

11.11

Jammu & Kashmir (combined)

11.11.1 Introduction

The Government of India vide notification dated 31.10.2019 has carved out two union territories of Jammu & Kashmir and Ladakh from the erstwhile State of Jammu & Kashmir. Situated in the northernmost part of the country, Jammu & Kashmir (UT) and Ladakh (UT), cover an area of 2,22,236 sq km, which is 6.76% of the geographical area of the country. The UT of Jammu & Kashmir is bordered by Pakistan in the west, UT of Ladakh is situated on the northern and eastern side and the States of Himachal Pradesh and Punjab lie South to the UT of Jammu & Kashmir. The UT of Ladakh has international border with Pakistan, Afghanistan and China. It shares borders with the UT of Jammu & Kashmir in the West and Himachal Pradesh in the South. The average annual rainfall varies from about 600 mm to about 800 mm and the average annual temperature from sub-zero to 40°C. The two UT's are drained by a number of rivers viz Jhelum, Chenab, Indus, Ravi, Tawi etc. All the 22 districts of UT of Jammu & Kashmir and two districts of UT of Ladakh are hill districts and both UT's do not have any tribal district. As per census 2011, the combined population of two UT's is 12.54 million accounting to 1.04% of India's population. The rural and urban population constitute 72.62% and 27.38% respectively. Tribal population is 11.91% of the UT's population. The average population density of the two UTs is 125 persons per sq km, which is lower than the national average. The 19th livestock census 2012 has reported a total livestock population of 9.2 million.

Table 11.11.1 Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	22,224	
Reporting area for land utilization	4,058	100.00
Forests	2,299	56.65
Not available for land cultivation	571	14.08
Permanent pastures and other grazing lands	113	2.77
Land under misc. tree crops and groves	57	1.39
Culturable wasteland	139	3.44
Fallow land other than current fallows	15	0.37
Current fallows	106	2.61
Net area sown	758	18.69

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



11.11.1.1 A Brief Overview of Forestry Scenario

As per the Champion & Seth Classification of Forest Types (1968), the forest in UT of Jammu & Kashmir and UT of Ladakh belong to eight Type Groups which are further divided into 42 Forest Types, the highest in the country. The Jammu & Kashmir Forest Act, 1987 is the only state-specific Forest/Wildlife act or rule that exists in the UTs. The two UTs have a Forest Protection Force to assist the Department in enforcing the forest laws on the ground and protection of forests and wildlife. The Forest Department of the two UTs have implemented various schemes focusing on rehabilitation of degraded forests, consolidation and demarcation, Eco Task Force, urban forestry, pasture and fodder development, stabilization of strip area on National Highways, development of Conifer Forests, CM's Participatory Afforestation Scheme, Integrated Forest Protection, participatory grazing land development programme etc.

Recorded Forest Area (RFA) in the two UTs is 20,230 sq km of which 17,643 sq km is Reserved Forests, 2,551 sq km is Protected Forest, and 36 sq km is Unclassed Forests. In the UT of Jammu & Kashmir and UT of Ladakh, during the period 1st January 2015 to 5th February 2019, no forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF&CC, 2019).

The two UTs have so far notified 15,912 sq km under the Protection Area Network (PAN) which is 15.59% of the total geographical area of the combined UT, comprising five National Parks, 14 Wildlife Sanctuaries and 35 Conservation Reserves. The Protected Area (PA) network of the two UTs is the highest in the country in terms of area, which is nearly 10% of the country's PA network.

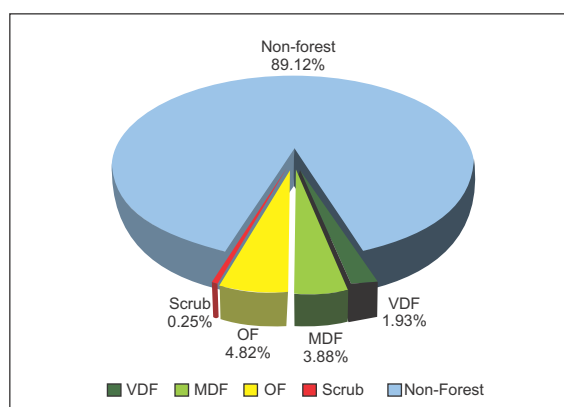
11.11.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Sept 2017 to Nov 2017, the Forest Cover in the two UTs is 23,611.89 sq km which is 10.63% of the geographical area. In terms of forest canopy density classes, the UTs have 4,280.48 sq km under Very Dense Forest (VDF), 8,612.36 sq km under Moderately Dense Forest (MDF) and 10,719.05 sq km under Open Forest (OF). Forest Cover in the UTs has increased by 370.89 sq km as compared to the previous assessment reported in ISFR2017.

TABLE 11.11.2 Combined Forest Cover of UTs of Jammu & Kashmir and Ladakh

(in sq km)		
Class	Area	% of GA
VDF	4,280.48	1.93
MDF	8,612.36	3.88
OF	10,719.05	4.82
Total	23,611.89	10.63
Scrub	547.54	0.25

FIGURE 11.11.1 Combined Forest Cover of UTs of Jammu & Kashmir and Ladakh



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

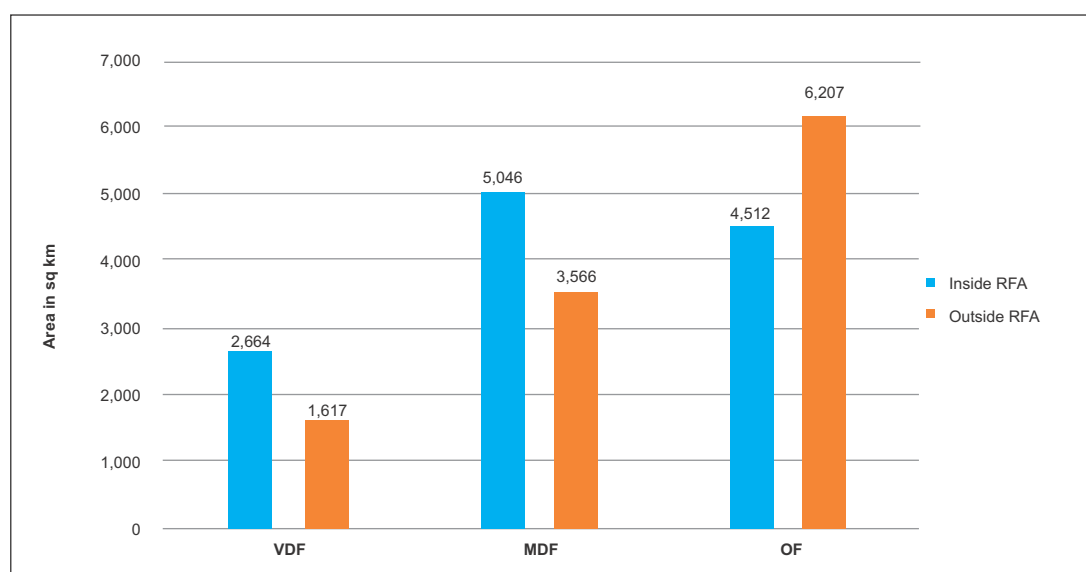
The two UTs have reported extent of recorded forest area (RFA) 20,230 sq km which is 9.10% of its geographical area. The reserved, protected and unclassified forests are 87.21%, 12.61% and 0.18% respectively of the recorded forest area in the UTs. However, as the digitized boundary of recorded forest area from the UTs cover 27,727.80 sq km, the analysis of forest cover inside and outside this area is given below.

TABLE 11.11.3 Combined Forest Cover inside and outside Recorded Forest Area or (Green Wash) in UTs of Jammu & Kashmir and Ladakh

(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
2,664	5,046	4,512	12,222	1,617	3,566	6,207	11,390
21.80%	41.29%	36.91%		18.13%	36.47%	45.40%	

*in case of Jammu & Kashmir and Ladakh RFA boundaries have been used.

FIGURE 11.11.2 Forest Cover inside and outside RFA in UTs of Jammu & Kashmir and Ladakh

TABLE 11.11.4a District-wise Forest Cover in Jammu & Kashmir, UT

(in sq km)

District	Shape File Area #	2019 Assessment				% of Shape File Area	Change wrt 2017 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Anantnag ^H	2,727	126.55	455.28	492.36	1,074.19	39.39	49.19	0.77
Badgam ^H	1,250	100.85	76.04	164.95	341.84	27.35	49.84	16.00
Bandipura ^H	2,676	270.85	177.16	194.83	642.84	24.02	34.84	3.53
Baramula ^H	2,062	287.57	211.90	370.79	870.26	42.20	63.26	7.05
Doda ^H	2,411	327.98	703.50	454.45	1,485.93	61.63	-30.07	0.40
Ganderbal ^H	1,620	129.36	179.13	186.01	494.50	30.52	58.50	6.58
Jammu ^H	2,407	0.00	241.41	526.22	767.63	31.89	22.63	35.54
Kathua ^H	2,512	108.16	607.96	615.32	1,331.44	53.00	-3.56	6.59
Kishtwar ^H	8,179	235.96	716.41	832.68	1,785.05	21.82	-20.95	5.82
Kulgam ^H	1,265	84.92	99.00	206.32	390.24	30.85	32.24	4.98
Kupwara ^H	2,744	783.42	408.34	273.19	1,464.95	53.39	-17.05	1.22
Mirpur ^H	3,759	0.00	484.66	753.13	1,237.79	32.93	12.79	41.56
Muzaffarabad ^H	4,663	873.97	441.86	293.20	1,609.03	34.51	-12.97	47.48
Pulwama ^H	896	15.70	117.72	240.72	374.14	41.76	70.14	5.60
Punch ^H	4,244	332.28	1,121.33	654.10	2,107.71	49.66	2.71	10.06

Contd.

District	Shape File Area #	2019 Assessment				% of Shape File Area	Change wrt 2017 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Rajauri ^h	2,635	42.04	424.48	838.78	1,305.30	49.54	0.30	7.43
Ramban ^h	1,288	70.55	287.17	308.52	666.24	51.73	-14.76	0.53
Reasi ^h	1,932	234.54	393.58	470.29	1,098.41	56.85	-4.59	12.37
Samba ^h	921	0.00	124.26	207.53	331.79	36.02	18.79	12.59
Shupiyan ^h	505	62.50	37.22	224.33	324.05	64.17	46.05	1.00
Srinagar ^h	282	0.24	20.03	24.97	45.24	16.04	18.24	0.00
Udhampur ^h	2,280	115.42	624.03	634.57	1,374.02	60.26	-27.98	22.45
Grand Total	53,258	4,202.86	7,952.47	8,967.26	21,122.59	39.66	347.59	249.55

Area of shape file provided by Survey of India (December, 2019). Notified geographical area from SOI awaited.

FIGURE 11.11.3a Forest Cover Map of Jammu & Kashmir, UT

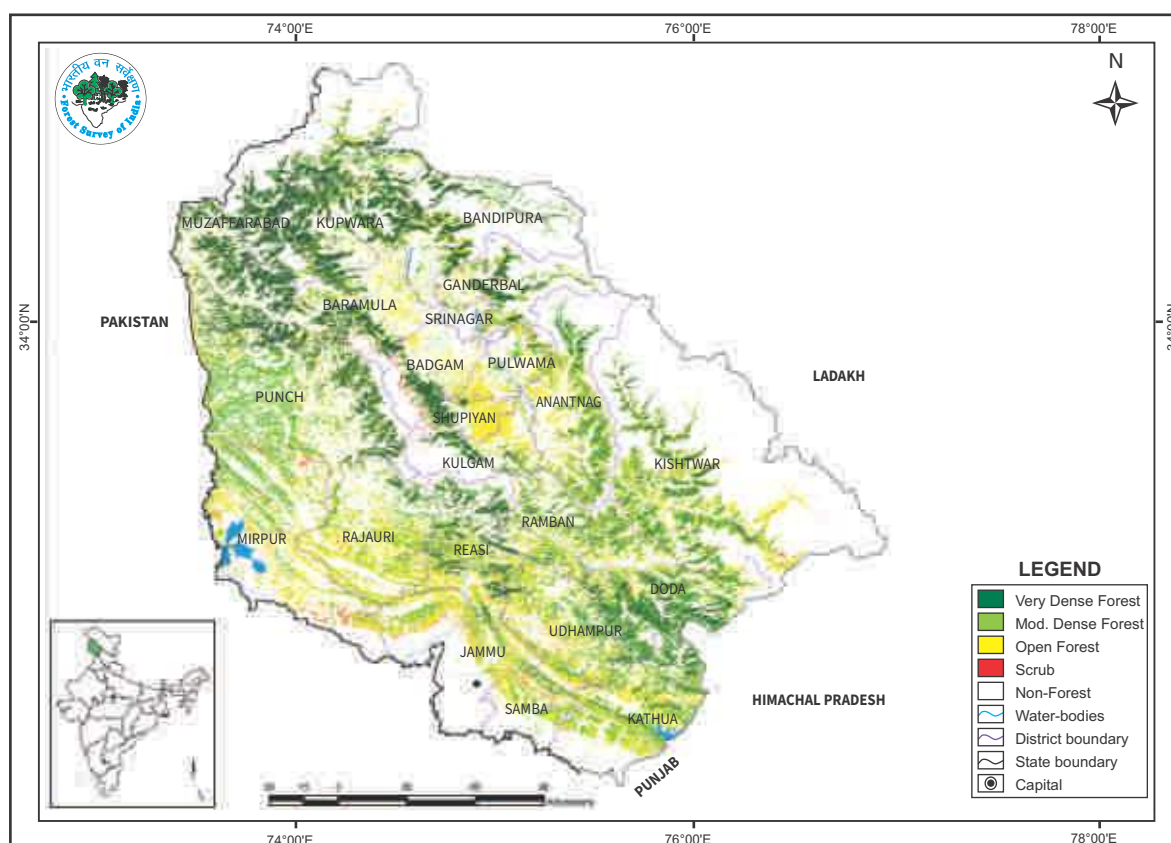


TABLE 11.11.4b District- wise Forest Cover in Ladakh, UT

(in sq km)

District	Shape File Area #	2019 Assessment				% of Shape File Area	Change wrt 2017 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Kargil ^h	14,202	0.00	2.16	57.52	59.68	0.42	8.68	26.32
Leh ^h	1,55,219	77.62	657.73	1,694.27	2,429.62	1.57	14.62	271.67
Grand Total	1,69,421	77.62	659.89	1,751.79	2,489.30	1.47	23.30	297.99

Area of shape file provided by Survey of India (December, 2019). Notified geographical area from SOI awaited.

FIGURE 11.11.3b Forest Cover Map of Ladakh, UT

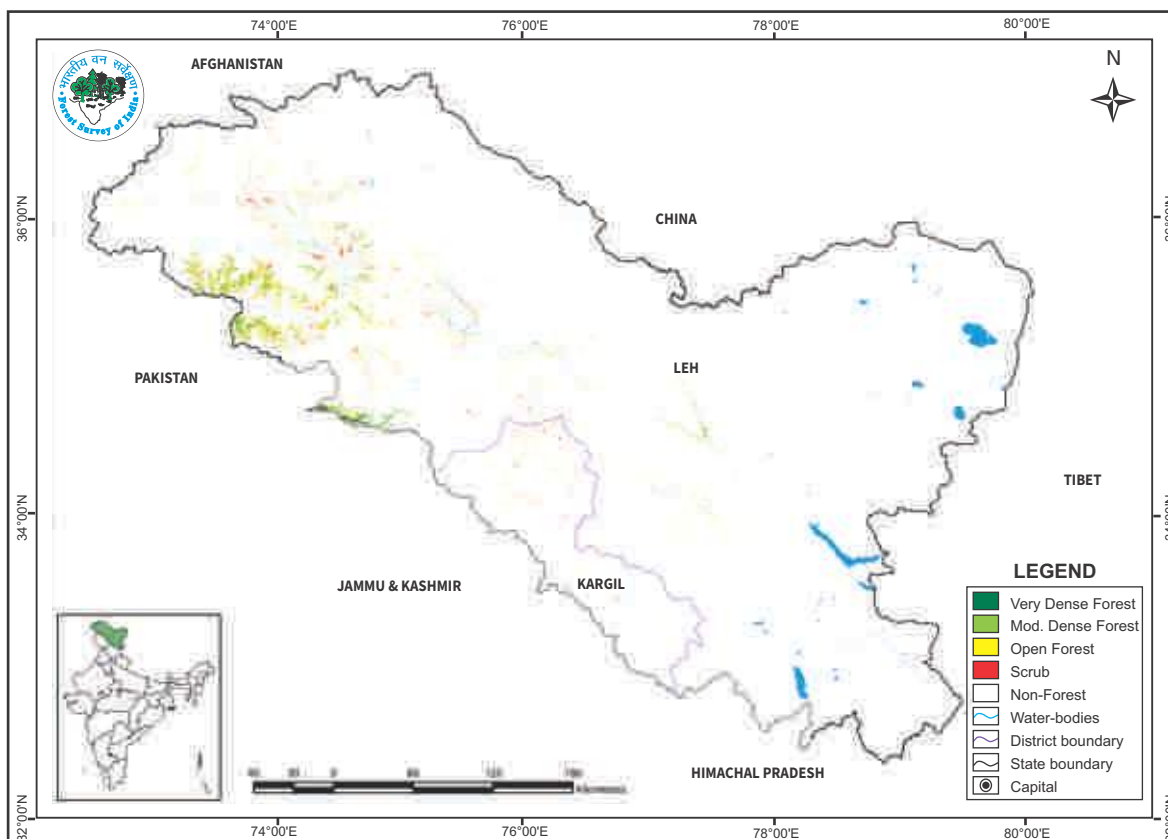


Table 11.11.5 Forest Cover Change Matrix for UTs of Jammu & Kashmir and Ladakh (combined) (in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	3,905	101	14	0	55	4,075
Moderately Dense Forest	232	8,109	77	13	148	8,579
Open Forest	81	210	9,823	15	458	10,587
Scrub	2	10	47	454	60	573
Non Forest	61	182	758	66	1,97,355	1,98,422
Total ISFR 2019	4,281	8,612	10,719	548	1,98,076	2,22,236
Net Change	206	33	132	-25	-346	

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

TABLE 11.11.6 Altitude-wise Forest Cover in UTs of Jammu & Kashmir and Ladakh (combined) (in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	5,084	1	220	756	977 (4.14%)	66
500-1000	6,585	44	1,380	2,243	3,667 (15.53%)	58
1000-2000	16,089	690	2,458	3,209	6,357 (26.92%)	27
2000-3000	19,306	2,902	3,299	2,741	8,942 (37.87%)	80
3000-4000	33,728	644	1,252	1,735	3,631 (15.38%)	257
>4000	1,41,444	0	3	35	38 (0.16%)	60
Total	2,22,236	4,281	8,612	10,719	23,612	548

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

TABLE 11.11.7 Forest Cover in different slope classes in UTs of Jammu & Kashmir and Ladakh (in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	37,945	94	518	1,796	2,408 (10.20%)	77
5-10	24,194	242	781	1,367	2,390 (10.12%)	66
10-15	25,178	419	1,139	1,445	3,003 (12.72%)	69
15-20	27,638	605	1,361	1,451	3,417 (14.47%)	72
20-25	28,297	710	1,393	1,362	3,465 (14.68%)	72
25-30	26,843	725	1,283	1,218	3,226 (13.66%)	67
>30	52,141	1,486	2,137	2,080	5,703 (24.15%)	125
Total	2,22,236	4,281	8,612	10,719	23,612	548

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

TABLE 11.11.8 Wetlands inside the Recorded Forest Area (or Green Wash) in UTs of Jammu & Kashmir and Ladakh (combined) (in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	8	11,266
High altitude Wetland	168	2,095
Riverine wetland	36	1,693
River/Stream	57	20,030
Sub - Total	269	35,084
Inland Wetlands - Man-made		
Reservoir/Barrage	3	967
Tank/Pond	1	3
Sub - Total	4	970
Wetlands (<2.25 ha)	208	208
Total	481	36,262
Total Recorded Forest (or Green Wash) Area (in ha)		27,72,780
% of Wetland area inside Recorded Forest (or Green Wash) Area		1.31%

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

11.11.3 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 UTs of Jammu & Kashmir and Ladakh (combined) as per the Champion & Seth classification (1968), according to the latest exercise are presented in the following table.

TABLE 11.11.9 Percentage area under different forest types of UTs of Jammu & Kashmir and Ladakh (combined)

Sl.No.	Forest Type	% of Forest cover
1	5B/C2 Northern Dry Mixed Deciduous Forest	6.17
2	5B/DS1 Dry Deciduous Scrub	1.89
3	5/DS3 (<i>Euphorbia</i> Scrub)	0.01
4	5/E9 Dry Bamboo Brake	0.12
5	5/1S2 <i>Khair-Sissu</i> Forest	0.02
6	9/C1a Lower or Siwalik Chir Pine Forest	10.86
7	9/C1b Upper or Himalayan Chir Pine Forest	4.27
8	9/DS1 Himalayan Subtropical Scrub	1.27
9	10/C1a <i>Olea Cuspidata</i> Scrub Forest	0.65

Contd.

Sl.No.	Forest Type	% of Forest cover
10	10/C1/DS1 <i>Dodonaea</i> Scrub	0.03
11	10/C1b <i>Acacia Modesta</i> Scrub Forest	0.04
12	12/C1a <i>Ban</i> Oak Forest (<i>Q. incana</i>)	2.75
13	12/C1b <i>Moru</i> Oak Forest (<i>Q. dilatata</i>)	0.16
14	12/C1/DS1 Oak Scrub	0.48
15	12/C1c Moist Deodar Forest (<i>Cedrus</i>)	8.93
16	12/C1d Western Mixed Coniferous Forest (Spruce, Blue Pine, Silver fir)	12.82
17	12/C1e Moist Temperate Deciduous Forest	0.12
18	12/C1f (Low-Level Blue Pine Forest (<i>P. wallichiana</i>))	6.47
19	12/C1/DS2 Himalayan Temperate Secondary Scrub	0.64
20	12/C2a <i>Kharsu</i> Oak Forest (<i>Q. semecarpifolia</i>)	0.00
21	12/C2b West Himalayan Upper Oak/Fir Forest	0.01
22	12/DS3 Himalayan Temperate Pastures	1.80
23	12/1S1 Alder Forest	0.02
24	12/1S2 Riverain Blue Pine Forest	0.21
25	12/2S1 Low-Level Blue Pine Forest	0.19
26	13(i)/C1 Dry Broadleaved and Coniferous Forest (<i>Q. ilex-P. gerardiana</i>)	2.55
27	13(i)/C2b Dry Deodar Forest (<i>Cedrus</i>)	3.12
28	13/C2/DS1 <i>Pohu</i> Scrub	0.24
29	13/C2/DS2 Dry Temperate Scrub	0.52
30	13(i)/C3 (West Himalayan Dry Temperate Deciduous Forest)	0.91
31	13(i)/C4 West Himalayan High-Level Dry Blue Pine Forest	4.83
32	13/1S2 <i>Populus / Salix</i> Forest	0.48
33	14/C1a West Himalayan Sub-Alpine Fir Forest	4.36
34	14/C1b West Himalayan Sub-Alpine Birch/Fir Forest	5.57
35	14/DS1 Sub-Alpine Pastures	0.30
36	14/2S1 (Sub-Alpine Blue Pine Forest (<i>P. wallichiana</i>))	1.05
37	15/C1 Birch/ <i>Rhododendron</i> Scrub Forest	0.56
38	15/C2 Deciduous Alpine Scrub	0.49
39	15/E1 Dwarf <i>Rhododendron</i> Scrub	0.04
40	15/C3 (Alpine Pastures)	2.37
41	16/C1 Dry Alpine Scrub	5.02
42	16/E1 Dwarf Juniper Scrub	2.82
43	Plantation/ TOF	4.84
	Total	100.00

11.11.3.1 Assessment of Biodiversity in UTs of Jammu & Kashmir and Ladakh (combined)

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 11.11.10 and table 11.11.11 in respect of UTs of Jammu & Kashmir and Ladakh (combined).

TABLE 11.11.10 No. of species observed during the rapid assessment

Plant Type	Number of Species
Tree	73
Shrub	133
Herb	272

TABLE 11.11.11 Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of UTs of Jammu & Kashmir and Ladakh (combined)

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1.	Group 5- Tropical Dry Deciduous Forests	2.28	3.00	2.04
2.	Group 9- Subtropical Pine Forests	2.43	3.37	1.97
3.	Group 10- Subtropical Dry Evergreen Forests	0.69	2.64	2.46
4.	Group 12- Himalayan Moist Temperate Forests	1.98	3.26	4.10
5.	Group 13- Himalayan Dry Temperate Forests	1.53	2.49	3.68
6.	Group 14- Sub Alpine Forests	1.58	2.96	3.52
7.	Group 15- Moist Alpine Scrub	1.25	1.30	2.77
8.	Group 16- Dry Alpine Scrub	1.05	*	*

* adequate number of sample plots were not available

11.11.4 Fire Prone Forest Areas

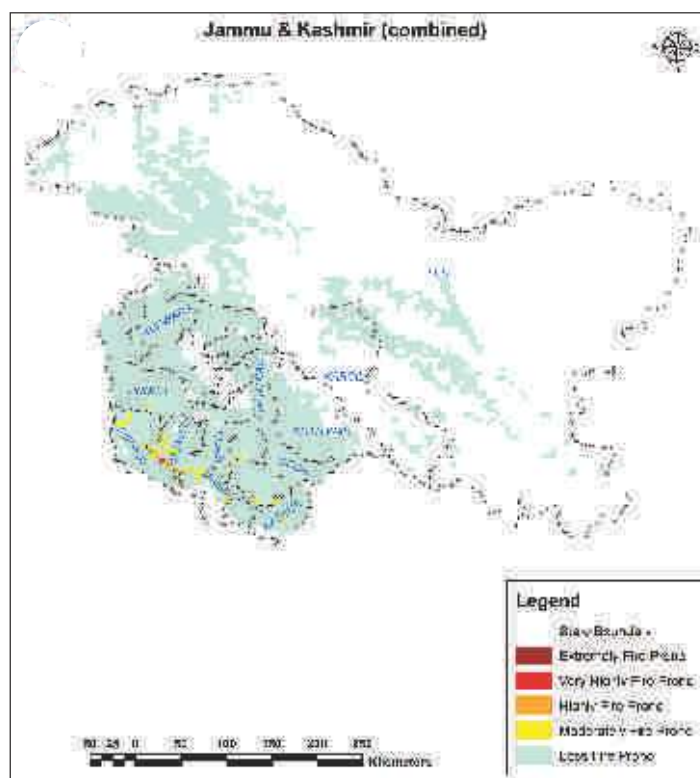
Geographical Areas under different forest fire class proneness are given in the following table:

TABLE 11.11.12 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	24.99	0.08
3.	Highly fire prone	124.96	0.38
4.	Moderately fire prone	924.51	2.65
5.	Less fire prone	70,420.60	96.89
	Total	71,495.06	100.00



FIGURE 11.11.4 Fire prone forest areas under different fire prone classes



11.11.5 Tree Cover

Forest cover presented in the section 11.11.2 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 UTs of Jammu & Kashmir and Ladakh (combined) has been estimated as given in table 11.11.12.

TABLE 11.11.13 Tree Cover in UTs of Jammu & Kashmir and Ladakh (combined)
(in sq km)

Tree Cover	Area
	7,944

Tree cover in UTs of Jammu & Kashmir and Ladakh (combined) has increased by 129 sq km as compared to the previous assessment reported in ISFR 2017.

11.11.6 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 methodology. 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 11.11.14 Extent of TOF in UTs of Jammu & Kashmir and Ladakh (combined)
(in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
11,390	7,944	19,334

11.11.7 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in UTs of Jammu & Kashmir and Ladakh (combined) is given in the table 11.11.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.11.16

TABLE 11.11.15 Growing Stock in UTs of Jammu & Kashmir and Ladakh (combined) (in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	291.63	6.82
Growing Stock in TOF	125.14	7.62

Table 11.11.16 Diameter class distribution of top five species inside RFA in UTs of Jammu & Kashmir and Ladakh (combined) (in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Abies pindrow</i>	9,968	16,356	12,912
2.	<i>Pinus wallichiana</i>	17,877	23,291	6,048
3.	<i>Quercus leucotrichophora</i>	21,730	5,579	366
4.	<i>Cedrus deodara</i>	7,784	9,994	8,567
5.	<i>Pinus roxburghii</i>	12,047	8,695	2,364

11.11.8 Carbon Stock in Forest

The total Carbon stock of forests in the UTs including the TOF patches which are more than 1 ha in size is 390.20 million tonnes (1,430.73 million tonnes of CO₂ equivalent) which is 5.48% of total forest carbon of the country. Pool wise forest carbon in UTs of Jammu & Kashmir and Ladakh (combined) is given in the following table

TABLE 11.11.17 Forest Carbon in UTs of Jammu & Kashmir and Ladakh (combined) in different pools (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
1,70,222	47,806	3,813	3,706	1,64,648	3,90,195

11.11.9 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in UTs of Jammu & Kashmir and Ladakh (combined) in Rural and Urban areas are given in the table 11.11.18 and table 11.11.19 respectively

TABLE 11.11.18 Top five tree species in TOF (Rural) in UTs of Jammu & Kashmir and Ladakh (combined)

Sl. No.	Species	Relative Abundance (%)
1.	<i>Grewia oppositifolia</i>	15.12
2.	<i>Populus species</i>	6.62
3.	<i>Quercus leucotrichophora</i>	5.28
4.	<i>Pyrus species</i>	5.26
5.	<i>Salix species</i>	4.29

TABLE 11.11.19 Top five tree species in TOF (Urban) in UTs of Jammu & Kashmir and Ladakh (combined)

Sl. No.	Species	Relative Abundance (%)
1.	<i>Grewia oppositifolia</i>	12.76
2.	<i>Leucaena leucocephala</i>	7.19
3.	<i>Populus species</i>	6.13
4.	<i>Acacia modesta</i>	5.56
5.	<i>Salix species</i>	5.45

11.11.10 Major Invasive Species

Major invasive species as assessed from forest inventory data are presented in the table 11.11.20

TABLE 11.11.20 Major Invasive Species in the UTs of Jammu & Kashmir and Ladakh (combined) inside the RFA/Green Wash (in sq km)

Sl. No.	Species	Estimated Extent
1.	<i>Lantana camara</i>	132
2.	<i>Parthenium hysterophorus</i>	50
3.	<i>Ageratum conyzoides</i>	18
4.	<i>Ipomoea fistulosa</i>	6
5.	<i>Solanum viarum</i>	5

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

11.11.11 Quantified estimation of Dependence of People living in forest fringe villages on forests in UTs of Jammu & Kashmir and Ladakh (combined)

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 UTs of Jammu & Kashmir and Ladakh (combined) is given in the table 11.11.21

TABLE 11.11.21 Estimation of Dependence of People in Forest Fringe Villages on Forests of UTs of Jammu & Kashmir and Ladakh (combined)

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
12,98,816	1,40,17,803	94	19,763

