11.15
MADHYA PRADESH

11.15.1 Introduction

Located in Central India, Madhya Pradesh is the second largest State covering an area of 3,08,252 sq km which is 9.38% of the geographical area of the country and is bordered on the west by Gujarat, on the northwest by Rajasthan, on the northeast by Uttar Pradesh, on the east by Chhattisgarh, and on the south by Maharashtra. The State lies between 21°17' N to 26°52' N latitude and 74°08' E to 82°49' E longitudes. Physiographically, the State can be divided into four regions, *viz* the low lying areas in north and north-west of Gwalior, Malwa Plateau, Satpuda and Vindhyan Ranges. Madhya Pradesh has a subtropical climate. The annual rainfall ranges 800 mm to 1,800 mm and the annual temperature varies from 22°C to 25°C. The State is drained by a number of rivers, which include Narmada, Tapti, Son, Betwa, Shipra and Chambal. The State has 50 districts, of which 21 are tribal districts. The State does not have any hill district. As per the 2011 census, Madhya Pradesh has a population of 72.63 million accounting to 6 percent of India's population. The rural and urban population stands at 72.37% and 27.63% respectively. Tribal population of the State is 21.09%. The population density of the State is 236 per sq km, which is much lower than the national average. The 19th Livestock census 2012 has reported a total livestock population of 36.33 million.

TABLE 11.15.1   Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	30,825	
Reporting area for land utilization	30,756	100.00
Forests	8,694	28.27
Not available for land cultivation	3,506	11.40
Permanent pastures and other grazing lands	1,303	4.24
Land under misc. tree crops and groves	20	0.06
Culturable wasteland	1,010	3.29
Fallow land other than current fallows	483	1.57
Current fallows	389	1.26
Net area sown	15,351	49.91

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

11.15.1.1 A Brief Overview of Forestry Scenario

Madhya Pradesh is a forest rich State and is ranked first among the States in terms of the RFA. The State has a sizeable tribal and rural population which is dependent on the forests for their livelihood and basic needs. As per the Champion & Seth Classification of Forest Types (1968), the forests in Madhya Pradesh belong to five Forest Type Groups, which are further divided into 21 Forest Types. Madhya Pradesh is a pioneering State in the implementation of the Joint Forest Management (JFM) movement in the country. The State has a strong JFM network through 15,228 JFMC/VSS/EDCs covering an area of 66,874 sq km.

In order to provide benefits to forest dwellers in collection and trade of forest produce, the Madhya Pradesh State Minor Forest Produce (Trading & Development) Co-operative Federation was formed in 1984. The Federation co-ordinates collection, processing and marketing of Tendu leaves, Sal Seed, Kullu Gum and other NTFPs through Primary Forest Produce Co-operative Societies. The Madhya Pradesh Rajya Van Vikas Nigam Ltd. Undertakes the scientific harvest of forests and its regeneration.

Recorded Forest Area (RFA) in the State is 94,689 sq km of which 61,886 sq km is Reserved Forests, 31,098 sq km is Protected Forests and 1,705 sq km is Unclassed Forests. In Madhya Pradesh, during the period 1st January 2015 to 5th February 2019, a total of 12,785.98 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019).

As per the information received from the State during that last two years, 85,535 ha of plantations were raised in the State.

Ten National Parks and 25 Wildlife Sanctuaries constitute the Protected Area network of the State covering 3.51% of its geographical area. There are 6 Tiger Reserves in the State covering an area of 6117.26 sq km. Eco-sensitive zones have been declared for 19 protected areas. The State with a population of 526 Tigers, is recognized as Tiger State of India, as per the 'All India Tiger Estimation 2018' released recently.
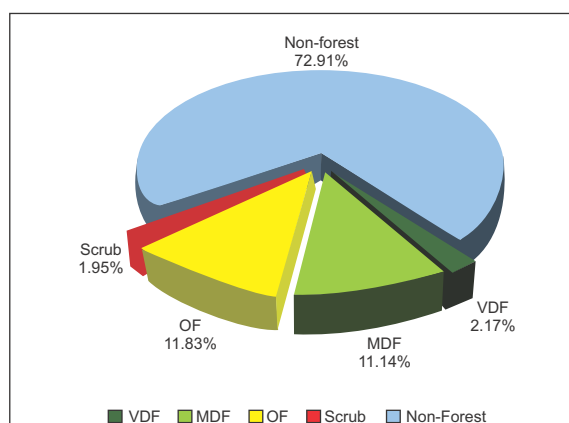
11.15.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Oct 2017 to January 2018, the Forest Cover in the State is 77,482.49 sq km which is 25.14 % of the State's geographical area. In terms of forest canopy density classes, the State has 6,676.02 sq km under Very Dense Forest (VDF), 34,341.40 sq km under Moderately Dense Forest (MDF) and 36,465.07 sq km under Open Forest (OF). Forest Cover in the State has increased by 68.49 sq km as compared to the previous assessment reported in ISFR 2017.

TABLE 11.15.2 Forest Cover of Madhya Pradesh

(in sq. km)

Class	Area	% of GA
VDF	6,676.02	2.17
MDF	34,341.40	11.14
OF	36,465.07	11.83
Total	**77,482.49**	**25.14**
Scrub	6,001.91	1.95

FIGURE 11.15.1 Forest Cover of Madhya Pradesh

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

The State has reported extent of recorded forest area (RFA) 94,689 sq km which is 30.72% of its geographical area. The reserved, protected and unclassed forests are 65.36%, 32.84% and 1.80% of the recorded forest area in the State respectively. However as the digitized boundary of recorded forest area from the state covers 88,956.01 sq km and the analysis of forest cover inside and outside this area is given below.

TABLE 11.15.3 Forest Cover inside and outside Recorded Forest Area or (Green Wash) in Madhya Pradesh

(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
6,259	30,270	28,223	64,752	417	4,071	8,242	12,730
9.66%	46.75%	43.59%		3.28%	31.98%	64.74%	

in case of Madhya Pradesh RFA boundaries have been used.

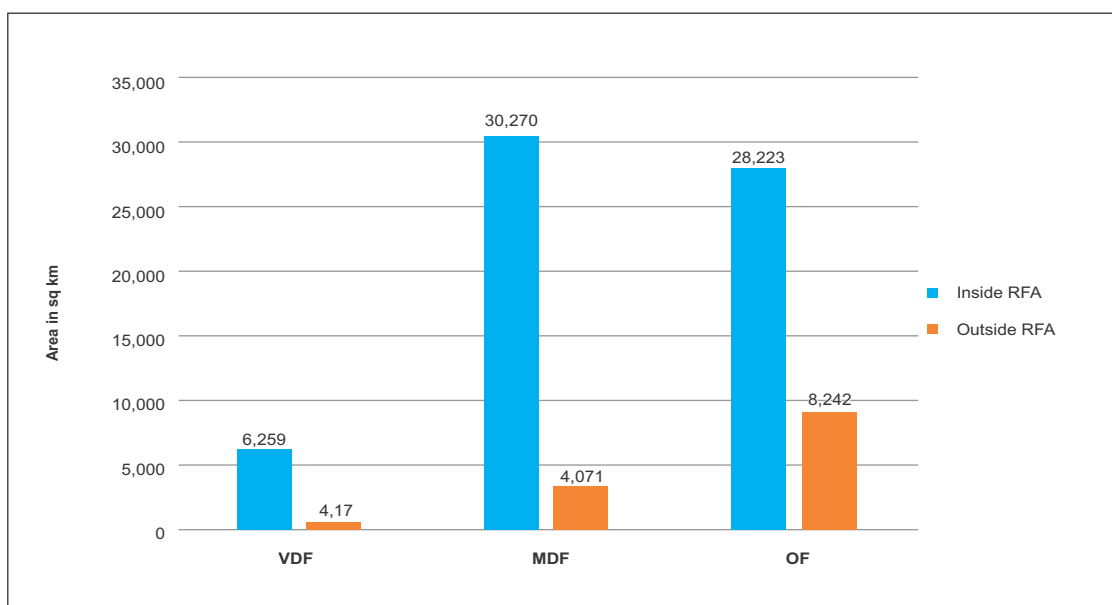**FIGURE 11.15.2** Forest Cover inside and outside RFA in Madhya Pradesh

TABLE 11.15.4 District- wise Forest Cover in Madhya Pradesh   (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			
Alirajpur[T]	3,182	0.00	211.82	472.60	684.42	21.51	9.42	30.27
Anuppur[T]	3,747	108.97	345.30	414.41	868.68	23.18	20.68	64.96
Ashoknagar	4,674	0.00	266.08	422.96	689.04	14.74	-10.96	122.85
Balaghat[T]	9,229	1,409.25	2,638.97	883.84	4,932.06	53.44	-1.94	29.71
Barwani[T]	5,427	0.00	186.96	741.03	927.99	17.10	-6.01	36.44
Betul[T]	10,043	230.34	1,938.14	1,495.22	3,663.70	36.48	10.70	167.00
Bhind	4,459	0.00	28.55	78.20	106.75	2.39	-1.25	412.91
Bhopal	2,772	0.00	120.92	207.75	328.67	11.86	-25.33	70.55
Burhanpur	3,427	57.92	631.09	605.55	1,294.56	37.78	-14.44	37.64
Chhatarpur	8,687	184.06	817.52	756.97	1,758.55	20.24	13.55	304.16
Chhindwara[T]	11,815	576.94	2,027.09	1,983.98	4,588.01	38.83	28.01	302.21
Damoh	7,306	2.00	845.79	1,739.39	2,587.18	35.41	-6.82	127.61
Datia	2,902	0.00	92.11	110.17	202.28	6.97	3.28	80.39
Dewas[T]	7,020	12.00	936.85	1,007.02	1,955.87	27.86	39.87	52.00
Dhar[T]	8,153	0.00	116.14	535.11	651.25	7.99	-34.75	90.53
Dindori[T]	7,470	1,086.94	1,281.17	663.85	3,031.96	40.59	4.96	136.92
Guna	6,390	2.00	414.33	913.41	1,329.74	20.81	-22.26	158.55
Gwalior	4,560	1.00	329.23	890.95	1,221.18	26.78	21.18	150.25
Harda[T]	3,334	19.00	527.69	409.57	956.26	28.68	-51.74	3.44
Hoshangabad[T]	6,703	271.89	1,370.32	780.44	2,422.65	36.14	-11.35	10.20
Indore	3,898	0.00	349.08	329.65	678.73	17.41	-0.27	24.25
Jabalpur[T]	5,211	41.00	502.50	570.43	1,113.93	21.38	-25.07	111.82
Jhabua[T]	3,600	0.00	30.97	190.70	221.67	6.16	-7.33	163.17
Katni	4,950	93.90	608.58	658.82	1,361.30	27.50	9.30	41.17
Khandwa (East Nimar)[T]	7,352	147.80	1,156.80	784.52	2,089.12	28.42	57.12	19.61
Khargone (West Nimar)[T]	8,025	1.00	474.50	830.56	1,306.06	16.27	-2.94	64.98
Mandla[T]	5,800	691.31	1,091.05	795.15	2,577.51	44.44	8.51	40.78
Mandsaur	5,535	0.00	40.00	201.59	241.59	4.36	-2.41	111.51
Morena[T]	4,989	0.00	96.18	643.99	740.17	14.84	-1.83	402.24
Narsimhapur	5,133	61.00	657.34	624.42	1,342.76	26.16	4.76	103.52
Neemuch	4,256	0.00	120.64	675.05	795.69	18.70	12.69	385.12
Panna	7,135	83.01	1,478.26	1,181.44	2,742.71	38.44	75.71	193.28
Raisen	8,466	23.00	1,306.51	1,346.75	2,676.26	31.61	-0.74	153.21
Rajgarh	6,153	0.00	37.99	134.10	172.09	2.80	4.09	84.80
Ratlam[T]	4,861	0.00	2.53	57.32	59.85	1.23	4.85	121.98
Rewa	6,314	61.00	386.58	333.57	781.15	12.37	3.15	167.53
Sagar	10,252	1.00	1,141.57	1,651.97	2,794.54	27.26	-19.46	197.17
Satna	7,502	12.00	909.70	831.20	1,752.90	23.37	22.90	196.06
Sehore	6,578	23.90	614.85	719.15	1,357.90	20.64	-46.10	58.74
Seoni[T]	8,758	237.08	1,791.14	1,041.37	3,069.59	35.05	-33.41	73.23

contd.

District	Geographical Area (GA)	2019 Assessment				% of GA	Change wrt 2017 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Shahdol[T]	6,205	122.00	820.54	1,028.17	1,970.71	31.76	48.71	43.11
Shajapur	6,195	0.00	2.44	60.91	63.35	1.02	17.35	69.06
Sheopur[T]	6,606	6.00	1,395.23	2,058.77	3,460.00	52.38	-26.00	128.96
Shivpuri	10,066	18.00	779.84	1,742.08	2,539.92	25.23	13.92	202.28
Sidhi[T]	4,851	315.99	884.30	768.87	1,969.16	40.59	37.16	90.54
Singrauli[T]	5,675	394.41	1,002.52	783.20	2,180.13	38.42	-8.87	53.98
Tikamgarh	5,048	1.00	89.96	295.68	386.64	7.66	-16.36	132.38
Ujjain	6,091	0.00	2.60	33.62	36.22	0.59	9.22	61.89
Umaria[T]	4,076	378.31	1,096.22	548.05	2,022.58	49.62	-9.42	24.00
Vidisha	7,371	1.00	344.91	431.55	777.46	10.55	-25.54	92.95
Grand Total	**3,08,252**	**6,676.02**	**34,341.40**	**36,465.07**	**77,482.49**	**25.14**	**68.49**	**6,001.91**

TABLE 11.15.5 Forest Cover Change Matrix for Madhya Pradesh
(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	6,553	0	2	0	8	**6,563**
Moderately Dense Forest	120	34,239	11	2	199	**34,571**
Open Forest	2	50	35,265	55	908	**36,280**
Scrub	0	1	207	5,740	331	**6,279**
Non Forest	1	51	980	205	223,322	**224,559**
Total ISFR 2019	**6,676**	**34,341**	**36,465**	**6,002**	**224,768**	**3,08,252**
Net Change	113	-230	185	-277	209	

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

TABLE 11.15.6 Altitude-wise Forest Cover in Madhya Pradesh
(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total		Scrub
0-500	2,31,982	2,098	21,093	25,636	48,827	(63.02%)	4,866
500-1000	75,712	4,465	13,098	10,739	28,302	(36.53%)	1,129
1000-2000	558	113	150	90	353	(0.45%)	7
Total	**3,08,252**	**6,676**	**34,341**	**36,465**	**77,482**		**6,002**

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

TABLE 11.15.7 Forest Cover in different slope classes in Madhya Pradesh
(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total		Scrub
0-5	265,973	3,346	21,178	25,153	49,677	(64.11%)	4,843
5-10	25,674	1,606	7,037	5,887	14,530	(18.75%)	774
10-15	9,369	906	3,368	2,807	7,081	(9.14%)	248
15-20	4,283	471	1,625	1,484	3,580	(4.62%)	92
20-25	1,884	219	719	716	1,654	(2.14%)	30
25-30	708	86	271	276	633	(0.82%)	9
>30	361	42	143	142	327	(0.42%)	6
Total	**3,08,252**	**6,676**	**34,341**	**36,465**	**77,482**		**6,002**

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

FIGURE 11.15.3 Forest Cover Map of Madhya Pradesh
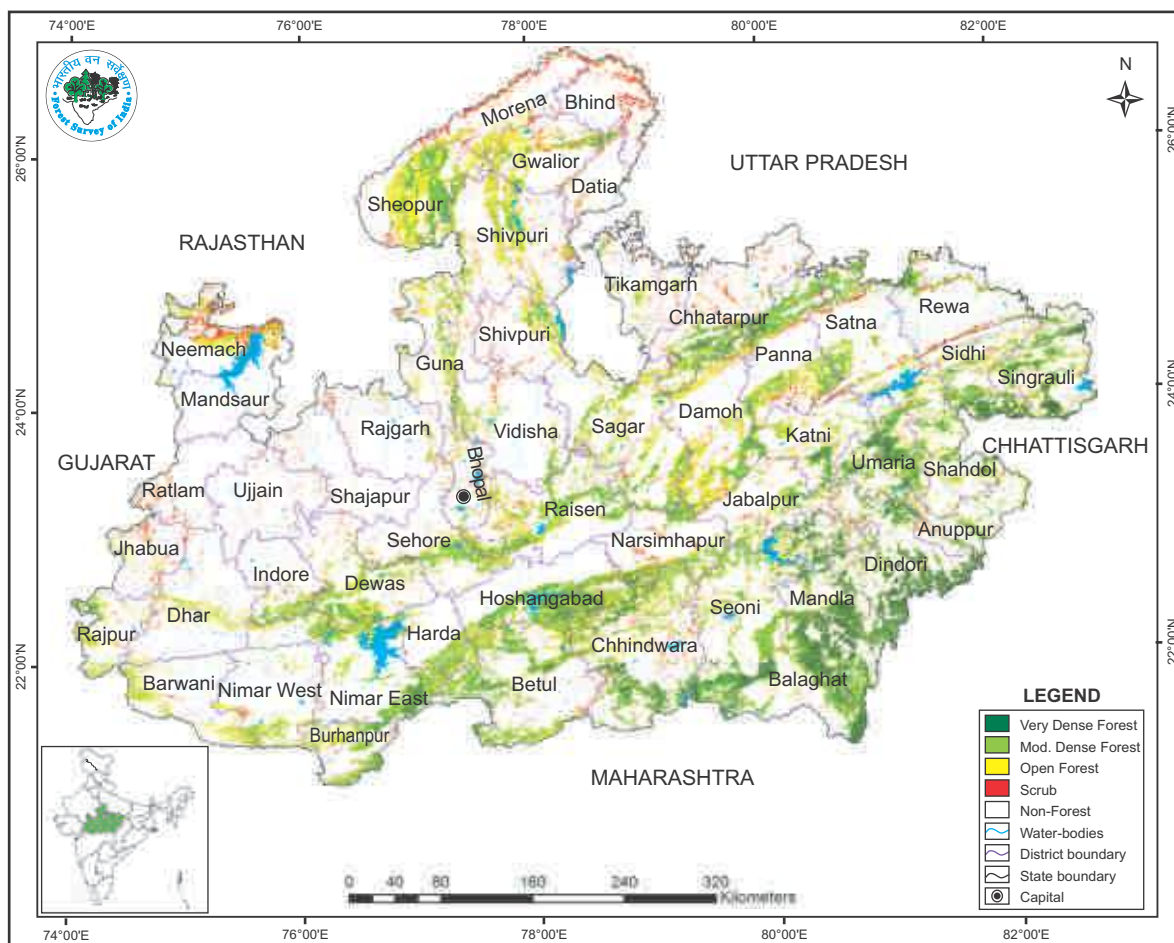

TABLE 11.15.8 Wetlands inside the Recorded Forest Area (or Green wash) in Madhya Pradesh

(in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	9	22
Waterlogged	1	4
River/Stream	239	71,090
Sub - Total	**249**	**71,116**
Inland Wetlands -Man-made		
Reservoir/Barrage	636	80,246
Tank/Pond	2,019	5,575
Sub - Total	**2,655**	**85,821**
Wetlands (<2.25 ha)	5,636	5,636
Total	**8,540**	**1,62,573**

Total Recorded Forest (or Green Wash) Area (in ha)	88,95,601
% of Wetland area inside Recorded Forest (or Green Wash) Area	**1.83%**

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

11.15.3   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 Madhya Pradesh as per the Champion & Seth classification (1968), according to the latest exercise are presented in the following table.

TABLE 11.15.9   Percentage area under different forest types of Madhya Pradesh

SI.No.	Forest Type	% of Forest cover
1.	3B/C1c Slightly Moist Teak Forest	2.28
2.	3B/C2 Southern Moist Mixed Deciduous Forest	2.29
3.	3C/DS1 Moist Sal Savannah	0.04
4.	3C/C2e (i) Moist Peninsular High Level Sal	3.25
5.	4E/RS1 Riparian Fringing Forest	0.02
6.	5/1S2 Khair-Sissu Forest	1.67
7.	5/E1/DS1 Anogeissus Pendula Scrub	0.39
8.	5/DS1 Dry Deciduous Scrub	8.10
9.	5/DS2 Dry Savannah Forest	0.00
10.	5/DS4 (Dry Grass Land)	0.01
11.	5/E1 Anogeissus Pendula Forest	3.43
12.	5/E2 Boswellia Forest	0.49
13.	5/E5 Butea Forest	0.24
14.	5/E9 Dry Bamboo Brake	0.90
15.	5A/C1a Very Dry Teak Forest	0.86
16.	5A/C1b Dry Teak Forest	26.40
17.	5A/C3 Southern Dry Mixed Deciduous Forest	24.55
18.	5B/C1c Dry Peninsular Sal Forest	5.10
19.	5B/C2 Northern Dry Mixed Deciduous Forest	18.55
20.	6B/C2 Ravine Thorn Forest	0.23
21.	8A/C3 Central Indian Subtropical Hill Forest	0.00
22.	Plantation/TOF	1.20
	Total	**100.00**

11.15.3.1 Assessment of Biodiversity

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 11.15.10 and table 11.15.11 in respect of Madhya Pradesh

TABLE 11.15.10   No. of species observed during the rapid assessment

Plant Type	Number of Species
Tree	146
Shrub	79
Herb	72

TABLE 11.15.11 Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Madhya Pradesh

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1.	Group 3- Tropical Moist Deciduous Forests	2.91	2.55	2.77
2.	Group 4- Littoral & Swamp Forest	0.94	*	*
3.	Group 5- Tropical Dry Deciduous Forests	3.16	1.21	2.60
4.	Group 6- Tropical Thorn Forests	*	2.11	2.35
5.	Group 8- Subtropical Broadleaved Hill Forests	*	2.49	2.09

adequate number of sample plots were not available
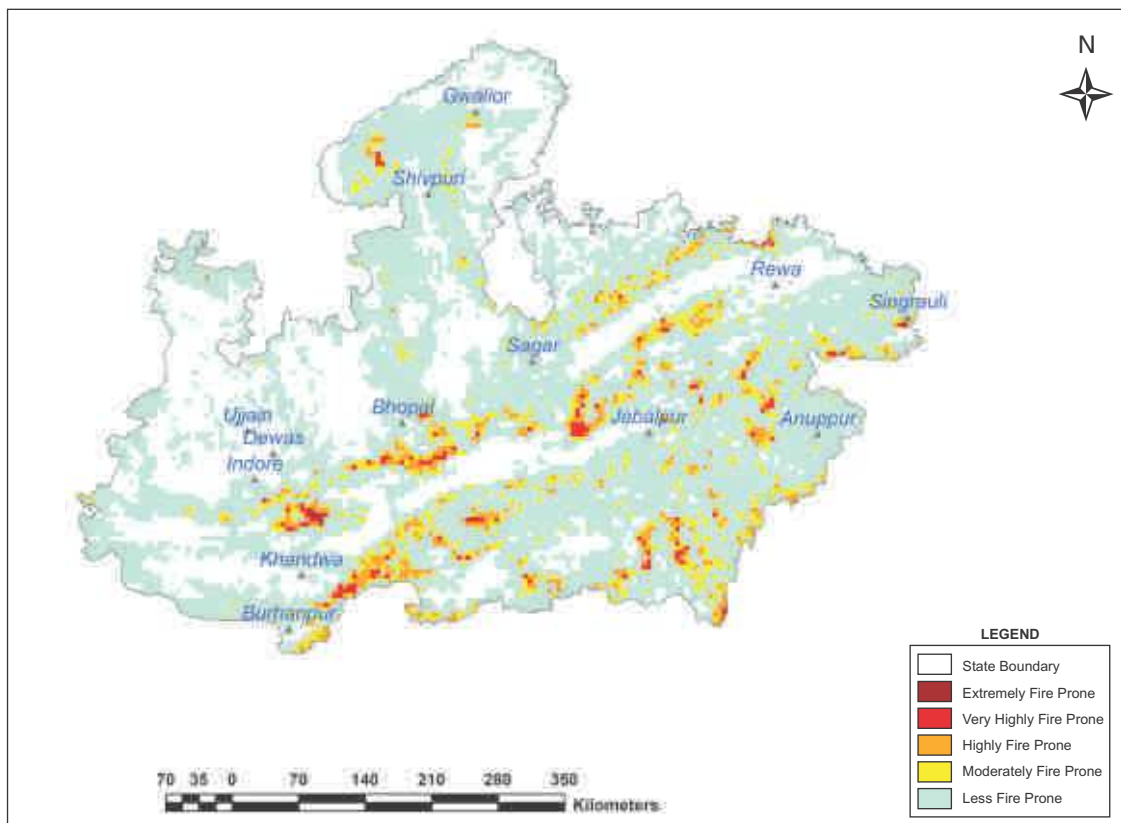
11.15.4   Fire Prone Forest Areas

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

TABLE 11.15.12 Forest Fire Prone Classes   (in sq km)

Sl. No.	Forest Fire Prone Classes	Geo graphical Area	% of Total forest cover
1.	Extremely fire prone	125.01	0.13
2.	Very highly fire prone	3,118.24	3.79
3.	Highly fire prone	10,598.48	11.87
4.	Moderately fire prone	20,223.12	19.36
5.	Less fire prone	177,471.32	64.85
	Total	**2,11,536.17**	**100.00**

FIGURE 11.15.4 Fire prone forest areas under different fire prone classes

Madhya Pradesh

11.15.5 Tree Cover

Forest cover presented in the section 11.15.2 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 Madhya Pradesh has been estimated as given in table 11.15.13.

TABLE 11.15.13 Tree Cover in Madhya Pradesh

(in sq km)

Tree Cover	Area
	8,339

Tree cover of Madhya Pradesh has increased by 266 sq km as compared to the previous assessment reported in ISFR 2017

11.15.6 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 11.15.14 Extent of TOF in Madhya Pradesh

(in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
12,730	8,339	21,069

11.15.7 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Madhya Pradesh is given in the table 11.15.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.15.16

TABLE 11.15.15 Growing Stock in Madhya Pradesh

(in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	342.62	8.02
Growing Stock in TOF	106.39	6.48

TABLE 11.15.16 Diameter class distribution of top five species inside RFA in Madhya Pradesh

(in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	Tectona grandis	2,62,655	32,563	0
2.	Shorea robusta	97,688	31,724	786
3.	Lagerstroemia parviflora	84,757	4,235	98
4.	Diospyros melanoxylon	81,134	7,287	101
5.	Anogeissus latifolia	73,994	6,515	395

11.15.8 Carbon Stock in Forest

The total Carbon stock of forest in the State including the TOF patches which are more than 1 ha in size is 588.73 million tonnes (2,158.68 million tonnes of CO_2 equivalent) which is 8.26% of total forest carbon of the country. Pool wise forest carbon in Madhya Pradesh is given in the following table

TABLE 11.15.17 Forest Carbon in West Bengal in different pools   (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
1,65,067	64,630	1,535	8,156	3,49,339	5,88,727

11.15.9 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 11.15.18

TABLE 11.15.18 Growing Stock of Bamboo in Madhya Pradesh

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green wash (in sq km)	20,867	13.04
Total number of culms (in millions)	3,595	9.11
Total equivalent green weight (in 000' tonnes)	14,088	5.08

11.15.10 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Madhya Pradesh in Rural and Urban areas are given in the table 11.15.19 and table 11.15.20 respectively.

TABLE 11.15.19 Top five tree species in TOF (Rural) in Madhya Pradesh

Sl. No.	Species	Relative Abundance (%)
1.	Butea frondosa	19.91
2.	Acacia Arabica	12.05
3.	Azadirachta indica	7.67
4.	Zizyphus jujuba	7.43
5.	Tectona grandis	6.30

TABLE 11.15.20 Top five tree species in TOF (Urban) Madhya Pradesh

Sl. No.	Species	Relative Abundance (%)
1.	Azadirachta indica	12.32
2.	Mangifera indica	12.16
3.	Leucaena leucocephala	7.59
4.	Psidium guyava	7.34
5.	Zizyphus jujuba	4.08

11.15.11 Major NTFP and Invasive Species

Major NTFP and invasive species as assessed from forest inventory data are presented in the table 11.15.21 and table 11.15.22 respectively.

TABLE 11.15.21 Major NTFP species in the State of Madhya Pradesh

Sl. No.	Species	Plant Type	Relative Abundance (%)
1.	Calamus longisetus	Shrub	91.77
2.	Corchorus capsularis	Shrub	4.01
3.	Calotropis gigantea	Shrub	1.64
4.	Rizophora mucronata	Shrub	1.39
5.	Calamus flagellum	Shrub	1.19

TABLE 11.15.22 Major invasive species in the State inside the RFA/Green wash in Madhya Pradesh   (in sq km)

Sl. No.	Species	Estimated Extent
1.	*Lantana camara*	4,416
2.	*Cassia tora*	2,050
3.	*Ageratina adenophora*	848
4.	*Ageratum conyzoides*	679
5.	*Senna occidentalis*	355

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

11.15.12 *Quantified estimation of Dependence of People living in forest fringe villages on forests in Madhya Pradesh*

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 Madhya Pradesh is given in the table 11.15.23

TABLE 11.15.23 Estimation of Dependence of People in Forest Fringe Villages on Forests in Madhya Pradesh

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
76,63,131	22,27,19,564	6,30,663	14,73,754