

11.22

PUNJAB

11.22.1 Introduction

Situated in the north-western part of the country, the State of Punjab has an area of 50,362 sq km, which is 1.53% of the geographical area of the country. The State lies between 29°33'N to 32°32'N latitude and 73°53'E to 76°56' E longitude. On the western side, Punjab has international border with Pakistan. The State shares border with Jammu & Kashmir in the north, Himachal Pradesh in the east and Haryana & Rajasthan on the south. Major part of the State is comprised of fertile alluvial plains and along the north eastern part of the state bordering Himachal Pradesh runs the belt of low Shivalik hills. Climate of the State is tropical, semi arid, hot and subtropical monsoon type with cold winter and hot summer. The annual rainfall ranges between 480 mm to 960 mm and the annual temperature varies from 0°C to 47°C. The State is drained by two main rivers, Satluj and Beas. The State has 20 districts none of which are hill or tribal district. As per the 2011 census, Punjab has a population of 27.74 million accounting to 2.29% of India's population. The rural and urban population comprise 62.52% and 37.48% respectively. The average population density of the State is 551 per sq km which is higher than the national average. The 19th Livestock Census 2012 has reported a total livestock population of 8.12 million.

TABLE 11.22.1 Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	5,036	
Reporting area for land utilization	5,033	100.00
Forests	256	5.08
Not available for land cultivation	488	9.69
Permanent pastures and other grazing lands	5	0.10
Land under misc. tree crops and groves	8	0.16
Culturable wasteland	69	1.37
Fallow land other than current fallows	5	0.11
Current fallows	83	1.65
Net area sown	4,119	81.84

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



11.22.1.1 A Brief Overview of Forestry Scenario

Punjab is predominantly an agricultural State, with 83% of the total geographical area is under agriculture. As per the Champion & Seth Classification of Forest types (1968), the forests in Punjab belong to three Forest Type Groups i.e. Tropical Dry Deciduous Forests, Tropical Thorn Forests and Subtropical Pine Forests which are further divided into seven Forest Types. The Community reserves of 'Lalwan' in Hoshiarpur and 'Keshopur-Chamb' in Gurdaspur districts are the first notified community reserves in the country under the Wildlife Protection Act, 1972. These reserves enable conservation of biodiversity on the community lands with the support of State Forest Department.

With major portion of the land under agriculture, there is limited scope to increase the area under forests except by bringing the wastelands and degraded lands. The department encourages farmers to take up agroforestry on their farm lands by providing quality planting material and technical hand holding.

Recorded Forest Area (RFA) in the State is 3,084 sq km of which 44 sq km is Reserved Forest, 1,137 sq km is Protected Forest and 1,903 sq km is Unclassed Forests. In Punjab, during the period 1st January 2015 to 5th February 2019, a total of 1,525 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019).

Thirteen Wildlife Sanctuaries, four Conservation Reserves and three Community Reserves constitute the Protected Area network of the State covering 0.76% of its geographical area.

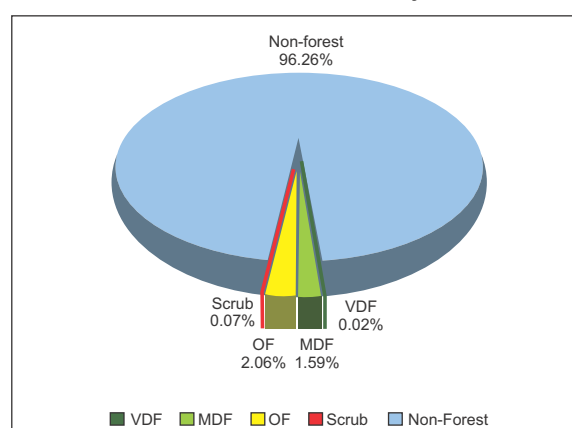
11.22.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Oct 2017, the Forest Cover in the State is 1,848.63 sq km which is 3.67% of the State's geographical area. In terms of forest canopy density classes, the State has 8.00 sq km under Very Dense Forest (VDF), 800.97 sq km under Moderately Dense Forest (MDF) and 1,039.66 sq km under Open Forest (OF). Forest Cover in the State has increased by 11.63 sq km as compared to the previous assessment reported in ISFR 2017.

TABLE 11.22.2 Forest Cover of Punjab
(in sq. km)

Class	Area	% of GA
VDF	8.00	0.02
MDF	800.97	1.59
OF	1,039.66	2.06
Total	1,848.63	3.67
Scrub	32.94	0.07

FIGURE 11.22.1 Forest Cover of Punjab



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

The State has reported extent of recorded forest area (RFA) 3,084 sq km which is 6.12% of its geographical area. The reserved, protected and unclassified forests are 1.43%, 36.87% and 61.70% respectively of the recorded forest area in the State. Due to non-availability of digitized boundary of recorded forest areas from the State, the updated Green Wash from Sol toposheets which is 924.03 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 11.22.3 Forest Cover inside and outside Recorded Forest Area or (Green Wash) (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
7	451	326	784	1	350	714	1,065
0.89%	57.54%	41.57%		0.09%	32.87%	67.04%	

**in case of Punjab Green Wash boundaries have been used.*

FIGURE 11.22.2 Forest Cover inside and outside Green Wash in Punjab

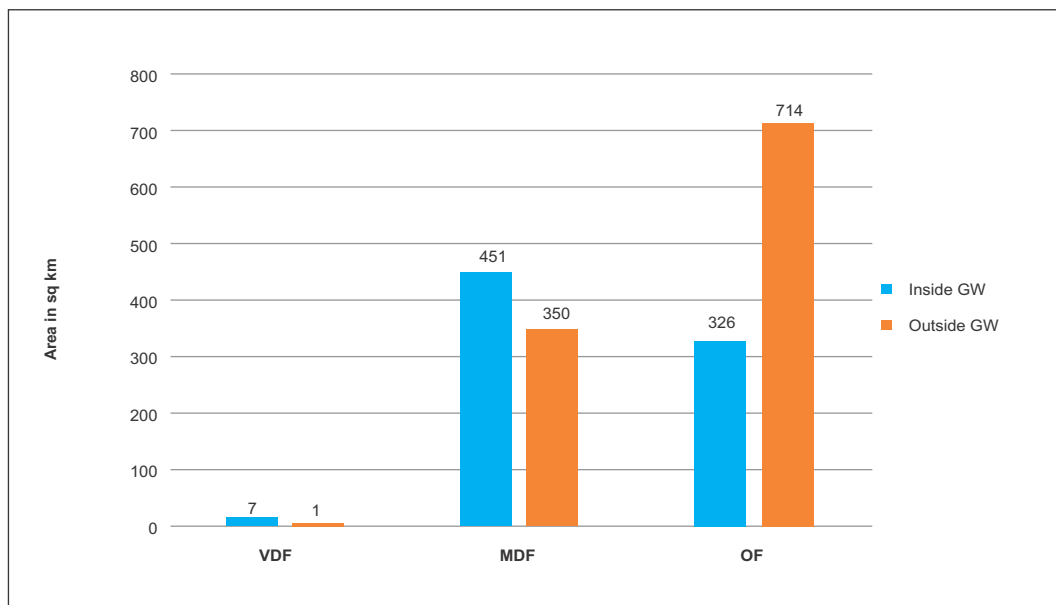


TABLE 11.22.4 District-wise Forest Cover in Punjab

(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			
Amritsar	2,683	1.00	11.05	14.73	26.78	1.00	-0.22	1.22
Barnala	1,482	0.00	1.00	7.33	8.33	0.56	0.33	0.00
Bathinda	3,353	0.00	18.91	36.52	55.43	1.65	-0.57	9.00
Faridkot	1,458	0.00	3.97	14.51	18.48	1.27	-2.52	1.00
Fatehgarh Sahib	1,180	0.00	3.74	0.00	3.74	0.32	-0.26	0.00
Firozpur	5,305	0.00	6.00	27.66	33.66	0.63	-0.34	0.85
Gurdaspur	3,551	0.00	104.16	108.16	212.32	5.98	-0.68	1.00
Hoshiarpur	3,386	0.00	370.33	353.87	724.20	21.39	-0.80	7.00
Jalandhar	2,624	0.00	1.92	8.69	10.61	0.40	-0.39	1.00
Kapurthala	1,633	0.00	1.93	7.92	9.85	0.60	-0.15	1.00
Ludhiana	3,578	0.00	25.18	33.74	58.92	1.65	3.92	1.00
Mansa	2,198	0.00	0.98	9.00	9.98	0.45	-0.02	0.00
Moga	2,242	0.00	0.00	8.89	8.89	0.40	-0.11	0.00
Muksar	2,593	0.00	5.97	12.35	18.32	0.71	0.32	0.00
Patiala	3,325	7.00	28.69	39.12	74.81	2.25	-0.19	3.11
Rupnagar	1,356	0.00	105.82	155.64	261.46	19.28	1.46	3.00
Sahibzada Ajit Singh Nagar	1,094	0.00	74.50	66.23	140.73	12.86	-1.27	3.00
Sangrur	3,625	0.00	6.00	16.83	22.83	0.63	-0.17	0.00
Shahid Bhagat Singh Nagar	1,282	0.00	25.90	105.86	131.76	10.28	13.76	0.00
Tarn Taran	2,414	0.00	4.92	12.61	17.53	0.73	-0.47	0.76
Grand Total	50,362	8.00	800.97	1,039.66	1,848.63	3.67	11.63	32.94

TABLE 11.22.5 Forest Cover Change Matrix for Punjab

(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	8	0	0	0	0	8
Moderately Dense Forest	0	801	0	0	5	806
Open Forest	0	0	1,010	1	12	1,023
Scrub	0	0	0	32	1	33
Non Forest	0	0	30	0	48,462	48,492
Total ISFR 2019	8	801	1,040	33	48,480	50,362
Net Change	0	-5	17	0	-12	

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

TABLE 11.22.6 Altitude-wise Forest Cover in Punjab

(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	49,882	8	581	885	1,474 (79.72%)	33
500-1000	480	0	220	155	375 (20.28%)	0
Total	50,362	8	801	1,040	1,849	33

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

TABLE 11.22.7 Forest Cover in different slope classes in Punjab

(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	48,329	7	379	663	1,049 (56.73%)	32
5-10	1,582	1	229	220	450 (24.34%)	1
10-15	316	0	126	107	233 (12.60%)	0
15-20	99	0	48	37	85 (4.60%)	0
20-25	26	0	14	9	23 (1.24%)	0
25-30	7	0	4	3	7 (0.38%)	0
>30	3	0	1	1	2 (0.11%)	0
Total	50,362	8	801	1,040	1,849	33

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



FIGURE 11.22.3 Forest Cover Map of Punjab

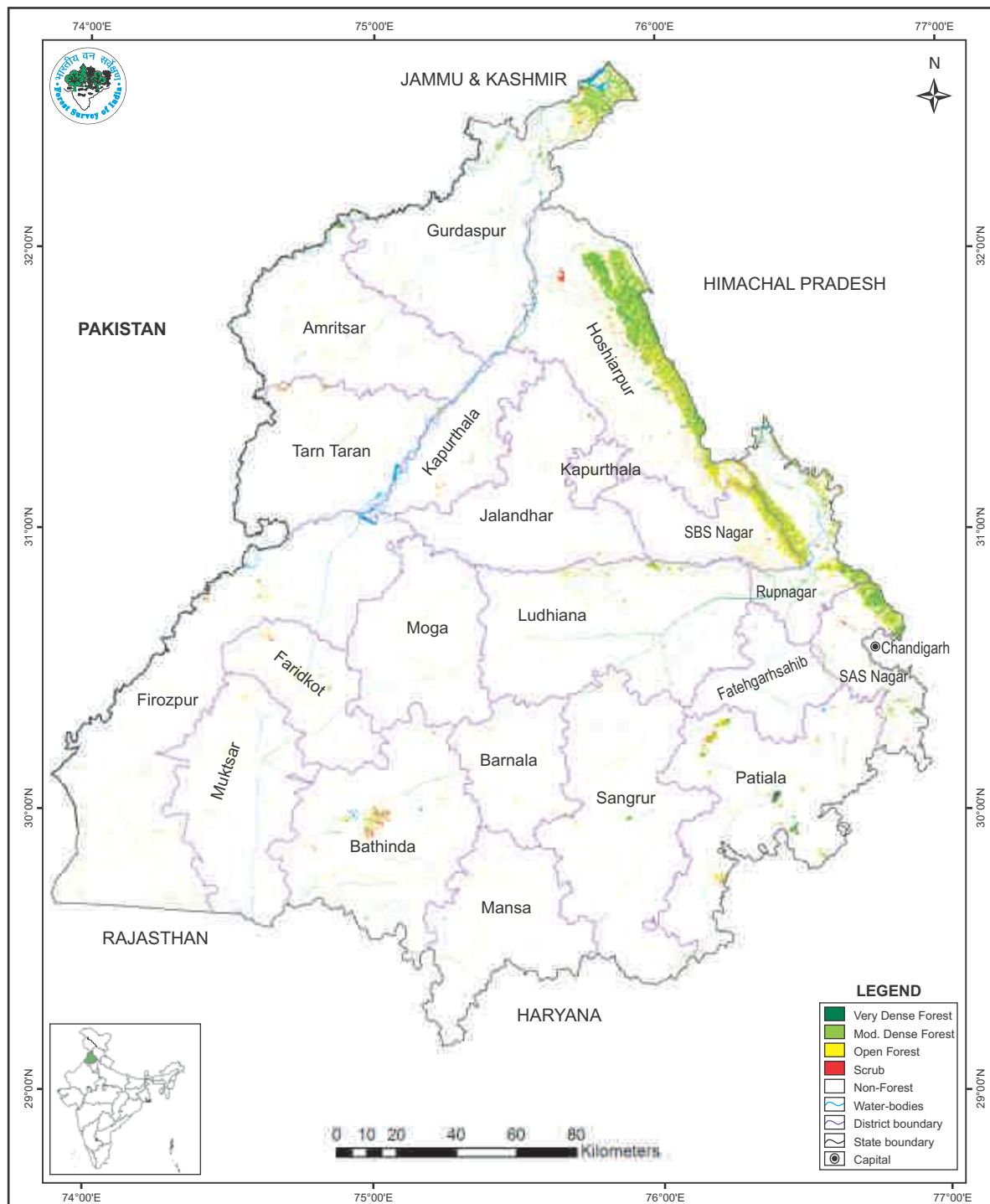


TABLE 11.22.8 Wetlands inside the Recorded Forest Area (or Green Wash) in Punjab (in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	5	15
Waterlogged	1	66
River/Stream	40	1,365
Sub - Total	46	1,446
Inland Wetlands -Man-made		
Reservoir/Barrage	26	1,570
Tank/Pond	11	16
Sub - Total	37	1,586
Coastal Wetlands - Natural		
Wetlands (<2.25 ha)	36	36
Total	119	3,068
Total Recorded Forest (or Green Wash) Area (in ha)		92,403
% of Wetland area inside Recorded Forest (or Green Wash) Area		3.32%

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

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

TABLE 11.22.9 Percentage area under different forest types of Punjab

Sl. No.	Forest Type	% of Forest cover
1.	5B/C2 Northern Dry Mixed Deciduous Forest	67.29
2.	5/DS1 Dry Deciduous Scrub	1.36
3.	5/E9 Dry Bamboo Brakes	1.62
4.	5/1S2 Khair-Sissu Forest	0.23
5.	6B/C2 Ravine Thorn Forest	4.17
6.	6/1S1 Desert Dune Scrub	0.27
7.	9/C1a Siwalik Chir Pine Forest	1.49
8.	Plantation/TOF	23.57
	Total	100.00

11.22.3.1 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 11.22.10 and table 11.22.11 in respect of Punjab.

TABLE 11.22.10 No. of species observed during the rapid assessment

Plant Type	Number of Species
Tree	50
Shrub	31
Herb	37

TABLE 11.22.11 Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Punjab

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1.	Group 5- Tropical Dry Deciduous Forests	3.06	2.07	1.65
2.	Group 6- Tropical Thorn Forests	1.78	2.38	2.28
3.	Group 9- Subtropical Pine Forests	*	1.94	2.36

*adequate number of sample plots were not available

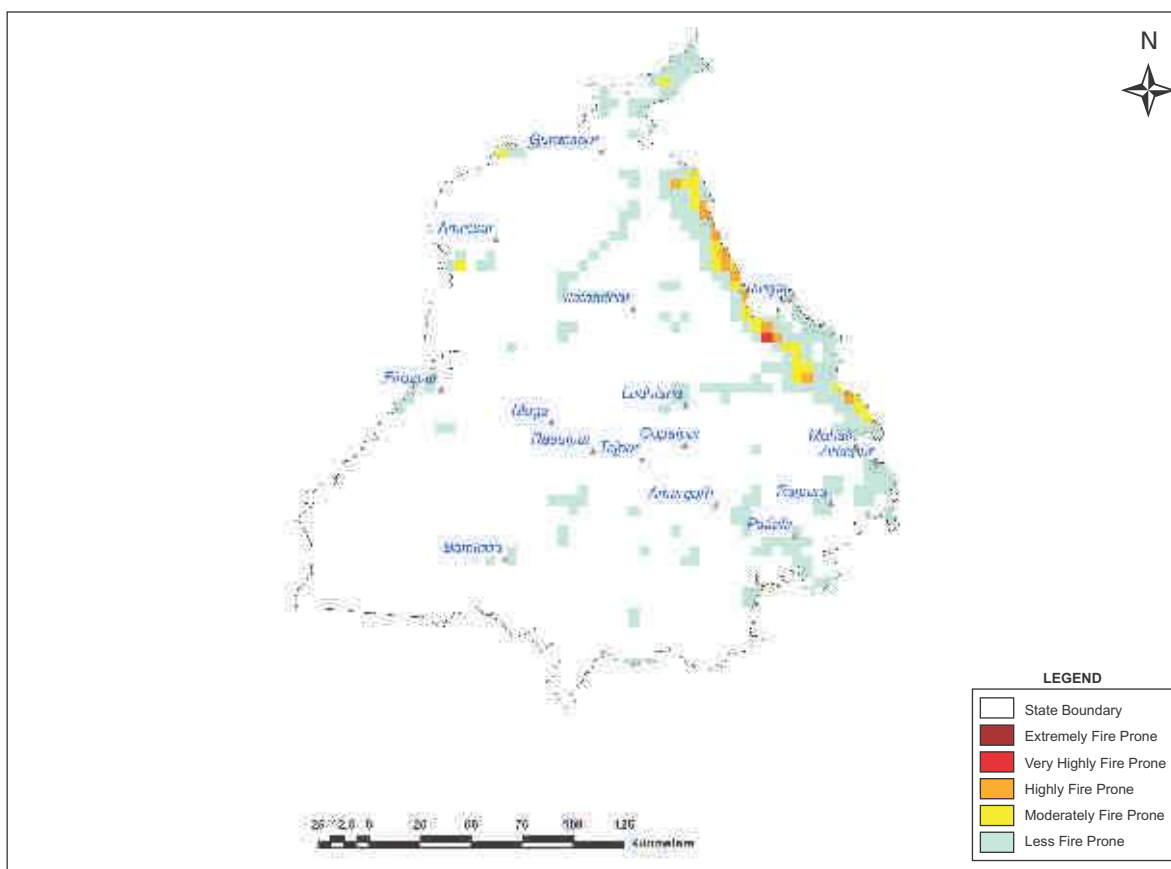
11.22.4 Fire Prone Forest Areas

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

TABLE 11.22.12 Forest Fire Prone Classes (in sq km)

Sl. No.	Forest Fire Prone Classes	Geographical Area	% of Total forest cover
1.	Extremely fire prone	0.00	0.00
2.	Very highly fire prone	25.00	0.56
3.	Highly fire prone	282.16	17.09
4.	Moderately fire prone	638.00	29.24
5.	Less fire prone	5,618.68	53.11
	Total	6,563.84	100.00

FIGURE 11.22.4 Fire prone forest areas under different fire prone classes



11.22.5 Tree Cover

Forest cover presented in the section 11.22.2 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 Punjab has been estimated as given in the table 11.22.13.

TABLE 11.22.13 Tree Cover in Punjab (in sq km)

Tree Cover	Area
	1,592

Tree cover of Punjab has decrease by 30 sq km as compared to the previous assessment reported in ISFR 2017.

11.22.6 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 11.22.14 Extent of TOF in Punjab (in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
1,065	1,592	2,657

11.22.7 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Punjab is given in the table 11.22.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.22.16

TABLE 11.22.15 Growing Stock in Punjab (in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	11.12	0.26
Growing Stock in TOF	18.56	1.13

TABLE 11.22.16 Diameter class distribution of top five species inside RFA in Punjab (in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Prosopis juliflora</i>	16,782	1,001	0
2.	<i>Eucalyptus species</i>	2,943	1,307	0
3.	<i>Butea monosperma</i>	297	0	0
4.	<i>Acacia catechu</i>	8,658	185	0
5.	<i>Grewia oppositifolia</i>	1,636	0	0

11.22.8 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 13.34 million tonnes (48.91 million tonnes of CO₂ equivalent) which is 0.19% of total forest carbon of the country. Pool wise forest carbon in Punjab is given in the following table

TABLE 11.22.17 Forest Carbon in Punjab in different pools (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
3,529	1,367	25	125	8,298	13,344

11.22.9 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 11.22.18

TABLE 11.22.18 Growing Stock of Bamboo in Punjab

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	255	0.16
Total number of culms (in millions)	11	0.03
Total equivalent green weight (in 000' tonnes)	47	0.02

11.22.10 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Punjab in Rural and Urban areas are given in the table 11.22.19 and table 11.22.20 respectively

TABLE 11.22.19 Top five tree species in TOF (Rural) in Punjab

Sl. No.	Species	Relative Abundance (%)
1.	<i>Eucalyptus species</i>	24.67
2.	<i>Melia azadirachta</i>	18.76
3.	<i>Populus species</i>	12.44
4.	<i>Dalbergia sissoo</i>	9.39
5.	<i>Morus species</i>	5.43

TABLE 11.22.20 Top five tree species in TOF (Urban) in Punjab

Sl. No.	Species	Relative Abundance (%)
1.	<i>Melia azadirachta</i>	20.97
2.	<i>Eucalyptus species</i>	14.26
3.	<i>Morus species</i>	7.58
4.	<i>Azadirachta indica</i>	4.79
5.	<i>Dalbergia sissoo</i>	4.64

11.22.11 Major Invasive Species

Major invasive species as assessed from forest inventory data are presented in the table 11.22.21.

TABLE 11.22.21 Major Invasive Species in the State within the RFA/Green Wash of Punjab (in sq km)

Sl. No.	Species	Estimated Extent
1.	<i>Lantana camara</i>	652
2.	<i>Ageratum houstonianum</i>	106
3.	<i>Leucanea leucocephala</i>	83
4.	<i>Senna occidentalis</i>	39
5.	<i>Imperata cylindrica</i>	39

Major invasive species are given in terms of their estimated extent.

11.22.12 Quantified estimation of Dependence of People living in forest fringe villages on forests in Punjab

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 Punjab is given in the table 11.22.22

TABLE 11.22.22 Estimation of Dependence of People in Forest Fringe Villages on Forests in Punjab

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
4,56,167	42,69,224	94	18,758