

# 11.10

## HIMACHAL PRADESH

### 11.10.1 Introduction

The State of Himachal Pradesh has a geographical area of 55,673 sq km, which constitutes 1.69% of the geographical area of the country. The State lies between 30°22'N to 33°12'N latitude and 75°45' E to 79°04' E longitude and is bordered by Jammu & Kashmir in the North, Punjab in the West, Haryana in the South and Uttarakhand in the Southwest. The State has international border with China in the East. Predominantly a mountainous State in the western Himalayas, the State has three distinct regions viz the Shiwaliks with altitude upto 1,500 m, middle Himalayan region between 1,500 m to 3,000 m and the Himadris higher than 3,000 m. About one third of the area in the State is permanently under snow, glaciers and cold desert. The tree growth is minimal in this region due to harsh conditions. The average annual rainfall is about 1,800 mm. The temperature varies from sub-zero to 35°C. The Satluj, Beas, Ravi, Chenab and Yamuna are the important rivers of the State. The State has 12 districts all of which are hill districts. There are three tribal districts. As per the 2011 census, Himachal Pradesh has a population of 6.86 million accounting for 0.57% of India's population. The rural and urban population constitutes 89.97% and 10.03% respectively. Tribal population is 5.71% of the State's population. The population density of the State is 123 per sq km which is much lower than the national average. The 19th livestock census 2012 has reported a total livestock population of 4.84 million.

**TABLE 11.10.1** Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	5,567	
Reporting area for land utilization	4,576	100.00
Forests	1,126	24.61
Not available for land cultivation	1,127	24.64
Permanent pastures and other grazing lands	1,511	33.01
Land under misc. tree crops and groves	64	1.39
Culturable wasteland	122	2.66
Fallow land other than current fallows	22	0.49
Current fallows	54	1.18
Net area sown	550	12.02

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



### 11.10.1.1 A Brief Overview of Forestry Scenario

As per the Champion & Seth Classification of Forest Types (1968), the forests in Himachal Pradesh belong to eight Type Groups which are further divided into 39 Forest Types. The forests in the State can be broadly classified into coniferous forests and broad-leaved forests. Distribution of species follows altitudinal zonation. The vegetation varies from dry scrub forests at lower altitudes to alpine pastures at higher altitudes. In between these two extremes, distinct vegetational zones of Mixed Deciduous Forests, Bamboo, Chir Pine, Oak, Deodar, Kail, Fir and Spruce are found. More than 95 species are endemic to Himachal Pradesh and characteristic of Western Himalayan flora, while about 5% (150 species) are exotic, introduced over the last 150 years. The State Government aims at bringing 50% of the geographical area under forest cover. Being a forest fire sensitive State, a detailed standard operating procedure called 'HP Forest Fire Manual – Prevention and Control' has been published by the State in 2018.

Recorded Forest Area (RFA) in the State is 37,033 sq km of which 1,898 sq km is Reserved Forests, 33,130 sq km is Protected Forests, and 2,005 sq km Unclassed Forests. In Himachal Pradesh, during the period 1st January 2015 to 5th February 2019, a total of 959.63 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF&CC, 2019).

The Protected Area network in the State has five National Parks, 28 Wildlife Sanctuaries and three Conservation Reserves, which cover 15.10% of geographical area of the State.

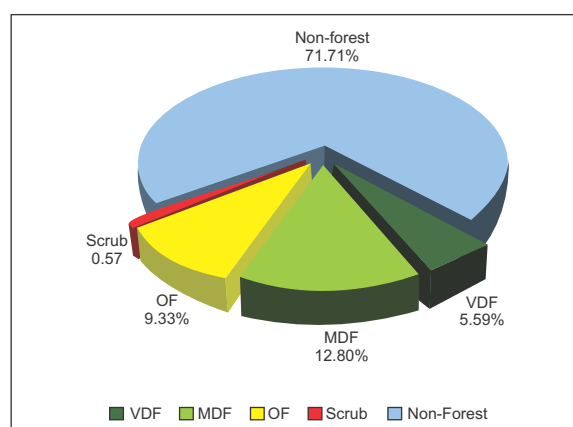
### 11.10.2 Forest Cover

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Oct to Dec 2017, the Forest Cover in the State is 15,433.52 sq km which is 27.72% of the State's geographical area. In terms of forest canopy density classes, the State has 3,112.71 sq km under Very Dense Forest (VDF), 7,125.93 sq km under Moderately Dense Forest (MDF) and 5,194.88 sq km under Open Forest (OF). Forest Cover in the State has increased by 333.52 sq km as compared to the previous assessment reported in ISFR 2017.

**TABLE 11.10.2** Forest Cover of Himachal Pradesh  
(in sq km)

Class	Area	% of GA
VDF	3,112.71	5.59
MDF	7,125.93	12.80
OF	5,194.88	9.33
<b>Total</b>	<b>15,433.52</b>	<b>27.72</b>
Scrub	315.28	0.57

**FIGURE 11.10.1** Forest Cover of Himachal Pradesh



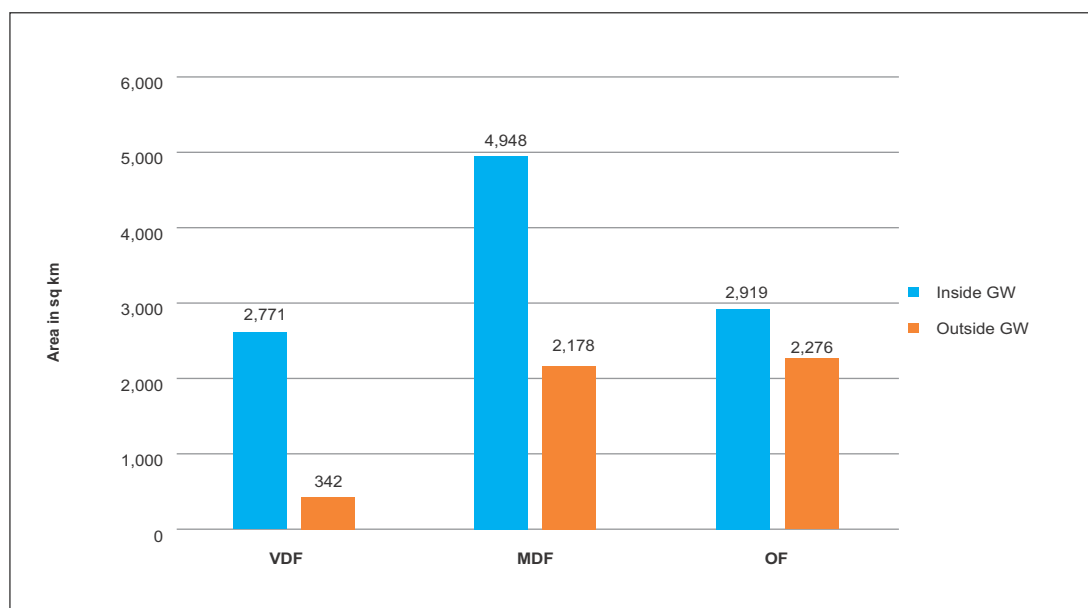
### 11.10.2.1 Forest Cover inside and outside Recorded Forest Area (or Green Wash)

The State has reported extent of recorded forest area (RFA) 37,033 sq km which is 66.52% of its geographical area. The reserved, protected and unclassified forests are 5.13%, 89.46% and 5.41% 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 14,024.98 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 11.10.3** Forest Cover inside and outside Recorded Forest Area or (Green Wash) in Himachal Pradesh (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
2,771	4,948	2,919	10,638	342	2,178	2,276	4,796
26.05%	46.51%	27.44%		7.13%	45.42%	47.45%	

\*in case of Himachal Pradesh Green Wash boundaries have been used.

**FIGURE 11.10.2** Forest Cover inside and outside Green Wash in Himachal Pradesh

**TABLE 11.10.4** District-wise Forest Cover in Himachal Pradesh (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			
Bilaspur <sup>H</sup>	1,167	21.70	190.72	168.28	380.70	32.62	5.70	1.70
Chamba <sup>TH</sup>	6,522	767.89	1,012.51	674.76	2,455.16	37.64	12.16	20.97
Hamirpur <sup>H</sup>	1,118	38.91	102.84	213.15	354.90	31.74	41.90	12.31
Kangra <sup>H</sup>	5,739	298.76	1,288.65	766.78	2,354.19	41.02	157.19	15.66
Kinnaur <sup>TH</sup>	6,401	79.81	329.28	236.90	645.99	10.09	22.99	60.37
Kullu <sup>H</sup>	5,503	586.08	879.25	510.96	1,976.29	35.91	-10.71	23.88
Lahul & Spiti <sup>TH</sup>	13,841	15.00	30.87	114.48	160.35	1.16	-32.65	15.37
Mandi <sup>H</sup>	3,950	368.51	756.98	647.53	1,773.02	44.89	12.02	19.96
Shimla <sup>H</sup>	5,131	745.74	1,090.30	583.37	2,419.41	47.14	20.41	30.37
Sirmaur <sup>H</sup>	2,825	130.22	689.96	570.69	1,390.87	49.23	3.87	56.98
Solan <sup>H</sup>	1,936	41.44	444.54	404.31	890.29	45.99	24.29	49.38
Una <sup>H</sup>	1,540	18.65	310.03	303.67	632.35	41.06	76.35	8.33
<b>Grand Total</b>	<b>55,673</b>	<b>3,112.71</b>	<b>7,125.93</b>	<b>5,194.88</b>	<b>15,433.52</b>	<b>27.72</b>	<b>333.52</b>	<b>315.28</b>

**TABLE 11.10.5** Forest Cover Change Matrix for Himachal Pradesh

(in sq km)

Class	2019 Assessment					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	3,088	20	2	0	0	<b>3,110</b>
Moderately Dense Forest	18	6,613	54	0	20	<b>6,705</b>
Open Forest	7	493	4,714	0	71	<b>5,285</b>
Scrub	0	0	0	264	44	<b>308</b>
Non Forest	0	0	425	51	39,789	<b>40,265</b>
<b>Total ISFR 2019</b>	<b>3,113</b>	<b>7,126</b>	<b>5,195</b>	<b>315</b>	<b>39,924</b>	<b>55,673</b>
Net Change	3	421	-90	7	-341	

Main reasons for the increase 333.52 sq km in forest cover in the State are plantation and conservation activities.

**TABLE 11.10.6** Altitude-wise Forest Cover in Himachal Pradesh

(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	2,925	13	458	360	831 (5.39%)	14
500-1000	7,625	220	1,912	1,589	3,721 (24.10%)	62
1000-2000	9,628	694	1,679	1,552	3,925 (25.43%)	124
2000-3000	8,101	1,814	2,225	1,057	5,096 (33.02%)	28
3000-4000	6,848	372	848	625	1,845 (11.96%)	70
>4000	20,546	0	4	12	16 (0.10%)	17
<b>Total</b>	<b>55,673</b>	<b>3,113</b>	<b>7,126</b>	<b>5,195</b>	<b>15,434</b>	<b>315</b>

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

**TABLE 11.10.7** Forest Cover in different slope classes in Himachal Pradesh

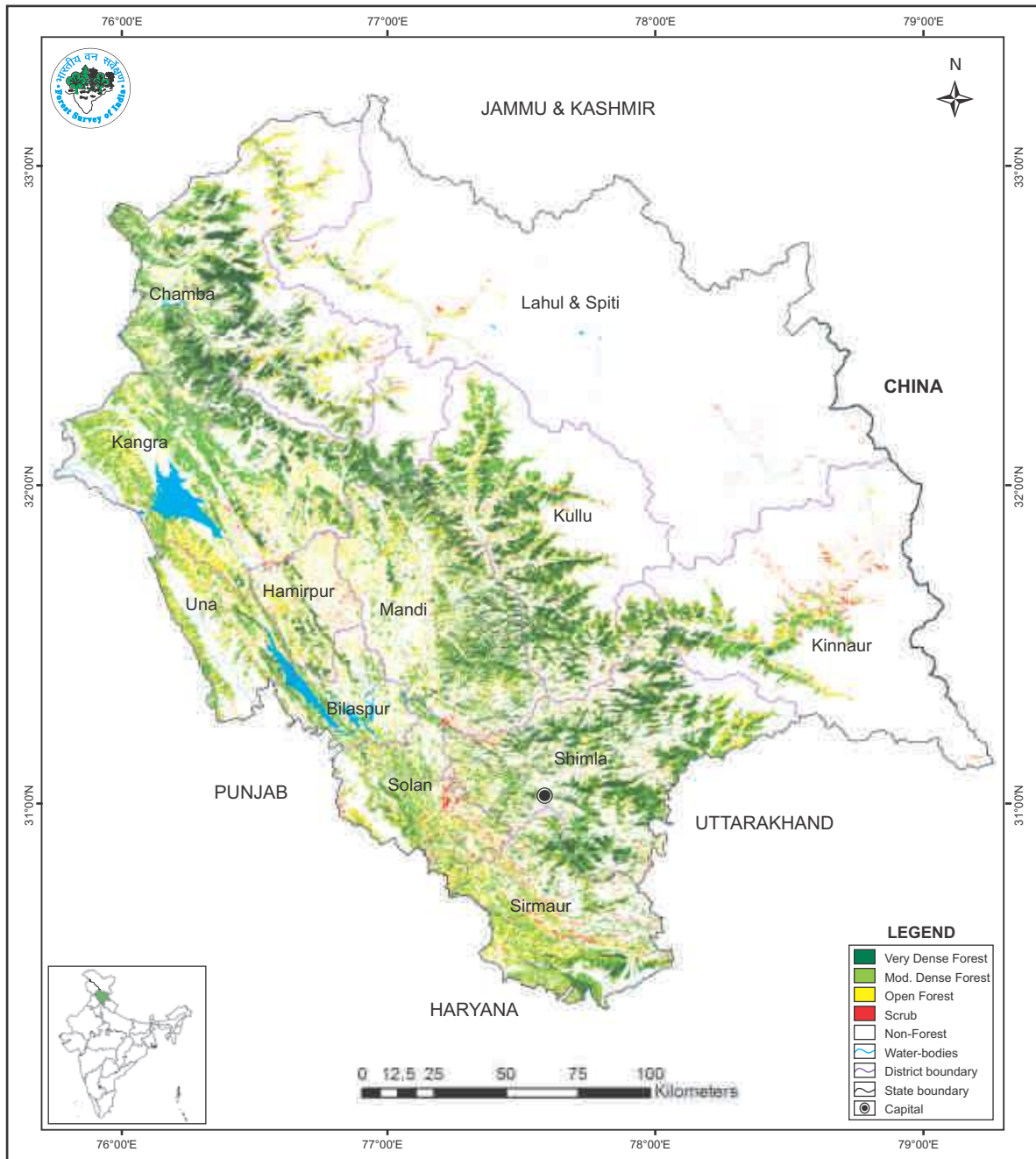
(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	6,362	69	438	551	1,058 (6.86%)	27
5-10	5,614	149	801	713	1,663 (10.78%)	27
10-15	6,424	282	975	730	1,987 (12.88%)	36
15-20	7,274	417	1,079	728	2,224 (14.41%)	44
20-25	7,570	497	1,082	690	2,269 (14.69%)	47
25-30	7,224	520	1,000	612	2,132 (13.81%)	46
>30	15,205	1,179	1,751	1,171	4,101 (26.57%)	88
<b>Total</b>	<b>55,673</b>	<b>3,113</b>	<b>7,126</b>	<b>5,195</b>	<b>15,434</b>	<b>315</b>

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



**FIGURE 11.10.3** Forest Cover Map of Himachal Pradesh



**TABLE 11.10.8** Wetlands inside the Recorded Forest Area (or Green Wash) in Himachal Pradesh (in ha)

Wetland Category	No. of Wetlands	Total Wetland Area
Inland Wetlands - Natural		
Lake/Pond	4	17
Waterlogged	2	3
River/Stream	44	6,207
<b>Sub - Total</b>	<b>50</b>	<b>6,227</b>
Inland Wetlands - Man-made		
Reservoir/Barrage	9	1936
Tank/Pond	4	6
Waterlogged	1	3
<b>Sub - Total</b>	<b>14</b>	<b>1,945</b>
Wetlands (<2.25 ha)	49	49
<b>Total</b>	<b>113</b>	<b>8,221</b>

Total Recorded Forest (or Green Wash) Area (in ha)	14,02,498
<b>% of Wetland area inside Recorded Forest (or Green Wash) Area</b>	<b>0.59%</b>

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

### 11.10.3 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 Himachal Pradesh as per the Champion & Seth classification (1968), according to the latest exercise are presented in the following table.

**TABLE 11.10.9** Percentage area under different forest types of Himachal Pradesh

Sl. No.	Forest Type	% of Forest cover
1.	3C/C2b(I) Bhabar-Dun Sal Forest	1.13
2.	5/1S2 Khair-sissu Forest	0.01
3.	5/DS1 Dry Deciduous Scrub	0.80
4.	5/DS3 ( <i>Euphorbia</i> Scrub)	0.03
5.	5/E9 Dry Bamboo Brake	0.49
6.	5B/C1a Dry Siwalik Sal Forest	0.51
7.	5B/C2 Northern Dry Mixed Deciduous Forest	12.70
8.	9/C1a Lower or Siwalik Chir Pine Forest	10.40
9.	9/C1b Upper or Himalayan Chir Pine Forest	3.76
10.	9/C1/DS1 Himalayan Subtropical Scrub	0.47
11.	12/1S1 Alder Forest	0.02
12.	12/2S1 Low Level Blue Pine Forest	2.79
13.	12/C1/DS1 Oak Scrub	1.31
14.	12/C1/DS2 Himalayan Temperate Secondary Scrub	0.67
15.	12/C1a <i>Ban</i> Oak Forest ( <i>Q.incana</i> )	4.43
16.	12/C1b <i>Moru</i> Oak Forest ( <i>Q.dilatata</i> )	0.07
17.	12/C1c Moist Deodar Forest ( <i>Cedrus</i> )	11.40
18.	12/C1d Western Mixed Coniferous Forest (Spruce, Blue Pine, Silver Fir)	14.03
19.	12/C1e Moist Temperate Deciduous Forest	0.81
20.	12/C2a <i>Kharsu</i> Oak Forest ( <i>Q.semecarpifolia</i> )	0.20

Contd.

Sl.No.	Forest Type	% of Forest cover
21.	12/C2b West Himalayan Upper Oak/Fir Forest	0.07
22.	12/DS1 Montane Bamboo Brakes	0.06
23.	12/DS3 Himalayan Temperate Pastures	4.36
24.	12/E1 Cypress Forest	0.02
25.	13/1S2 Populus / Salix Forest	0.02
26.	13/C1 Dry Broadleaved and Coniferous Forest ( <i>Q.ilex- P. gerardiana</i> )	0.04
27.	13/C2a Neoza Pine Forest ( <i>P.gerardiana</i> )	0.63
28.	13/C2b Dry Deodar Forest ( <i>Cedrus</i> )	1.19
29.	13/C3 West Himalayan Dry Temperate Deciduous Forest	0.00
30.	13/C4 West Himalayan High Level Dry Blue Pine Forest ( <i>P. wallichiana</i> )	0.65
31.	13/C5 West Himalayan Dry Juniper Forest ( <i>J. macropoda</i> )	0.79
32.	14/C1a West Himalayan Sub-Alpine High Level Fir Forest	0.92
33.	14/C1b West Himalayan Birch/Fir Forest	3.37
34.	15/C1 Birch/ <i>Rhododendron</i> Scrub Forest	0.29
35.	15/C2 Deciduous Alpine Scrub	0.05
36.	15/C3 Alpine Pasture	13.96
37.	15/E1 Dwarf <i>Rhododendron</i> Scrub	0.02
38.	16/C1 Dry Alpine Scrub	0.97
39.	16/E1 Dwarf Juniper Scrub	1.57
40.	Plantation/ TOF	4.99
	<b>Total</b>	<b>100.00</b>

### 11.10.3.1 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 11.10.10 and table 11.10.11 in respect of Himachal Pradesh.

**TABLE 11.10.10** No. of species observed during the rapid assessment

Plant Type	Number of Species
Tree	116
Shrub	99
Herb	109

**TABLE 11.10.11** Shannon-Wiener Index of Tree, Shrub and Herb species in different Type Groups of Himachal Pradesh

Sl.No.	Forest Type Group	Shannon-Wiener Index		
		Tree	Shrub	Herb
1.	Group 3- Tropical Moist Deciduous Forests	1.95	2.15	1.71
2.	Group 5- Tropical Dry Deciduous Forests	2.87	2.13	1.95
3.	Group 9- Subtropical Pine Forests	2.63	2.17	1.89
4.	Group 12- Himalayan Moist Temperate Forests	2.95	3.25	3.48
5.	Group 13- Himalayan Dry Temperate Forests	2.03	2.56	2.51
6.	Group 14- Sub Alpine Forests	1.64	1.83	1.87
7.	Group 15- Moist Alpine Scrub	0.17	*	*
8.	Group 16- Dry Alpine Scrub	0.87	2.34	2.30

\*adequate number of sample plots were not available

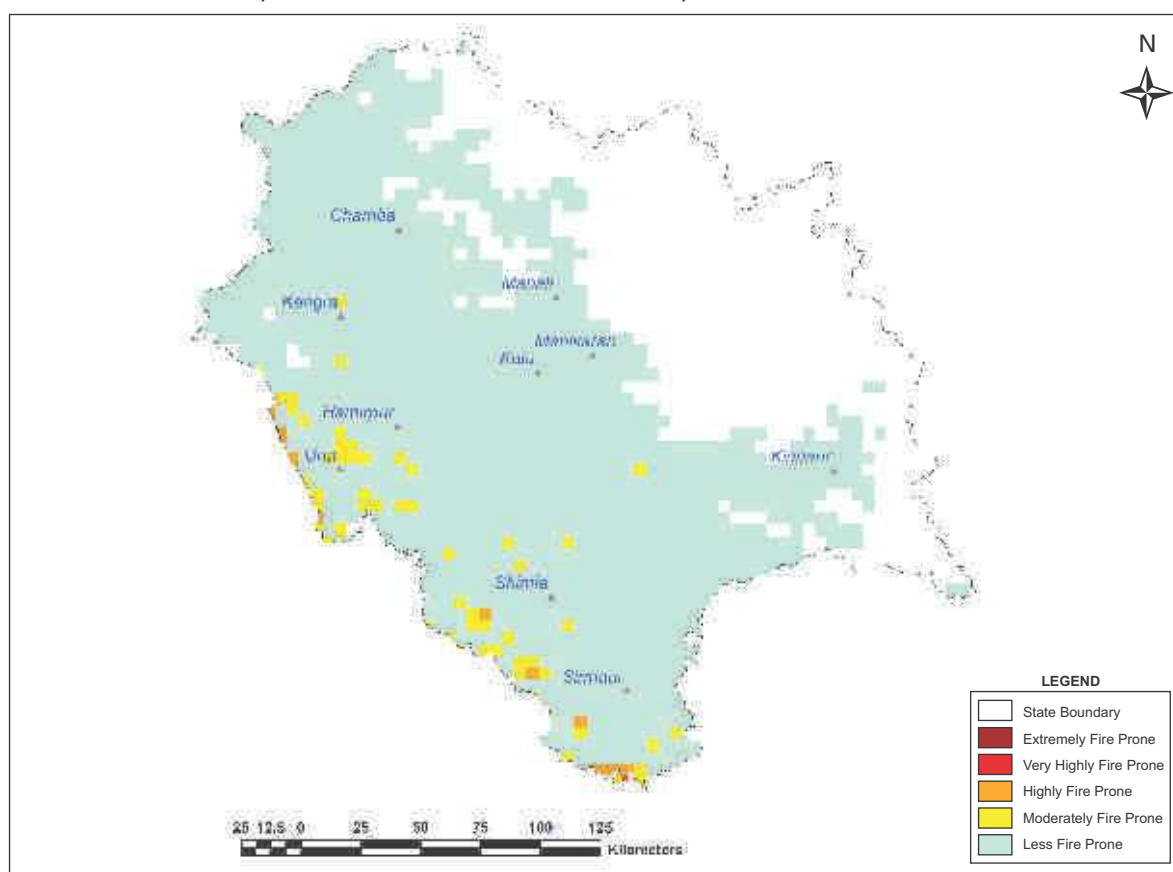
### 11.10.4 Fire Prone Forest Areas

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

**TABLE 11.10.12** 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	4.76	0.03
3.	Highly fire prone	220.4	1.18
4.	Moderately fire prone	1,204.52	4.59
5.	Less fire prone	35,829.66	94.20
	<b>Total</b>	<b>37,259.42</b>	<b>100.00</b>

**FIGURE 11.10.4** Fire prone forest areas under different fire prone classes



### 11.10.5 Tree Cover

Forest cover presented in the section 11.10.2 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 Himachal Pradesh has been estimated as given in table 11.10.13.

**TABLE 11.10.13** Tree Cover in Himachal Pradesh (in sq km)

Tree Cover	Area
	829



Tree cover of Himachal Pradesh has increased by 7 sq km as compared to the previous assessment reported in ISFR2017.

#### 11.10.6 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 11.10.14** Extent of TOF in Himachal Pradesh (in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
4,796	829	5,625

#### 11.10.7 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Himachal Pradesh is given in the table 11.10.15. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 11.10.16

**TABLE 11.10.15** Growing Stock in Himachal Pradesh (in m cum)

Growing Stock (GS)		% of Country's GS
Growing Stock in Recorded Forest Area	347.07	8.12
Growing Stock in TOF	25.19	1.53

**TABLE 11.10.16** Diameter class distribution of top five species inside RFA in Himachal Pradesh (in '000)

Sl.No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Cedrus deodara</i>	48,821	16,723	3,546
2.	<i>Pinus wallichiana</i>	30,849	11,563	3,808
3.	<i>Quercus leucotrichaphora</i>	74,936	12,287	622
4.	<i>Pinus roxburghii</i>	50,408	18,922	1,969
5.	<i>Mallotus philippinensis</i>	24,768	72	0

#### 11.10.8 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 252.36 million tonnes (925.32 million tonnes of CO<sub>2</sub> equivalent) which is 3.54% of total forest carbon of the country. Pool wise forest carbon in Himachal Pradesh is given in the following table

**TABLE 11.10.17** Forest Carbon in Himachal Pradesh in different pools (in '000 tonnes)

AGB	BGB	Dead wood	Litter	SOC	Total
1,10,045	30,745	2,559	2,711	1,06,300	2,52,360

#### 11.10.9 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 11.10.18

**TABLE 11.10.18** Growing Stock of Bamboo in Himachal Pradesh

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	650	0.41
Total number of culms (in millions)	485	1.23
Total equivalent green weight (in 000' tonnes)	1,975	0.71

**11.10.10 Dominant tree species in Trees Outside Forests (TOF)**

Top five species in numbers in Trees Outside Forests in Himachal Pradesh in Rural and Urban areas are given in the table 11.10.19 and table 11.10.20 respectively

**TABLE 11.10.19** Occurrence of top five tree species in TOF (Rural) in Himachal Pradesh

Sl. No.	Species	Relative Abundance (%)
1.	<i>Pinus roxburghii</i>	21.83
2.	<i>Acacia catechu</i>	9.05
3.	<i>Grewia oppositifolia</i>	8.79
4.	<i>Cedrus deodara</i>	5.36
5.	<i>Quercus leucotrichophora</i>	3.64

**TABLE 11.10.20** Occurrence of top five tree species in TOF (Urban) in Himachal Pradesh

Sl. No.	Species	Relative Abundance (%)
1.	<i>Pinus roxburghii</i>	11.53
2.	<i>Morus species</i>	9.07
3.	<i>Grewia oppositifolia</i>	8.16
4.	<i>Mangifera indica</i>	6.64
5.	<i>Cedrela toona</i>	5.15

**11.10.11 Invasive Species**

Invasive species as assessed from forest inventory data are presented in the table 11.10.21.

**TABLE 11.10.21** Major invasive species in the State inside the RFA/Green Wash in Himachal Pradesh (in sq km)

Sl. No.	Species	Estimated Extent
1	<i>Lantana camara</i>	654
2	<i>Ageratina adenophora</i>	39
3	<i>Ageratum conyzoides</i>	36
4	<i>Melochia corchorifolia</i>	30
5	<i>Dioscorea deltoidea</i>	29

Invasive species are given in terms of their estimated extent.

**11.10.12 Quantified estimation of Dependence of People living in forest fringe villages on forests in Himachal Pradesh**

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 Himachal Pradesh is given in the table 11.10.22

**TABLE 11.10.22** Estimation of Dependence of People in Forest Fringe Villages on Forests in Himachal Pradesh

Fuelwood (tonnes)	Fodder (tonnes)	Bamboo (tonnes)	Small Timber (cum)
5,92,761	32,55,579	593	11,264