

11.29

UTTARAKHAND

11.29.1 Introduction

The predominantly mountainous State of Uttarakhand covers an area of 53,483 sq km, which is 1.63% of the geographical area of the country. The State lies between 28°43' N to 31°28' N latitude and 77°34' E to 81°03' E longitude and shares borders with Himachal Pradesh in north & Uttar Pradesh in south. It also shares International borders with Nepal and China. As the State lies in the Himalayan range, the climate and vegetation vary greatly with altitude, from glaciers at the highest elevations to subtropical forests at the lower elevations. Ice and bare rocks cover the higher elevations. The average annual rainfall is 1,500 mm and the annual temperature varies from 0°C to 43°C. Many major rivers including Ganga, Yamuna, Ramganga & Sharda drain the State along with their tributaries. The State has 13 districts; all of them are hill districts. The State does not have any tribal districts. As per the 2011 census, Uttarakhand has a population of 10.09 million, which is 0.83% of India's population. The rural and urban population of the State constitute 69.77% and 30.23% respectively. The Tribal population is 2.89%. The population density of the State is 189 per sq km, which is lower than the national average. The 19th Livestock Census 2012 has reported a total livestock population of 4.79 million.

TABLE 11.29.1 Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	5,348	
Reporting area for land utilization	5,993	100.00
Forests	3,800	63.41
Not available for land cultivation	452	7.54
Permanent pastures and other grazing lands	192	3.21
Land under misc. tree crops and groves	388	6.47
Culturable wasteland	317	5.29
Fallow land other than current fallows	87	1.44
Current fallows	57	0.96
Net area sown	700	11.68

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

11.29.1.1 A Brief Overview of Forestry Scenario

Uttarakhand is rich in forest resources. As per the Champion & Seth Classification of Forest Types (1968), the forests in Uttarakhand belong to nine Forest Type Groups, which are further divided into 43 Forest Types. Physiographically, the State can be divided into three zones namely, the Himalayas, the Shiwalik and the Terai region. The human and livestock population is largely dependent on forests due to agrarian economy and pastoralism.

Van Panchayats in Uttarakhand are unique institutions of community forest management which came into existence in 1921. At present there are 12,167 Van Panchayats in the State which manage an area of 7,32,688 hectares of forest. Occurrence of forest fires at regular intervals is a major problem in the State.

Recorded Forest Area (RFA) in the State is 38,000 sq km of which 26,547 sq km is Reserved Forest, 9,885 sq km is Protected Forest and 1,568 sq km is Unclassed Forests. In Uttarakhand, during the period 1st January 2015 to 5th February 2019, a total of 2,850.87 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019).

Six National Parks, seven Wildlife Sanctuaries and four Community Reserves constitute the Protected Area network of the State covering 3.24% of its geographical area. The Corbett National Park is located in the State.

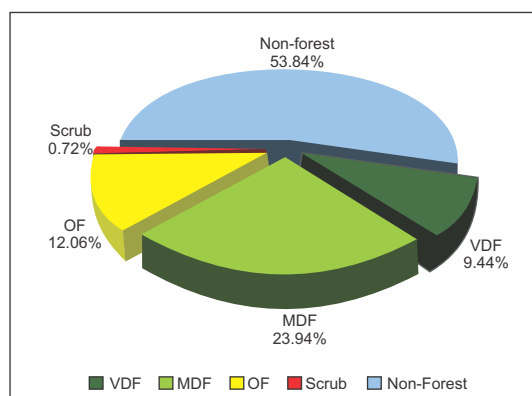
11.29.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Oct 2017 to Oct 2018, the Forest Cover in the State is 24,303.04 sq km which is 45.44% of the State's geographical area. In terms of forest canopy density classes, the State has 5,046.76 sq km under Very Dense Forest (VDF), 12,805.24 sq km under Moderately Dense Forest (MDF) and 6,451.04 sq km under Open Forest (OF). Forest Cover in the State has increased by 8.04 sq km as compared to the previous assessment reported in ISFR 2017.

TABLE 11.29.2 Forest Cover of Uttarakhand

(in sq. km)		
Class	Area	% of GA
VDF	5,046.76	9.44
MDF	12,805.24	23.94
OF	6,451.04	12.06
Total	24,303.04	45.44
Scrub	383.17	0.72

FIGURE 11.29.1 Forest Cover of Uttarakhand



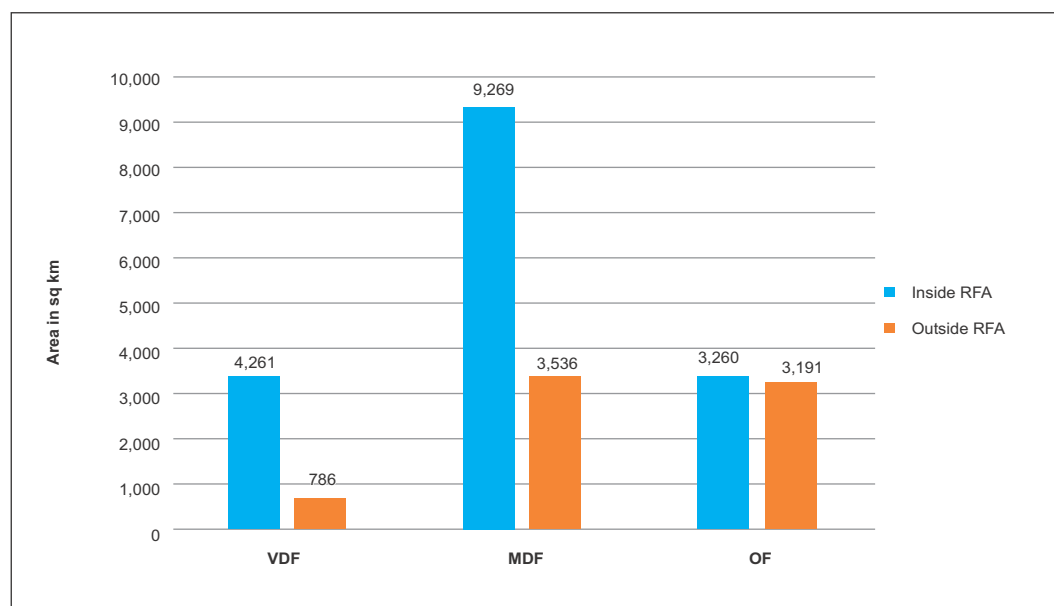
11.29.2.1 Forest Cover inside and outside Recorded Forest Area (or Green Wash)

The State has reported extent of recorded forest area (RFA) 38,000 sq km which is 71.05% of its geographical area. The reserved, protected and unclassed forests are 69.86%, 26.01% and 4.13% of the recorded forest area in the State respectively. However as the digitized boundary of recorded forest area from the state covers 25,494.46 sq km and the analysis of forest cover inside and outside this area is given below.

TABLE 11.29.3 Forest Cover inside and outside Recorded Forest Area or (Green Wash) in Uttarakhand (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
4,261	9,269	3,260	16,790	786	3,536	3,191	
25.38%	55.20%	19.42%		10.46%	47.07%	42.47%	

*in case of Uttarakhand RFA boundaries have been used

FIGURE 11.29.2 Forest Cover inside and outside RFA in Uttarakhand**TABLE 11.29.4** District-wise Forest Cover in Uttarakhand

(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			
Almora ^H	3,144	199.00	837.00	683.14	1,719.14	54.68	1.14	6.00
Bageshwar ^H	2,241	162.39	761.61	338.69	1,262.69	56.34	1.69	1.00
Chamoli ^H	8,030	443.00	1,580.00	686.43	2,709.43	33.74	0.43	1.00
Champawat ^H	1,766	367.00	593.00	265.55	1,225.55	69.40	1.55	7.00
Dehradun ^H	3,088	659.77	601.56	347.36	1,608.69	52.09	3.69	86.28
Garhwal ^H	5,329	574.26	1,902.03	918.70	3,394.99	63.71	0.99	95.97
Haridwar ^H	2,360	74.74	276.42	234.09	585.25	24.80	-2.75	6.00
Nainital ^H	4,251	773.06	1,728.93	539.57	3,041.56	71.55	-6.44	9.63
Pithoragarh ^H	7,090	505.00	965.00	609.80	2,079.80	29.33	1.80	39.00
Rudraprayag ^H	1,984	252.00	580.00	310.17	1,142.17	57.57	1.17	9.00
Tehri Garhwal ^H	3,642	272.71	1,084.08	709.19	2,065.98	56.73	0.98	97.44
Udham Singh Nagar ^H	2,542	149.16	188.75	93.88	431.79	16.99	-4.21	3.85
Uttarkashi ^H	8,016	614.67	1,706.86	714.47	3,036.00	37.87	8.00	21.00
Grand Total	53,483	5,046.76	12,805.24	6,451.04	24,303.04	45.44	8.04	383.17

TABLE 11.29.5 Forest Cover Change Matrix for Uttarakhand

(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	4,968	0	0	0	1	4,969
Moderately Dense Forest	79	12,787	6	0	12	12,884
Open Forest	0	18	6,406	2	16	6,442
Scrub	0	0	1	379	3	383
Non Forest	0	0	38	2	28,765	28,805
Total ISFR 2019	5,047	12,805	6,451	383	28,797	53,483
Net Change	78	-79	9	0	-8	

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

TABLE 11.29.6 Altitude-wise Forest Cover in Uttarakhand

(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	7,937	628	1,636	620	2,884 (11.87%)	9
500-1000	5,703	1,196	1,865	898	3,959 (16.29%)	104
1000-2000	17,560	1,569	5,165	3,306	10,040 (41.31%)	238
2000-3000	7,248	1,548	3,099	1,128	5,775 (23.76%)	20
3000-4000	4,193	106	1,039	494	1,639 (6.74%)	11
>4000	10,842	0	1	5	6 (0.03%)	1
Total	53,483	5,047	12,805	6,451	24,303	383

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

TABLE 11.29.7 Forest Cover in different slope classes in Uttarakhand

(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	9,446	843	1,470	641	2,954 (12.16%)	26
5-10	4,069	486	976	346	1,808 (7.44%)	18
10-15	5,688	614	1,507	642	2,763 (11.37%)	37
15-20	7,028	728	1,933	921	3,582 (14.74%)	58
20-25	7,313	729	2,051	1,048	3,828 (15.75%)	69
25-30	6,683	649	1,874	1,021	3,544 (14.58%)	67
>30	13,256	998	2,994	1,832	5,824 (23.96%)	108
Total	53,483	5,047	12,805	6,451	24,303	383

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



FIGURE 11.29.3 Forest Cover Map of Uttarakhand

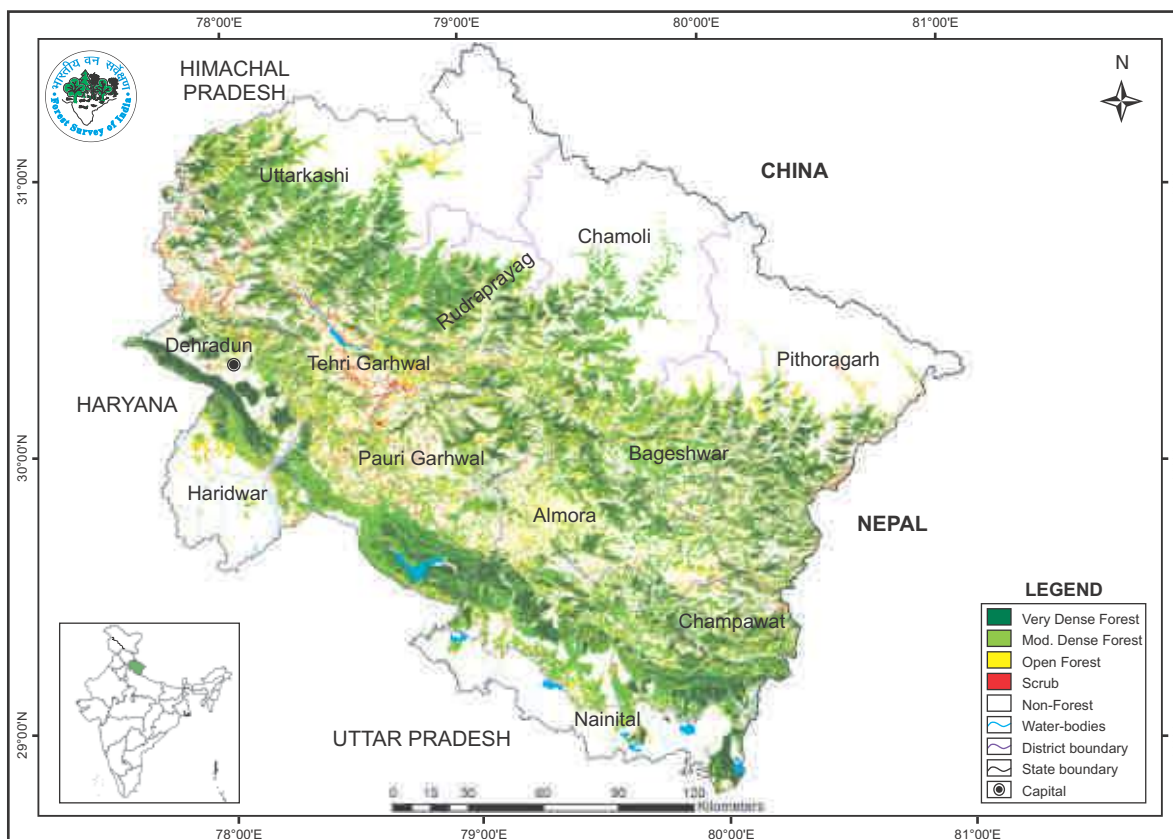


TABLE 11.29.8 Wetlands inside the Recorded Forest Area (or Green Wash) in Uttarakhand (in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	5	17
Ox-bow lake/Cut-off meander	5	14
High altitude Wetland	8	34
Riverine wetland	1	1
Waterlogged	1	9
River/Stream	75	38,932
Sub - Total	95	39,007
Inland Wetlands - Man-made		
Reservoir/Barrage	9	14,998
Tank/Pond	1	8
Sub - Total	10	15,006
Wetlands (<2.25 ha)	116	116
Total	221	54,129
Total Recorded Forest (or Green Wash) Area (in ha)		25,49,446
% of Wetland area inside Recorded Forest (or Green Wash) Area		2.12%

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

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

Table 11.29.9 Percentage area under different forest types of Uttarakhand

Sl.No.	Forest Type	% of Forest cover
1.	3C/C2a Moist Siwalik Sal Forest	14.05
2.	3C/C2c Moist Tarai Sal Forest	1.56
3.	3C/C2d (i) Western Light Alluvium Plains Sal Forest	0.62
4.	3C/DS1 Moist Sal Savannah	0.02
5.	3C/C3a West Gangatic Moist Mixed Deciduous Forest	4.04
6.	4C/FS2 Submontane Hill-Valley Swamp Forest	0.00
7.	5B/C1a Dry Siwalik Sal Forest	1.57
8.	5B/C1b Dry Plains Sal Forest	0.04
9.	5B/C2 Northern Dry Mixed Deciduous Forest	3.59
10.	5/DS1 Dry Deciduous Scrub	0.16
11.	5/1S2 Khair-Sissu Forest	0.97
12.	9/C1a Lower Or Siwalik Chir Pine Forest	0.18
13.	9/C1b Upper Or Himalayan Chir Pine Forest	27.97
14.	9/DS1 Himalayan Subtropical Scrub	1.61
15.	9/DS2 Subtropical Euphorbia Scrub	0.11
16.	12/C1a Ban Oak Forest (<i>Q.incana</i>)	13.86
17.	12/C1b Moru Oak Forest (<i>Q.dilatata</i>)	0.47
18.	12/C1c Moist Deodar Forest (<i>Cedrus</i>)	1.55
19.	12/C1d Western Mixed Coniferous Forest (Spruce, Blue Pine, Silver Fir)	5.01
20.	12/C1e Moist Temperate Deciduous Forest	0.79
21.	12/C1f Low-Level Blue Pine Forest (<i>P.wallichiana</i>)	0.09
22.	12/C1/DS1 Oak Scrub	0.14
23.	12/C1/DS2 Himalayan Temperate Secondary Scrub	0.06
24.	12/C2a Kharsu Oak Forest (<i>Q.semecarpifolia</i>)	3.08
25.	12/C2b West Himalayan Upper Oak/Fir Forest	5.49
26.	12/C2c (Moist Temperate Deciduous Forest)	0.79
27.	12/DS2 Himalayan Temperate Parkland	0.03
28.	12/DS3 Himalayan Temperate Pastures	0.16
29.	12/1S1 Alder Forest	0.03
30.	12/2S1 Low Level Blue Pine Forest	0.09
31.	13/C2b Dry Deodar Forest (<i>Cedrus</i>)	0.73
32.	13/C5 West Himalayan Dry Juniper Forest (<i>J.macropoda</i>)	0.02
33.	13/1S1 Hippophae / Myricaria Scrub	0.26
34.	14/C1a West Himalayan Sub-Alpine Birch/Fir Forest (<i>Betula/Abies</i>)	0.71
35.	14/C1b West Himalayan Sub-Alpine Fir Forest	2.06
36.	14/1S1 Hippophae / Myricaria Brakes	0.08
37.	14/1S2 Deciduous Sub-Alpine Scrub	0.16
38.	14/DS1 Sub-Alpine Pastures	0.82
39.	15/C1 Birch/Rhododendron Scrub Forest	0.45

Contd.

Sl.No.	Forest Type	% of Forest cover
40.	15/E1 Dwarf Rhododendron Scrub	0.06
41.	15/C3 (Alpine Pastures)	5.54
42.	16/C1 Dry Alpine Scrub	0.01
43.	16/E1 Dwarf Juniper Scrub	0.12
44.	Plantation/ TOF	0.85
	Total	100.00

11.29.3.1 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 11.29.10 and table 11.29.11 in respect of Uttarakhand.

TABLE 11.29.10 No. of species observed during the rapid assessment

Plant Type	Number of Species
Trees	112
Shrub	73
Herb	94

TABLE 11.29.11 Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Uttarakhand

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1.	Group 3- Tropical Moist Deciduous Forests	2.51	2.08	*
2.	Group 5- Tropical Dry Deciduous Forests	2.53	2.19	2.18
3.	Group 9- Subtropical Pine Forests	1.84	1.90	2.41
4.	Group 12- Himalayan Moist Temperate Forests	2.41	2.58	3.70
5.	Group 13- Himalayan Dry Temperate Forests	0.65	1.76	1.85
6.	Group 14- Sub Alpine Forests	*	2.49	2.82
7.	Group 15 - Moist Alpine Scrub	1.35	*	*
8.	Group 16- Dry Alpine Scrub	*	1.36	1.10

* adequate number of sample plots were not available

11.29.4 Fire Prone Forest Areas

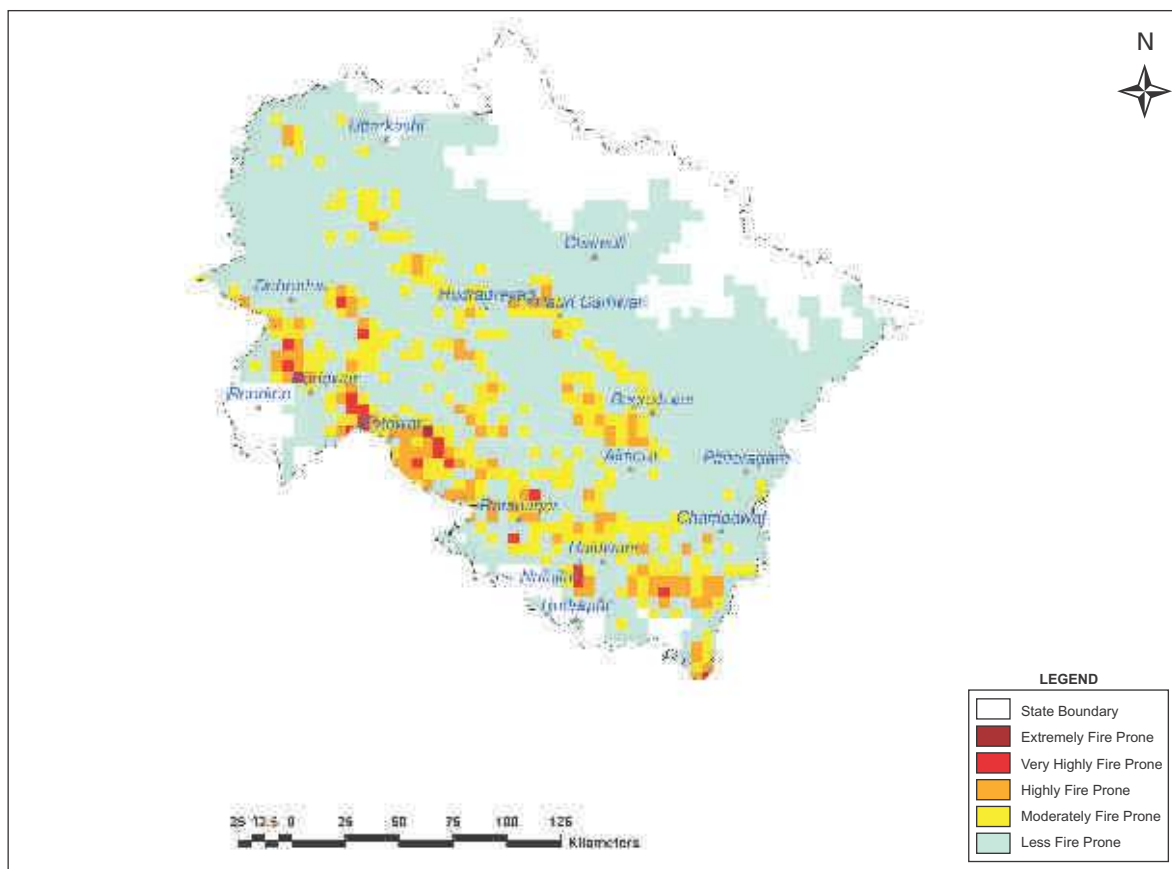
Geographical area under different classes of forest fire proneness are given in the following table.

TABLE 11.29.12 Forest Fire Prone Classes (in sq km)

Sl. No.	Forest Fire Prone Classes	Geographical Area	% of Total forest cover
1	Extremely fire prone	45.56	0.17
2	Very highly fire prone	443.12	1.60
3	Highly fire prone	2,689.15	9.32
4	Moderately fire prone	7,316.58	21.66
5	Less fire prone	32,275.70	67.25
	Total	42,770.11	100.00



FIGURE 11.29.4 Fire prone forest areas under different fire prone classes



11.29.5 Tree Cover

Forest cover presented in the section 11.29.2 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 Uttarakhand has been estimated as given in table 11.29.13.

TABLE 11.29.13 Tree Cover in Uttarakhand (in sq km)

Tree Cover	Area
	841

Tree cover of Uttarakhand has increased by 74 sq km as compared to the previous assessment reported in ISFR2017.

11.29.6 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 11.29.14 Extent of TOF in Uttarakhand (in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
7,513	841	8,354

11.29.7 Growing Stock in Uttarakhand

Growing stock in the recorded forest areas (RFA) in Uttarakhand is given in the table 11.29.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.29.16.

TABLE 11.29.15 Growing Stock in Forest (in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	406.08	9.50
Growing Stock in TOF	19.13	1.16

TABLE 11.29.16 Diameter class distribution of top five species inside RFA in Uttarakhand (in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Shorea robusta</i>	43,087	28,380	4,250
2.	<i>Pinus roxburghii</i>	1,10,278	52,652	4,344
3.	<i>Quercus leucotrichophora</i>	1,19,542	21,968	3,082
4.	<i>Mallotus philippinensis</i>	54,823	1,161	0
5.	<i>Rhododendron arboreum</i>	76,339	14,212	651

11.29.8 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 370.91 million tonnes (1,360.00 million tonnes of CO₂ equivalent) which is 5.21% of total forest carbon of the country. Pool wise forest carbon in Uttarakhand is given in the following table

TABLE 11.29.17 Forest Carbon in Uttarakhand in different pools (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
1,52,540	40,975	2,948	4,904	1,69,545	3,70,912

11.29.9 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 11.29.18

TABLE 11.29.18 Growing Stock of Bamboo in Uttarakhand

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	1,489	0.93
Total number of culms (in millions)	384	0.97
Total equivalent green weight (in '000' tonnes)	1,390	0.50

11.29.10 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Uttarakhand in Rural and Urban areas are given in the table 11.29.19 and table 11.29.20 respectively

TABLE 11.29.19 Top five tree species in TOF (Rural) in Uttarakhand

Sl. No.	Species	Relative Abundance (%)
1.	<i>Pinus roxburghii</i>	13.27
2.	<i>Grewia oppositifolia</i>	13.05
3.	<i>Mangifera indica</i>	12.61
4.	<i>Quercus leucotrichophora</i>	11.38
5.	<i>Ficus species</i>	6.03

TABLE 11.29.20 Top five tree species in TOF (Urban) in Uttarakhand

Sl. No.	Species	Relative Abundance (%)
1.	<i>Quercus leucotrichophora</i>	18.63
2.	<i>Mangifera indica</i>	14.33
3.	<i>Cedrus deodara</i>	7.36
4.	<i>Cupressus species</i>	5.63
5.	<i>Populus species</i>	4.58

11.29.11 Major NTFP and Invasive Species

Major NTFP and invasive species as assessed from forest inventory data are presented in the table 11.29.21 and table 11.29.22 respectively.

TABLE 11.29.21 Major NTFP species in the State of Uttarakhand

Sl. No.	Species	Plant Type	Relative Abundance (%)
1.	<i>Rhododendron arborium</i>	Tree	71.98
2.	<i>Myrica esculenta</i>	Tree	16.65
3.	<i>Lannea coromandelica</i>	Tree	3.35
4.	<i>Ehretia laevis</i>	Tree	3.15
5.	<i>Taxus baccata</i>	Tree	1.52

TABLE 11.29.22 Major invasive species in the State with RFA/Green Wash in Uttarakhand (in sq km)

Sl. No.	Species	Estimated Extent
1.	<i>Lantana camara</i>	605
2.	<i>Ageratina adenophora</i>	271
3.	<i>Saccharum spontanem</i>	104
4.	<i>Cassia tora</i>	42
5.	<i>Acacia farnesiana</i>	30

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

11.29.12 Quantified estimation of Dependence of People living in forest fringe villages on forests in Uttarakhand

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 Uttarakhand is given in the table 11.29.23

TABLE 11.29.23 Estimation of Dependence of People in Forest Fringe Villages on Forests in Uttarakhand

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
40,75,981	3,21,18,736	2,427	38,801