

11.21

ODISHA

11.21.1 Introduction

Situated on the east coast of the country, Odisha covers an area of 1,55,707 sq km which is 4.74% of the geographical area of the country. The State lies between 17°47'N to 22°34'N latitude and 81°22'E to 87°29'E longitude and shares border with West Bengal, Jharkhand in the north, Chhattisgarh in the west, Andhra Pradesh in the south and Bay of Bengal in the east. Physiographically, the State can be divided into four regions, viz, Northern Plateau, Eastern Ghats, Central Tableland and Coastal Plains. The annual rainfall ranges between 1,200 mm to 1,600 mm and the annual temperature varies from 25°C to 28°C. The State is drained by a number of important rivers, which includes Mahanadi, Brahmani and Baitarni. The State has 30 districts, among which 12 are tribal districts. The State does not have any hill districts. As per the 2011 census, Odisha has a population of 41.97 million which is 3.47% of India's population. The rural and urban population constitute 83.32%, and 16.68% respectively. The tribal population is a sizeable 22.85%. The population density of the State is 270 per sq km, which is lower than the national average. The 19th Livestock census 2012 has reported a total livestock population of 20.73 million in the State.

TABLE 11.21.1 Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	15,571	
Reporting area for land utilization	15,518	100.00
Forests	5,814	37.46
Not available for land cultivation	2,396	15.44
Permanent pastures and other grazing lands	524	3.38
Land under misc. tree crops and groves	211	1.36
Culturable wasteland	550	3.54
Fallow land other than current fallows	631	4.07
Current fallows	918	5.92
Net area sown	4,474	28.83

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



11.21.1.1 A Brief Overview of Forestry Scenario

Odisha's forests are well stocked, diverse, multi-storied and dense. The State is also very rich in mineral resources. As per the Champion & Seth Classification of Forest Types (1968), the forests in Odisha belong to four Forest Type Groups which are further divided into 19 Forest Types. In realizing the need for community participation in forest protection, the Government of Odisha is one of the pioneer State in implementing Joint Forest Management Programme.

Recorded Forest Area (RFA) in the State is 61,204 sq km of which 36,049 sq km is Reserved Forest, 25,133 sq km is Protected Forest and 22 sq km is Unclassed Forests. In Odisha, during the period 1st January 2015 to 5th February 2019, a total of 4,968.48 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 the last two years, 6,30,896 ha of plantations were raised.

Two National Parks and 19 Wildlife Sanctuaries constitute the Protected Area network of the State covering 5.19% of its geographical area.

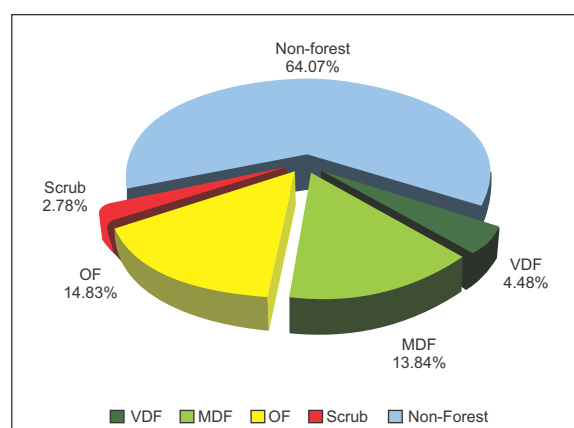
11.21.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period November 2017 to February 2018, the Forest Cover in the State is 51,618.51 sq km which is 33.15 % of the State's geographical area. In terms of forest canopy density classes, the State has 6,969.71 sq km under Very Dense Forest (VDF), 21,551.93 sq km under Moderately Dense Forest (MDF) and 23,096.87 sq km under Open Forest (OF). Forest Cover in the State has increased by 273.51 sq km as compared to the previous assessment reported in ISFR 2017.

TABLE 11.21.2 Forest Cover of Odisha
(in sq. km)

Class	Area	% of GA
VDF	6,969.71	4.48
MDF	21,551.93	13.84
OF	23,096.87	14.83
Total	51,618.51	33.15
Scrub	4,326.91	2.78

FIGURE 11.21.1 Forest Cover of Odisha



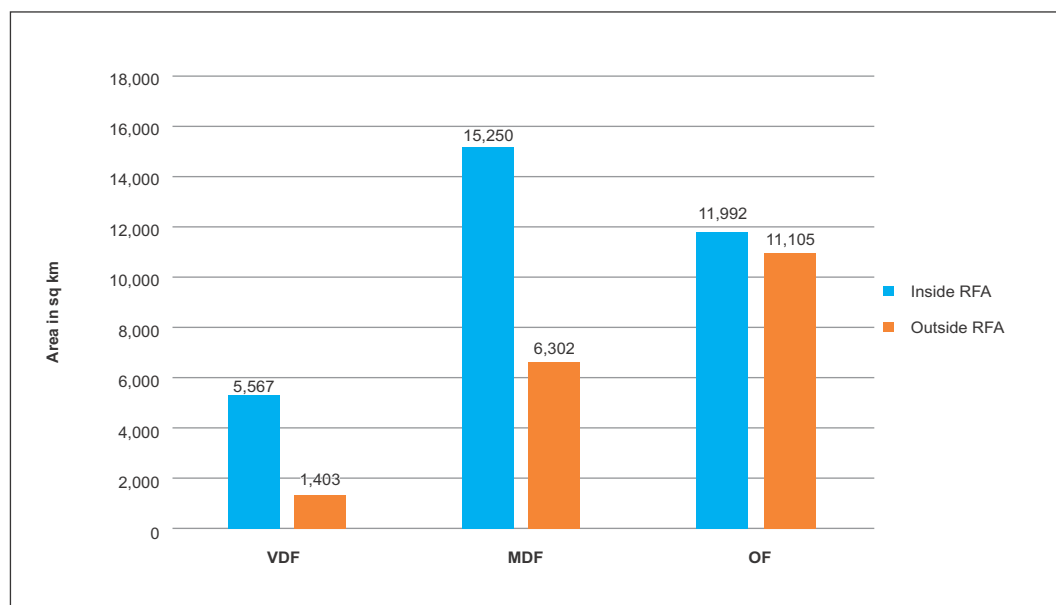
11.21.2.1 Forest Cover inside and outside Recorded Forest Area (or Green Wash)

The State has reported extent of recorded forest area (RFA) 61,204 sq km which is 39.31% of its geographical area. The Reserved, Protected and Unclassed forests are 58.90%, 40.75% and 0.35% of the recorded forest area in the State respectively. However as the digitized boundary of recorded forest area from the state covers 42,430.50 sq km and the analysis of forest cover inside and outside this area is given below.

TABLE 11.21.3 Forest Cover inside and outside Recorded Forest Area or (Green Wash) in Odisha (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
5,567	15,250	11,992	32,809	1,403	6,302	11,105	18,810
16.97%	46.48%	36.55%		7.46%	33.50%	59.04%	

*in case of Odisha RFA boundaries have been used.

FIGURE 11.21.2 Forest Cover inside and outside RFA in Odisha**TABLE 11.21.4** District-wise Forest Cover in Odisha

(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			
Anugul	6,375	371.01	1,380.00	1,031.62	2,782.63	43.65	27.63	84.18
Balangir	6,575	70.00	224.00	841.26	1,135.26	36.64	4.26	143.16
Baleshwar ^T	3,806	23.00	133.38	226.18	382.56	5.82	2.56	46.59
Bargarh	5,837	175.01	374.14	501.31	1,050.46	27.60	19.46	40.57
Baudh	3,098	262.91	562.04	465.99	1,290.94	51.53	1.94	57.39
Bhadrak	2,505	0.00	8.70	69.30	78.00	1.34	3.00	0.00
Cuttack	3,932	53.00	226.00	525.38	804.38	20.46	8.38	67.80
Debagarh	2,940	191.00	667.41	618.75	1,477.16	50.23	5.16	14.08
Dhenkanal	4,452	173.99	420.38	851.24	1,445.61	32.47	28.61	83.88
Gajapati ^T	4,325	84.16	1,490.09	947.12	2,521.37	58.30	1.37	262.88
Ganjam	8,206	164.39	1,074.32	866.69	2,105.40	25.66	2.40	655.00
Jagatsinghapur	1,668	0.00	4.64	131.64	136.28	8.17	0.28	0.00
Jajapur	2,899	6.00	71.99	228.09	306.08	10.56	3.08	49.78
Jharsuguda	2,114	3.00	173.82	155.82	332.64	15.74	10.64	29.21
Kalahandi ^T	7,920	361.64	734.19	1,323.97	2,419.80	30.55	1.80	371.69
Kandhamal ^T	8,021	660.95	2,593.23	2,143.53	5,397.71	65.01	5.71	385.51
Kendrapara	2,644	83.40	88.54	139.36	311.30	3.88	6.30	1.99
Kendujhar ^T	8,303	288.78	1,420.07	1,513.31	3,222.16	121.87	10.16	53.24
Khordha	2,813	21.00	186.00	260.09	467.09	16.60	10.09	90.47
Koraput ^T	8,807	94.48	740.41	1,263.38	2,098.27	23.83	9.27	947.86
Malkangiri ^T	5,791	158.00	712.76	1,465.41	2,336.17	40.34	-5.83	45.90
Mayurbhanj ^T	10,418	1,334.95	1,717.24	1,041.98	4,094.17	39.30	14.17	37.57

Contd.

District	Geographical Area (GA)	2019 Assessment				% of GA	Change wrt 2017 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Nabarangapur ^T	5,291	172.63	447.04	527.08	1,146.75	29.48	43.75	48.62
Nayagarh	3,890	189.00	965.00	559.75	1,713.75	44.49	3.75	171.36
Nuapada	3,852	86.01	481.69	706.76	1,274.46	24.09	1.46	108.82
Puri	3,479	0.00	59.73	165.36	225.09	6.47	11.09	10.79
Rayagada ^T	7,073	419.54	853.42	1,873.55	3,146.51	44.49	20.51	359.91
Sambalpur ^T	6,624	498.99	1,696.32	1,096.98	3,292.29	49.70	12.29	40.55
Subarnapur	2,337	2.00	187.00	161.85	350.85	15.01	0.85	29.22
Sundargarh ^T	9,712	1,020.87	1,858.38	1,394.12	4,273.37	44.00	9.37	88.89
Grand Total	1,55,707	6,969.71	21,551.93	23,096.87	51,618.51	33.15	273.51	4,326.91

TABLE 11.21.5 Forest Cover Change Matrix for Odisha

(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	6,957	5	1	0	4	6,967
Moderately Dense Forest	9	21,337	11	2	11	21,370
Open Forest	3	201	22,763	10	31	23,008
Scrub	1	5	24	4,267	9	4,306
Non Forest	0	4	298	48	99,706	1,00,056
Total ISFR 2019	6,970	21,552	23,097	4,327	99,761	1,55,707
Net Change	3	182	89	21	-295	

Main reasons for the increase in forest cover in the State are plantation and conservation activities as well as improvement in interpretation.

TABLE 11.21.6 Altitude-wise Forest Cover in Odisha

(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	1,19,476	3,575	12,856	16,283	32,714 (63.38%)	2,513
500-1000	34,706	3,305	8,384	6,556	18,245 (35.34%)	1,531
1000-2000	1,525	90	312	258	660 (1.28%)	283
Total	1,55,707	6,970	21,552	23,097	51,619	4,327

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

TABLE 11.21.7 Forest Cover in different slope classes in Odisha

(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	1,09,048	1,653	6,429	10,557	18,639 (36.11%)	1,365
5-10	15,890	1,642	4,356	3,766	9,764 (18.92%)	753
10-15	10,209	1,427	3,747	2,890	8,064 (15.62%)	724
15-20	9,130	1,024	2,997	2,392	6,413 (12.42%)	644
20-25	6,609	646	2,120	1,783	4,549 (8.81%)	464
25-30	3,005	349	1,187	1,058	2,594 (5.03%)	251
>30	1,816	229	716	651	1,596 (3.09%)	126
Total	1,55,707	6,970	21,552	23,097	51,619	4,327

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

FIGURE 11.21.3 Forest Cover Map of Odisha

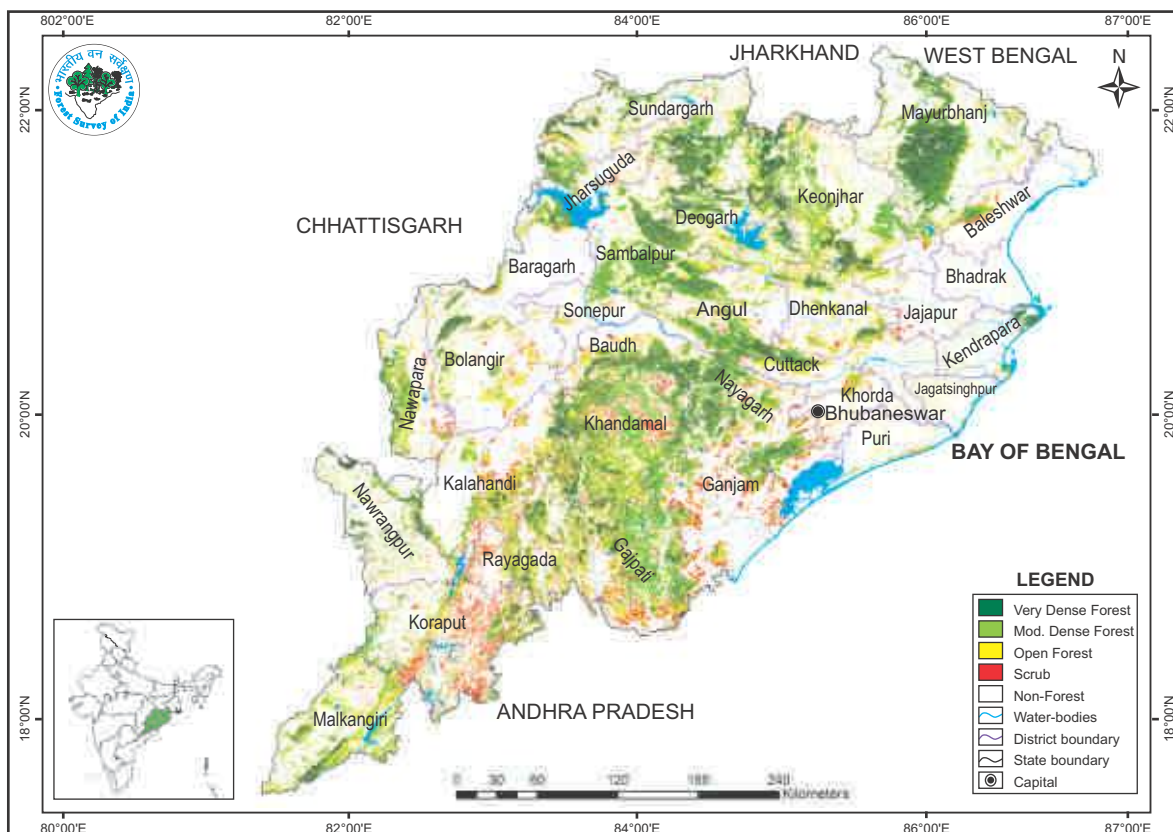


TABLE 11.21.8 Wetlands inside the Recorded Forest Area (or Green Wash) in Odisha (in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	1	9
Waterlogged	69	282
River/Stream	323	13,098
Sub - Total	393	13,389
Inland Wetlands - Man-made		
Reservoir/Barrage	340	38,889
Tank/Pond	451	1,327
Waterlogged	4	11
Sub - Total	795	40,227
Coastal Wetlands - Natural		
Lagoon	1	1
Sand/Beach	27	629
Intertidal mud flat	76	3,523
Mangrove	66	4,089
Sub -Total	170	8,242
Wetlands (<2.25 ha)	2,769	2,769
Total	4,127	64,627
Total Recorded Forest (or Green Wash) Area (in ha)		42,43,050
% of Wetland area inside Recorded Forest (or Green Wash) Area		1.52%

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

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

TABLE 11.21.9 Percentage area under different forest types of Odisha

Sl.No.	Forest Type	% of Forest cover
1	2B/C3 Orissa Semi-Evergreen Forest	0.14
2	2/2S1 Secondary Moist Bamboo Brakes	0.39
3	3B/C2 Southern Moist Mixed Deciduous Forest	2.26
4	3B/2S1 Southern Secondary Moist Mixed Deciduous Forest	0.75
5	3C/C1d Peninsular (Coastal) Sal Forest	0.01
6	3C/C2e (i) Moist Peninsular High Level Sal	4.47
7	3C/C2e (ii) Moist Peninsular Low Level Sal	22.06
8	3C/C2e (iii) Moist Peninsular Valley Sal	1.74
9	3C/2S1 Northern Secondary Moist Mixed Deciduous Forest	8.66
10	3C/DS1 Moist Sal Savannah	0.01
11	4A/L1 Littoral Forest	0.23
12	4B/TS2 Mangrove Forest	0.44
13	5A/C1b Dry Teak Forest	0.32
14	5A/C3 Southern Dry Mixed Deciduous Forest	10.51
15	5B/C1c Dry Peninsular Sal Forest	17.79
16	5B/C2 Northern Dry Mixed Deciduous Forest	21.29
17	5/DS1 Dry Deciduous Scrub	3.92
18	5/E9 Dry Bamboo Brake	1.63
19	5/E2 Boswellia Forest	0.06
20	Plantation/ TOF	3.32
	Total	100.00

11.21.3.1 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 11.21.10 and table 11.21.11 in respect of Odisha.

TABLE 11.21.10 No. of species observed during the rapid assessment

Plant Type	Number of Species
Tree	192
Shrub	90
Herb	105



TABLE 11.21.11 Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Odisha

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1	Group 2- Tropical Semi-Evergreen Forests	2.05	2.51	2.78
2	Group 3- Tropical Moist Deciduous Forests	3.10	2.91	3.48
3	Group 4- Littoral and Swamp Forests	*	2.74	2.36
4	Group 5- Tropical Dry Deciduous Forests	3.33	3.26	3.61

*adequate number of sample plots were not available

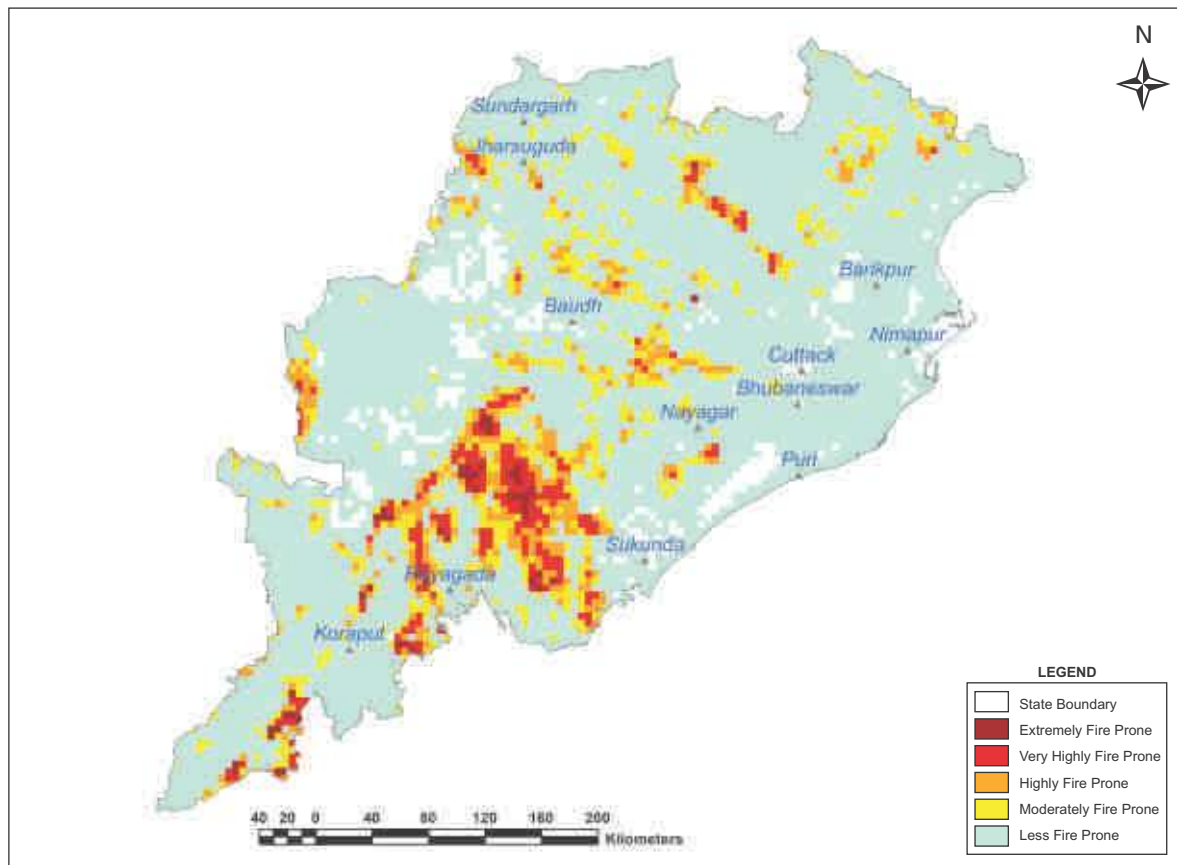
11.21.4 Fire Prone Forest Areas

Geographical area under different forest fire proneness are given in the following table:

TABLE 11.21.12 Forest Fire Prone Classes (in sq km)

Sl. No.	Forest Fire Prone Classes	Geographical Area	% of Total forest cover
1.	Extremely fire prone	1,811.42	2.82
2.	Very highly fire prone	4,925.48	7.73
3.	Highly fire prone	8,857.86	13.32
4.	Moderately fire prone	15,159.88	19.96
5.	Less fire prone	1,16,976.77	56.17
	Total	1,47,731.41	100.00

FIGURE 11.21.4 Fire prone forest areas under different fire prone classes



11.21.5 Tree Cover

Forest cover presented in the section 11.21.2 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 Odisha has been estimated as given in table 11.21.13.

TABLE 11.21.13 Tree Cover in Odisha (in sq km)

Tree Cover	Area
	4,648

Tree cover of Odisha has increased by 655 sq km as compared to the previous assessment reported in ISFR 2017.

11.21.6 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 11.21.14 Extent of TOF in Odisha (in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
18,810	4,648	23,458

11.21.7 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Odisha is given in the table 11.21.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.21.16

TABLE 11.21.15 Growing Stock in Odisha (in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	299.04	7.00
Growing Stock in TOF	95.02	5.79

TABLE 11.21.16 Diameter class distribution of top five species inside RFA in Odisha (in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Shorea robusta</i>	2,02,258	38,248	3,671
2.	<i>Lannea grandis</i>	50,604	7,702	177
3.	<i>Buchanania latifolia</i>	50,910	1,274	0
4.	<i>Terminalia tomentosa</i>	53,964	9,791	530
5.	<i>Cleistanthus collinus</i>	55,394	1,564	0

11.21.8 Carbon Stock in Forest in Odisha

The total Carbon stock of forests in the State including the TOF patches which are more than 1 ha in size is 432.29 million tonnes (1,585.06 million tonnes of CO₂ equivalent) which is 6.07% of total forest carbon of the country. Pool wise forest carbon in Odisha is given in the following table

TABLE 11.21.17 Forest Carbon in Odisha in different pools (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
1,26,656	39,066	1,647	9,062	2,55,857	4,32,288

11.21.9 Growing Stock of Bamboo

Bamboo bearing area and growing stock inside the recorded forest area (RFA)/ Green Wash in the State which include culms of 1 year age and above are given in the table 11.21.18

TABLE 11.21.18 Growing Stock of Bamboo in Odisha

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	11,827	7.39
Total number of culms (in millions)	2,291	5.81
Total equivalent green weight (in 000' tonnes)	16,131	5.81

11.21.10 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Odisha in Rural and Urban areas are given in the table 11.21.19 and table 11.21.20 respectively.

TABLE 11.21.19 Top five tree species in TOF (Rural) in Odisha

Sl. No.	Species	Relative Abundance (%)
1.	<i>Mangifera indica</i>	6.61
2.	<i>Shorea robusta</i>	6.43
3.	<i>Madhuca latifolia</i>	6.04
4.	<i>Azadirachta indica</i>	5.99
5.	<i>Anacardium occidentale</i>	5.69

TABLE 11.21.20 Top five tree species in TOF (Urban) in Odisha

Sl. No.	Species	Relative Abundance (%)
1.	<i>Mangifera indica</i>	9.79
2.	<i>Cocos nucifera</i>	7.71
3.	<i>Azadirachta indica</i>	6.81
4.	<i>Tectona grandis</i>	5.81
5.	<i>Moringa species</i>	5.50

11.21.11 Major NTFP and Invasive Species

Major NTFP and invasive species as assessed from forest inventory data are presented in the table 11.21.21 and table 11.21.22 respectively.

TABLE 11.21.21 Major NTFP species in the State of Odisha

Sl. No.	Species	Plant Type	Relative Abundance (%)
1.	<i>Shorea robusta</i>	Tree	57.91
2.	<i>Madhuca indica</i>	Tree	17.11
3.	<i>Buchanania Lanza</i>	Tree	12.48
4.	<i>Schleichera oleosa</i>	Tree	3.02
5.	<i>Semecarpus anacardium</i>	Tree	2.98

TABLE 11.21.22 Major invasive species in the State inside the RFA/Green Wash in Odisha (in sq km)

Sl. No.	Species	Estimated Extent
1.	<i>Chromolaena odorata</i>	668
2.	<i>Lantana camara</i>	236
3.	<i>Ageratum conyzoides</i>	212
4.	<i>Acacia farnesiana</i>	107
5.	<i>Dioscorea pentaphylla</i>	15

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

11.21.12 Quantified estimation of Dependence of People living in forest fringe villages on forests in Odisha

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 Odisha is given in the table 11.21.23

TABLE 11.21.23 Estimation of Dependence of People in Forest Fringe Villages on Forests in Odisha

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
91,85,833	5,60,35,117	1,10,787	3,76,521

