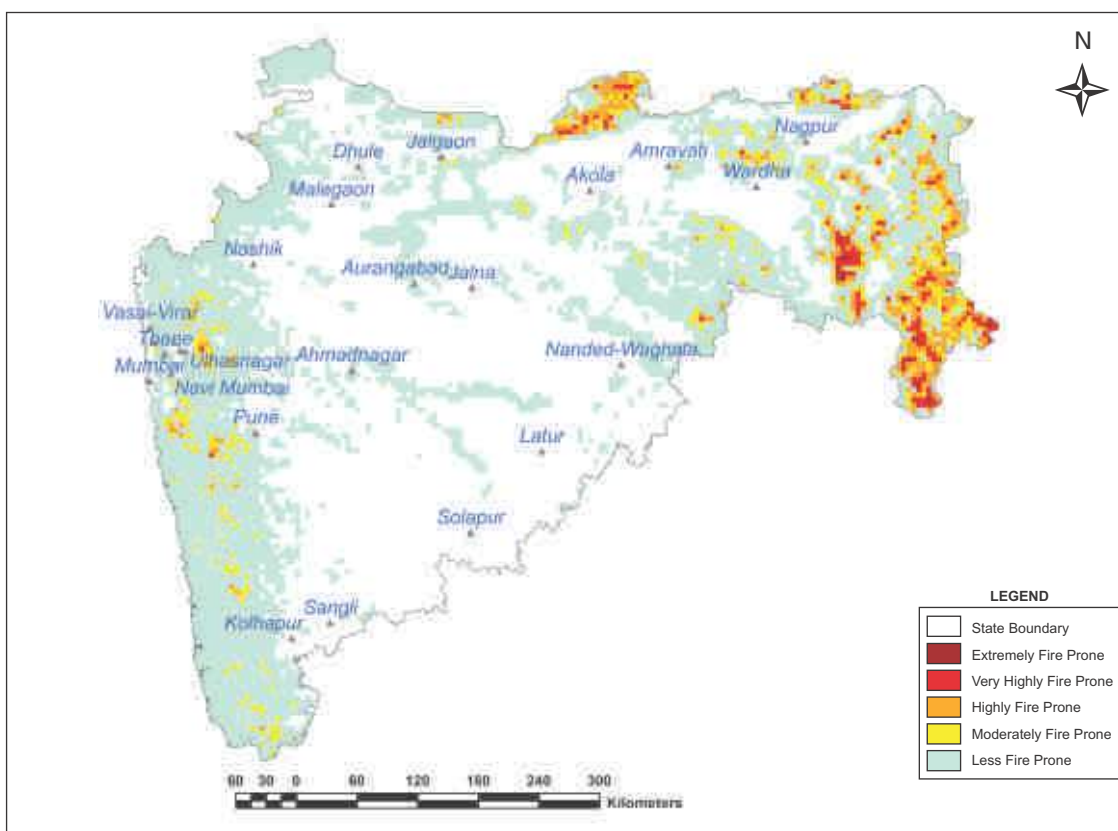*adequate number of sample plots were not available*

11.16.4   Fire Prone Forest Areas

Geographical area under different classes of forest fire proneness are given in the following table.

TABLE 11.16.12   Forest Fire Prone Classes   (in sq km)

Sl. No.	Forest Fire Prone Classes	Geographical Area	% of Total forest cover
1	Extremely fire prone	1,821.51	3.40
2	Very highly fire prone	2,135.42	4.01
3	Highly fire prone	9,191.46	15.60
4	Moderately fire prone	12,902.40	16.65
5	Less fire prone	1,16,890.40	60.34
	Total	**1,42,941.19**	**100.00**

FIGURE 11.16.4   Fire prone forest areas under different fire prone classes

11.16.5   Tree Cover

Forest cover presented in the section 11.16.2 accounts for tree patches of size 1 ha and more having canopy density more than 10%. However, trees occurring in patches of size less than 1 ha including scattered trees are assessed through sampling based methodology. Tree cover in Maharashtra has been estimated as given in table 11.16.13.

TABLE 11.16.13   Tree Cover in Maharashtra
          (in sq km)

Tree Cover	Area
	10,806

Tree cover of Maharashtra has increased by 975 sq km as compared to the previous assessment reported in ISFR 2017.

11.16.6   Extent of Trees Outside Forest (TOF)

Trees outside Forests (TOF) refer to tree resources found outside the forests as defined in the Government records. FSI maps forest cover using satellite data and assesses tree cover outside forests using sampling based method. Forest Cover outside the recorded forest area is derived using boundaries of RFA or Green Wash. Extent of TOF therefore may be estimated as the sum of extent of forest cover outside the recorded forest areas (RFA) and tree cover as given in the preceding section.

TABLE 11.16.14 Extent of TOF in Maharashtra

(in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
16,139	10,806	26,945

11.16.7   Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Maharashtra is given in the table 11.16.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.16.16

TABLE 11.16.15 Growing Stock in Maharashtra

(in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	231.76	5.42
Growing Stock in TOF	177.12	10.78

TABLE 11.16.16 Diameter class distribution of top five species inside RFA in Maharashtra

(in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	Tectona grandis	1,87,997	21,226	499
2.	Terminalia tomentosa	96,126	13,731	613
3.	Anogeissus latifolia	47,465	5,928	210
4.	Lannea coromandelica	33,158	6,325	97
5.	Cleistanthus collinus	54,605	1,962	0

11.16.8   Carbon Stock in Forest

The total Carbon stock of forest in the State including the TOF patches which are more than 1ha in size is 440.51 million tonnes (1,615.20 million tonnes of CO_2 equivalent) which is 6.18 % of total forest carbon of the country. Pool wise forest carbon in Maharashtra is given in the following table.

TABLE 11.16.17 Forest Carbon in Maharashtra in different pools

(in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
1,31,249	40,380	1,586	10,687	2,56,606	4,40,508

11.16.9   Growing Stock of Bamboo

Bamboo bearing area and growing stock inside the recorded forest area (RFA)/ Green Wash which include culms of 1 year age and above are given in the table 11.16.18

TABLE 11.16.18 Growing Stock of Bamboo in Maharashtra

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	15,408	9.63
Total number of culms (in millions)	2,971	7.53
Total equivalent green weight (in 000' tonnes)	26,515	9.55

11.16.10 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Maharashtra in Rural and Urban areas are given in the table 11.16.19 and table 11.16.20 respectively

TABLE 11.16.19 Top five tree species in TOF (Rural) in Maharashtra

Sl. No.	Species	Relative Abundance (%)
1.	Azadirachta indica	19.01
2.	Mangifera indica	8.21
3.	Acacia Arabica	7.86
4.	Terminalia tomentosa	6.89
5.	Zizyphus jujuba	5.78

TABLE 11.16.20 Top five tree species in TOF (Urban) in Maharashtra

Sl. No.	Species	Relative Abundance (%)
1.	Cocos nucifera	12.45
2.	Mangifera indica	10.84
3.	Azadirachta indica	8.18
4.	Polyalthia species	3.05
5.	Moringa species	2.96

11.16.11 Major NTFP and Invasive Species

Major NTFP and invasive species as assessed from forest inventory data are presented in the table 11.16.21 and table 11.16.22 respectively.

TABLE 11.16.21 Major NTFP species in the state of Maharashtra

Sl. No.	Species	Plant Type	Relative Abundance (%)
1.	Calamus longisetus	Shrub	46.40
2.	Butea monosperma	Tree	14.35
3.	Pterocarpus marsupium	Tree	7.20
4.	Acacia catechu	Tree	6.96
5.	Buchanania lanzan	Tree	6.53

TABLE 11.16.22 Major invasive species in the state inside the RFA/Green Wash in Maharashtra (in sq km)

Sl. No.	Species	Estimated Extent
1.	Lantana camara	1,185
2.	Cassia tora	891
3.	Cyperus rotundus	287
4.	Triumfetta rhomboidea	258
5.	Ageratum conyzoides	145

Major NTFP species are given in terms of relative abundance whereas invasive species are given in terms of their estimated extent.

11.16.12 Quantified estimation of Dependence of People living in forest fringe villages on forests in Maharashtra

Through a nation-wide study, FSI has done estimation of dependence of people living in the villages close to forest for fuel wood, fodder, small timber and bamboo in quantified terms for each State & UT of the country (Please refer to Chapter 10 in Vol. I for details). The estimated quantities of the four produce for Maharashtra is given in the table 11.16.23

TABLE 11.16.23 Estimation of Dependence of People in Forest Fringe Villages on Forests in Maharashtra

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
95,39,132	15,71,36,100	1,28,673	8,62,138

Maharashtra