

11.3

ASSAM

11.3.1 Introduction

Assam the second largest State in North Eastern India, is situated south of the Eastern Himalayas along the Brahmaputra and Barak river valleys. The State has a geographical area of 78,438 sq km, which is 2.39% of the geographical area of the country. The State lies between 24°07' N to 28°00' N latitude 89°42' E to 96°02' E longitude. The State can be broadly divided into 3 physiographic domains viz. Brahmaputra valley, Central Assam Hills (Mikir Hills in Karbi Anglong and North Cachar Hill districts) and Barak valley. The State has subtropical climate and the annual rainfall ranges between 1,500 mm to 3,800 mm and the annual temperature varies from 5°C to 32°C. Brahmaputra is a major river draining the State. The State is bordered by Arunachal Pradesh in the north, Meghalaya, Tripura & Mizoram in the south, Nagaland and Manipur in the east and West Bengal in west. The State also has international borders with Bhutan in the North and Bangladesh in the South. The State has 27 districts, among which 19 are tribal and 3 are hill districts. As per the 2011 census, Assam has a population of 31.21 million accounting to 2.58% of India's population. The State's urban and rural population is 14.10% & 85.90% respectively. The Tribal population is 12.45 %. The average population density is 398 persons per sq km which is slightly higher than the national average. The Livestock population as per 19th Live Stock Census 2012 is 19.08 million.

TABLE 11.3.1 Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	7,844	
Reporting area for land utilization	7,844	100.00
Forests	1,853	23.62
Not available for land cultivation	2,460	31.37
Permanent pastures and other grazing lands	167	2.13
Land under misc. tree crops and groves	220	2.80
Culturable wasteland	142	1.81
Fallow land other than current fallows	87	1.11
Current fallows	87	1.11
Net area sown	2,827	36.05

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

11.3.1.1 A Brief Overview of Forestry Scenario

Assam is the land of enchanting aesthetic beauty with lush green hills, pastures, tea gardens, river plains and wilderness. Running and cascading through the entire length and breadth of the State are mighty rivers; the Brahmaputra in the north and the Barak in the south, which along with their tributaries nourish a wide range of precious flora and fauna in the State. The Kaziranga National Park, a UNESCO World Heritage site in the State is home to two-thirds of the world's population of the one-horned Rhinoceros. The one-horned Rhino which was almost extinct in India, with only a dozen left at the turn of last century, now stands restored to scientifically sustainable level. As per the Champion & Seth Classification of Forest Types (1968), the forests of Assam belong to seven Forest Type Groups further divided into 25 different Forest Types. Assam can boast of possessing a host of endangered and rare mammals, avian and amphibian species. These include pigmy hog, hispid hare, white winged wood duck and great Indian hornbill among many others.

Recorded Forest Area (RFA) in the State is 26,832 sq km of which 17,864 sq km is Reserved Forest and 8,968 sq km is Unclassed Forest. In Assam, during the period 1st January 2015 to 5th February 2019, only 1 hectare of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019).

Five National Parks and 18 Wildlife Sanctuaries constitute the Protected Area network of the State covering 4.87% of its geographical area.

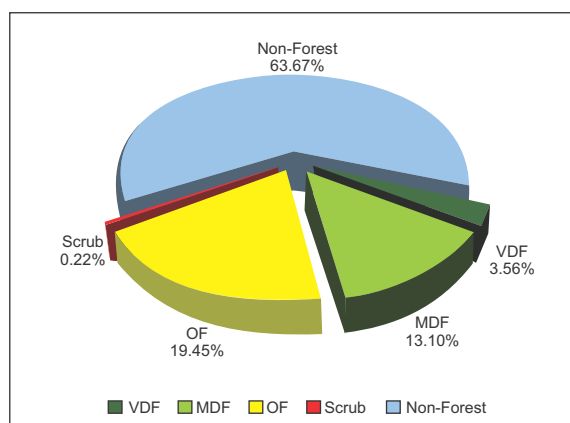
11.3.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Nov 2017 to Feb 2018, the Forest Cover in the State is 28,326.51 sq km which is 36.11 % of the State's geographical area. In terms of forest canopy density classes, the State has 2,794.86 sq km under Very Dense Forest (VDF), 10,278.91 sq km under Moderately Dense Forest (MDF) and 15,252.74 sq km under Open Forest (OF). Forest Cover in the State has increased by 221.51 sq km as compared to the previous assessment reported in ISFR 2017.

TABLE 11.3.2 Forest Cover of Assam
(in sq km)

Class	Area	% of GA
VDF	2,794.86	3.56
MDF	10,278.91	13.10
OF	15,252.74	19.45
Total	28,326.51	36.11
Scrub	173.43	0.22

FIGURE 11.3.1 Forest Cover of Assam



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

The State has reported extent of recorded forest area (RFA) 26,832 sq km which is 34.21% of its geographical area. The reserved and unclassified forests are 66.58% and 33.42% of the recorded forest area in the State respectively. Due to non-availability of digitized boundary of recorded forest areas from the State, the updated Green Wash from Sol toposheets which is 27,547.84 sq km has been used as proxy to the RFA boundary and the analysis of forest cover inside and outside this area is given below.

TABLE 11.3.3 Forest Cover inside and outside Recorded Forest Area or (Green Wash) in Assam (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
2,540	8,840	8,764	20,144	255	1,439	6,489	8,183
12.61%	43.88%	43.51%		3.11%	17.59%	79.30%	

*in case of Assam Green Wash boundaries have been used

FIGURE 11.3.2 Forest Cover inside and outside Green Wash in Assam

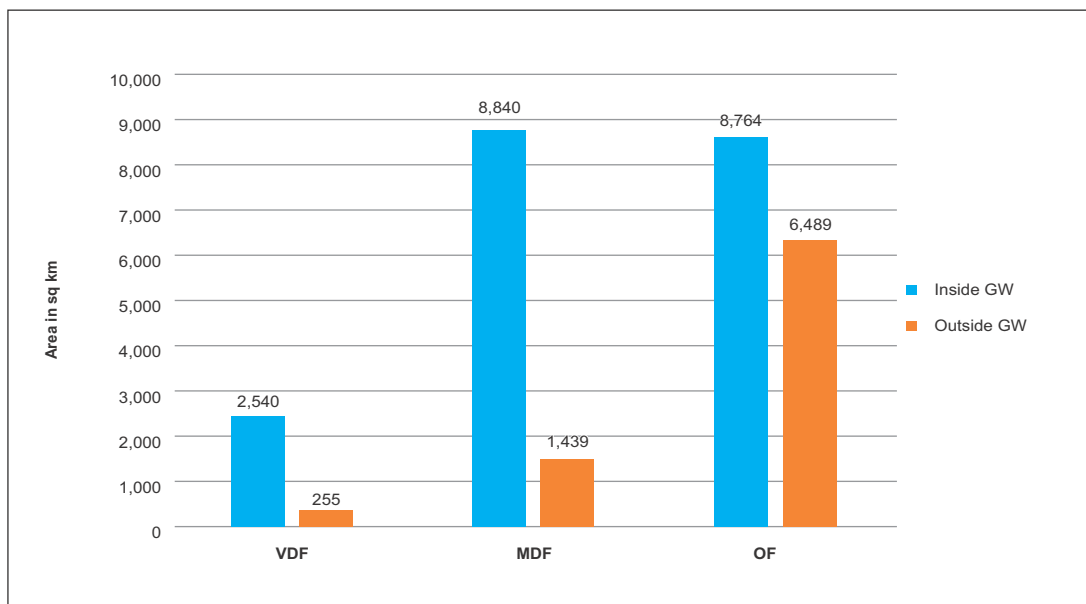


TABLE 11.3.4 District-wise Forest Cover in Assam

(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			
Baksa ^T	2,457	156.00	130.01	273.66	559.67	22.78	3.67	6.00
Barpeta ^T	2,282	0.00	33.21	81.97	115.18	5.05	10.18	1.00
Bongaigaon	1,093	0.00	62.18	187.95	250.13	22.88	14.13	0.00
Cachar ^T	3,786	93.00	1,077.58	1,051.76	2,222.34	58.70	-0.66	17.45
Chirang	1,923	402.00	110.45	187.39	699.84	36.39	5.84	3.00
Darrang ^T	1,585	0.00	13.89	75.54	89.43	5.64	3.43	1.00
Dhemaji ^T	3,237	68.00	124.66	152.14	344.80	10.65	6.80	4.00
Dhubri ^T	2,176	1.00	22.44	75.02	98.46	4.52	8.46	4.00
Dibrugarh ^T	3,381	105.86	68.10	581.27	755.23	22.34	-1.77	1.00
Dima Hasao ^H	4,888	209.00	1,519.73	2,478.20	4,206.93	86.07	-3.07	4.00
Goalpara ^T	1,824	14.00	137.66	244.08	395.74	21.70	97.74	1.72
Golaghat	3,502	21.00	119.30	529.61	669.91	19.12	18.91	4.00
Hailakandi	1,327	13.00	366.04	395.30	774.34	58.35	1.34	1.48
Jorhat ^T	2,851	12.00	103.00	445.10	560.10	19.65	6.10	4.00
Kamrup ^T	3,105	50.00	455.95	457.52	963.47	31.03	44.47	3.00
Kamrup Metropolitan ^T	955	0.00	225.00	235.05	460.05	48.17	0.05	1.00
Karbi-Anglong ^H	10,434	583.93	3,766.62	3,538.63	7,889.18	75.61	-93.82	84.38
Karimganj	1,809	3.00	300.23	548.20	851.43	47.07	35.43	0.76
Kokrajhar ^T	3,296	438.00	270.19	458.38	1,166.57	35.39	8.57	1.00
Lakhimpur ^T	2,277	29.00	85.88	191.69	306.57	13.46	11.57	0.96
Morigaon ^T	1,551	10.00	42.00	122.11	174.11	11.23	0.11	4.00
Naogaon ^H	3,973	50.00	363.00	498.26	911.26	22.94	1.26	9.00
Nalbari ^T	1,052	0.00	30.84	76.27	107.11	10.18	13.11	0.00
Sibsagar ^T	2,668	9.00	152.83	528.13	689.96	25.86	1.96	2.40
Sonitpur ^T	5,204	108.97	257.53	703.11	1,069.61	20.55	14.61	3.38
Tinsukia ^T	3,790	410.10	353.92	818.55	1,582.57	41.76	3.57	9.90
Udalguri ^T	2,012	8.00	86.67	317.85	412.52	20.50	9.52	1.00
Grand Total	78,438	2,794.86	10,278.91	15,252.74	28,326.51	36.11	221.51	173.43

TABLE 11.3.5 Forest Cover Change Matrix for Assam

(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	2,795	0	0	0	2	2,797
Moderately Dense Forest	0	10,149	3	0	40	10,192
Open Forest	0	7	14,923	10	176	15,116
Scrub	0	0	51	163	3	217
Non Forest	0	123	276	0	49,717	50,116
Total ISFR 2019	2,795	10,279	15,253	173	49,938	78,438
Net Change	-2	87	137	-44	-178	

An increase of 221.51 sq km in the forest cover is mainly due to plantations mostly outside of forest areas.

TABLE 11.3.6 Altitude-wise Forest Cover in Assam (in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	72,348	2,287	7,876	12,825	22,988 (81.15%)	136
500-1000	5,315	362	2,108	2,153	4,623 (16.32%)	36
1000-2000	775	146	295	2,75	716 (2.53%)	1
Total	78,438	2,795	10,279	15,253	28,327	173

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

TABLE 11.3.7 Forest Cover in different slope classes in Assam (in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	61,901	1,767	3,887	8,608	14,262 (50.34%)	108
5-10	6,929	366	2,323	2,515	5,204 (18.37%)	30
10-15	4,156	229	1,688	1,802	3,719 (13.13%)	17
15-20	2,643	176	1,118	1,169	2,463 (8.69%)	10
20-25	1,511	124	654	654	1,432 (5.06%)	5
25-30	759	74	338	315	727 (2.57%)	2
>30	539	59	271	190	520 (1.84%)	1
Total	78,438	2,795	10,279	15,253	28,327	173

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

FIGURE 11.3.3 Forest Cover Map of Assam

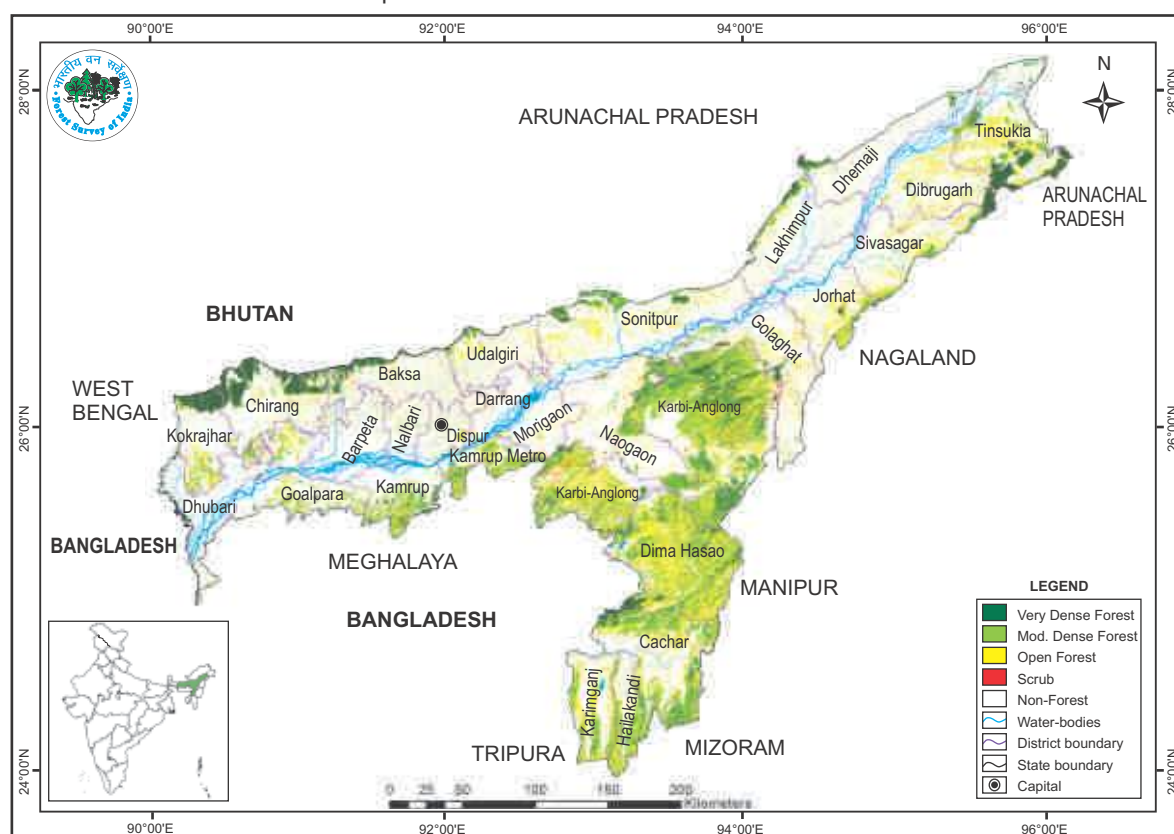


TABLE 11.3.8 Wetlands inside the Recorded Forest Area (or Green Wash) in Assam (in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	224	4,619
Ox-bow lake/Cut-off meander	140	1,223
Riverine wetland	36	1,168
Waterlogged	411	3,601
River/Stream	227	54,456
Sub - Total	1,038	65,067
Inland Wetlands -Man-made		
Reservoir/Barrage	2	2,217
Tank/Pond	12	35
Waterlogged	5	11
Sub - Total	19	2,263
Wetlands (<2.25 ha)	527	527
Total	1,584	67,857
Total Recorded Forest (or Green Wash) Area (in ha)		27,54,784
% of Wetland area inside Recorded Forest (or Green Wash) Area		2.46%

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

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

TABLE 11.3.9 Percentage area under different forest types of Assam

Sl.No.	Forest Type	% of Forest cover
1.	1B/C1 Assam Valley Tropical Wet Evergreen Forest (<i>Dipterocarpus</i>)	3.56
2.	1B/C3 Cachar Tropical Evergreen Forest	3.11
3.	1B/C2a Kayea Forest	0.76
4.	1B/C2b Mesua Forest	0.02
5.	2B/C2 Cachar Semi-Evergreen Forest	37.75
6.	2/2S1 Secondary Moist Bamboo Brakes	3.01
7.	2B/C1a Assam Alluvial Plains Semi-Evergreen Forest	1.60
8.	2B/1S1 Sub-Himalayan Light Alluvial Semi-Evergreen Forest	1.25
9.	2B/2S2 Eastern Alluvial Secondary Semi-Evergreen Forest	1.23
10.	2B/2S1 (Pioneer Euphorbiaceous Scrub)	0.28
11.	2B/1S2 Syzygium Parkland	0.07
12.	3C/C3b East Himalayan Moist Mixed Deciduous Forest	17.92
13.	3C/C2d(iv) App. Kamrup Sal	2.71
14.	3C/C1b(I) East Himalayan Upper Bhabar Sal	2.37
15.	3C/2S1 Northern Secondary Moist Mixed Deciduous Forest	1.93
16.	3C/1S1 Low Alluvial Savannah Woodland (<i>Salmalia albizzia</i>)	0.05
17.	3C/C1a(ii) Khasi Hill Sal	0.12

Contd.

Sl.No.	Forest Type	% of Forest cover
18.	3/1S2a Terminalia-Lagerstroemia	0.01
19.	4D/SS1 Eastern Seasonal Swamp Forest	0.01
20.	4C/FS3 Creeper Swamp Forest	0.00
21.	4D/2S1 (Syzygium Parkland)	0.00
22.	4D/2S2 Eastern Wet Alluvial Grassland	0.53
23.	5/1S2 Khair-Sissu Forest	0.08
24.	8B/DS1 (Assam Subtropical Hill Savannah Woodland)	0.04
25.	9/C2 Assam Sub-Tropical Pine Forest	0.41
26.	Plantation/TOF	21.18
	Total	100.00

11.3.3.1 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 11.3.10 and table 11.3.11 in respect of Assam.

TABLE 11.3.10 No. of species observed during the rapid assessment

Plant Type	Number of Species
Tree	143
Shrub	149
Herb	153

TABLE 11.3.11 Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Assam

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1	Group 1- Tropical Wet Evergreen Forests	2.63	2.99	3.16
2	Group 2- Tropical Semi-Evergreen Forests	3.50	3.17	3.47
3	Group 3- Tropical Moist Deciduous Forests	3.58	2.64	2.85
4	Group 4- Littoral and Swamp Forests	1.37	2.20	2.38
5	Group 5- Tropical Dry Deciduous Forests	*	2.77	2.82
6	Group 8- Subtropical Broadleaved Hill Forests	0.50	2.44	2.25
7	Group 9- Subtropical Pine Forests	1.56	2.54	3.07

* adequate number of sample plots were not available



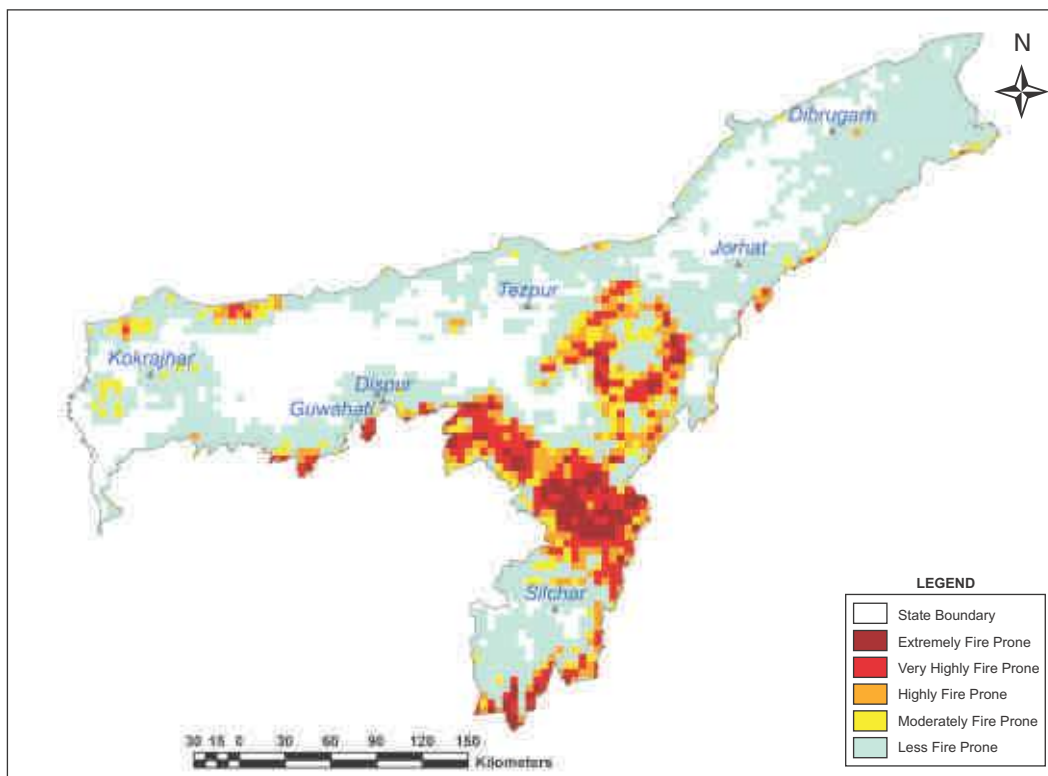
11.3.4 Fire Prone Forest Areas

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

TABLE 11.3.12 Forest Fire Prone Classes (in sq km)

Sl. No.	Forest Fire Prone Classes	Geo graphical Area	% of Total forest cover
1.	Extremely fire prone	6,292.11	21.98
2.	Very highly fire prone	1,743.42	6.10
3.	Highly fire prone	4,731.93	14.48
4.	Moderately fire prone	4,726.24	13.72
5.	Less fire prone	35,712.64	43.72
	Total	53,206.34	100.00

FIGURE 11.3.4 Fire prone forest areas under different fire prone classes



11.3.5 Tree Cover

Forest cover presented in the section 11.3.2 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 Assam has been estimated as given in table 11.3.13

TABLE 11.3.13 Tree Cover in Assam (in sq km)

Tree Cover	Area
	1,408

Tree cover of Assam has decreased by 88 sq km as compared to the previous assessment reported in ISFR2017.

11.3.6 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 11.3.14 Extent of TOF in Assam (in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
8,183	1,408	9,591

11.3.7 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Assam is given in the table 11.3.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.3.16

TABLE 11.3.15 Growing Stock in Assam (in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	115.40	2.70
Growing Stock in TOF	22.96	1.40

TABLE 11.3.16 Diameter class distribution of top five species inside RFA in Assam (in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Schima wallichii</i>	22,155	4,425	0
2.	<i>Bauhinia retusa</i>	11,794	1,668	171
3.	<i>Shorea robusta</i>	8,878	514	171
4.	<i>Tectona grandis</i>	14,607	2,694	0
5.	<i>Albizia species</i>	9,219	3,588	316

11.3.7 Carbon Stock in Forest

The total Carbon stock of forests in the State including the TOF patches which are more than 1 ha in size is 270.15 million tonnes (990.55 million tonnes of CO₂ equivalent) which is 3.79 % of total forest carbon of the country. Pool wise forest carbon in Assam is given in the following table

TABLE 11.3.17 Forest Carbon in Assam in different pools (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
85,844	21,148	11,002	7,223	1,54,832	2,70,149

11.3.9 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 11.3.18

TABLE 11.3.18 Growing Stock of Bamboo in Assam

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	10,525	6.58
Total number of culms (in millions)	3,829	9.70
Total equivalent green weight (in 000' tonnes)	24,064	8.67

11.3.10 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Assam in Rural and Urban areas are given in the table 11.3.19 and table 11.3.20 respectively

TABLE 11.3.19 Top five tree species in TOF (Rural) in Assam

Sl. No.	Species	Relative Abundance (%)
1.	<i>Areca catechu</i>	27.87
2.	<i>Albizia species</i>	5.11
3.	<i>Gmelina arborea</i>	4.85
4.	<i>Hevea brasiliensis</i>	4.37
5.	<i>Albizia procera</i>	4.17

TABLE 11.3.20 Top five tree species in TOF (Urban) in Assam

Sl. No.	Species	Relative Abundance (%)
1.	<i>Areca catechu</i>	42.06
2.	<i>Cocos nucifera</i>	11.23
3.	<i>Mangifera indica</i>	8.74
4.	<i>Artocarpus integrifolia</i>	4.05
5.	<i>Anthocephalus cadamba</i>	3.60

11.3.11 Major NTFP and Invasive Species

Major NTFP and invasive species as assessed from forest inventory data are presented in the table 11.3.21 and table 11.3.22 respectively.

TABLE 11.3.21 Major NTFP species in the State of Assam

Sl. No.	Species	Plant Type	Relative Abundance (%)
1.	<i>Diplagium species</i>	Herb	61.97
2.	<i>Thysanolaena maxima</i>	Herb	38.03

TABLE 11.3.22 Major invasive species in the State inside the RFA/Green Wash in Assam (in sq km)

Sl. No.	Species	Estimated Extent
1.	<i>Chromolaena odorata</i>	886
2.	<i>Mikania micrantha</i>	468
3.	<i>Lantana camara</i>	339
4.	<i>Microcystis aeruginosa</i>	42
5.	<i>Imperata cylindrica</i>	41

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

11.3.12 Quantified estimation of Dependence of People living in forest fringe villages on forests in Assam

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 Assam is given in the table 11.3.23

TABLE 11.3.23 Estimation of Dependence of People in Forest Fringe Villages on Forests in Assam

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
14,10,975	1,17,12,057	14,437	32,972

