

13.23

SIKKIM



Geographical Area
7,096 sq km

Geographical Coordinates
Latitude- 27° 04' N to 28° 07' N
Longitude-88° 00' E to 88° 55' E

Population (as per Census 2011)
0.61 million
Urban 0.153 million (25.15 %)
Rural 0.457 million (74.85 %)
Tribal 0.206 million (33.72 %)

Average Population Density
86 per sq km

Livestock population
(as per 19th Live Stock Census)
0.29 million

No. of Districts
4

No. of Hill Districts
4

No. of Tribal Districts
4

Table 13.23.1 Land Use Pattern

Land Use Types	Area (in '000 ha)	Percentage
Geographical Area	710	
Reporting area for land utilization	441	100.00
Forests	334	75.74
Not available for land cultivation	10	2.27
Permanent pastures and other grazing lands	-	-
Land under misc. tree crops and groves	4	0.91
Culturable wasteland	4	0.91
Fallow land other than current fallows	5	1.13
Current fallows	7	1.58
Net area sown	77	17.46

Source: Land Use Statistics, Ministry of Agriculture, GOI, (2017-18)

13.23.1 Forest Cover

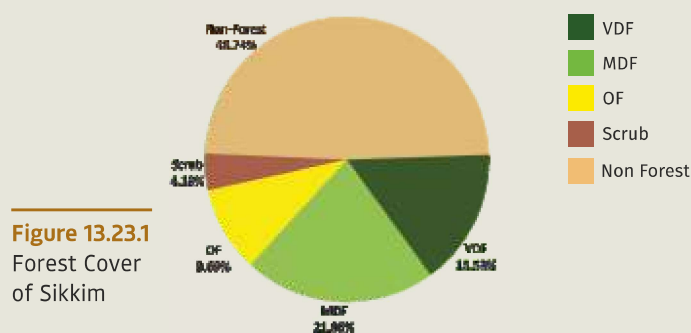


Table 13.23.2 Forest Cover of Sikkim (in sq km)

Class	Area	% of GA
VDF	1,101.82	15.53
MDF	1,551.06	21.86
OF	688.15	9.69
Total	3,341.03	47.08
Scrub	296.44	4.18

Table 13.23.3 District- wise Forest Cover in Sikkim

(in sq km)

District	Geo-graphical Area (GA)	2021 Assessment				%of GA	Change wrt 2019 assessment	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
East Sikkim TH	954	271.67	313.00	128.60	713.27	74.77	0.55	54.19
North Sikkim TH	4,226	410.36	586.04	285.91	1,282.31	30.34	-1.74	197.17
South Sikkim TH	750	173.39	288.99	108.76	571.14	76.15	-0.68	3.71
West Sikkim TH	1,166	246.40	363.03	164.88	774.31	66.41	0.41	41.37
Grand Total	7,096	1,101.82	1,551.06	688.15	3,341.03	47.08	-1.46	296.44

13.23.1.1 Forest Cover Inside and Outside Recorded Forest Area (or Green Wash)

The Forest Cover inside and outside Recorded Forest Area (RFA) has been analysed in different categories and presented in Table given below.

Table 13.23.4 Forest Cover Inside and Outside Recorded Forest Area (or Green Wash) in Sikkim

(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
832	879	343	2,054	270	672	345	1,287
40.51%	42.79%	16.70%		20.98%	52.21%	26.81%	

*in case of Sikkim, RFA boundaries have been used.

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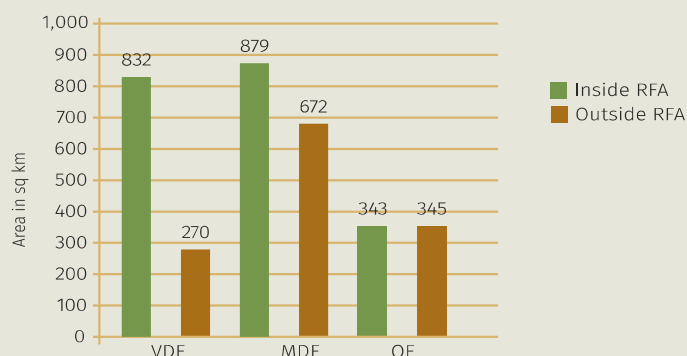


Figure 13.23.2
Forest Cover Inside
and Outside of RFA
in Sikkim

Table 13.23.5 Forest Cover Change Matrix for Sikkim

(in sq km)

Class	2021 Assessment					Total ISFR 2019
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	1,101	1	0	0	0	1,102
Moderately Dense Forest	1	1,550	1	0	0	1,552
Open Forest	0	0	685	1	2	688
Scrub	0	0	1	291	15	307
Non Forest	0	0	1	4	3,442	3,447
Total ISFR 2021	1,102	1,551	688	296	3,459	7,096
Net Change	0	-1	0	-11	12	

Table 13.23.6 Altitude-wise Forest Cover in Sikkim

(in sq km)

Altitude Zone (m)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-500	50	0	20	16	36	1
500-1000	375	12	154	95	261	12
1000-2000	1,306	277	572	246	1,095	15
2000-3000	1,155	577	404	91	1,072	7
3000-4000	1,103	230	368	172	770	105
>4000	3,107	6	33	68	107	156
Total	7,096	1,102	1,551	688	3,341	296

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

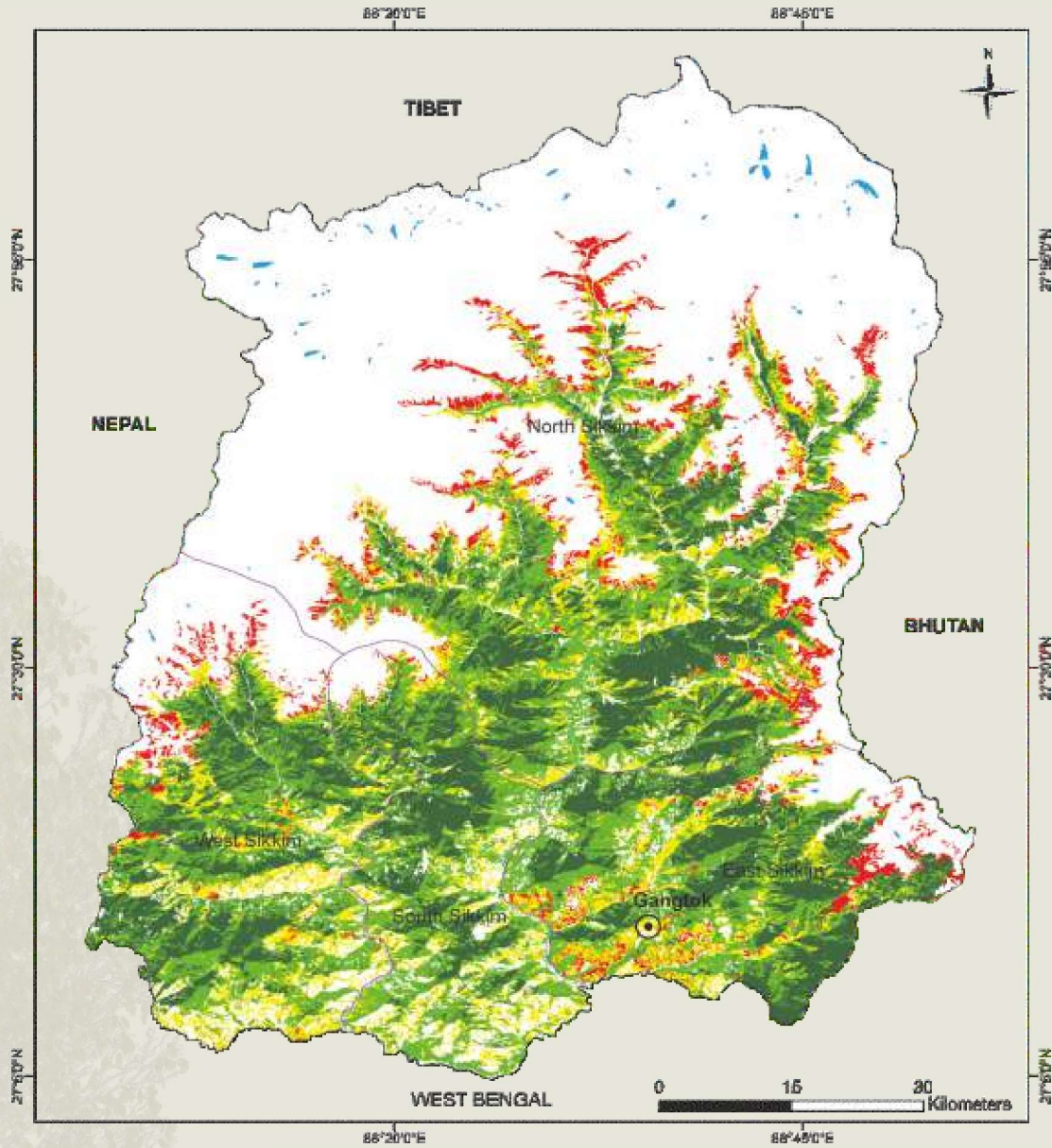
Table 13.23.7 Forest Cover in different slope classes in Sikkim

(in sq km)

Slope (in degrees)	Geographical Area	VDF	MDF	OF	Total	Scrub
0-5	351	13	16	7	36	8
5-10	554	48	57	25	130	20
10-15	767	109	130	54	293	34
15-20	969	167	211	89	467	45
20-25	1,062	199	266	111	576	50
25-30	1,034	198	275	116	589	18
>30	2,359	368	596	286	1,250	121
Total	7,096	1,102	1,551	688	3,341	296

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

Figure 13.23.3 Forest Cover Map of Sikkim



LEGEND

- Very Dense Forest
- Moderately Dense Forest
- Open Forest
- Scrub
- Non-Forest
- Water-bodies
- International Boundary
- State Boundary
- District Boundary
- Capital

13.23.2 Forest Types

The area under different forest types of Sikkim as per the Champion & Seth classification (1968), according to the Atlas Forest Types of India 2020 are presented in the following Table.

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Table 13.23.8 Area statistics of the Forest Types found in Sikkim

(in sq km)

Sl. No.	Forest Type	Area	% of the total mapped area*
1.	3C/C1a(I) East Himalayan sal	69.47	1.84
2.	3C/C3b East Himalayan moist mixed deciduous forest	194.86	5.15
3.	8B/C1 East Himalayan sub-tropical wet hill forest	905.73	23.93
4.	11B/C1b <i>Buk</i> oak forest	874.93	23.11
5.	12/C3a East Himalayan mixed coniferous forest	224.16	5.92
6.	12/DS1 Montane bamboo brakes	7.04	0.19
7.	14/C2 East Himalayan sub-alpine birch/fir forest	912.14	24.09
8.	15/C1 Birch/ <i>Rhododendron</i> scrub forest	128.19	3.39
9.	15/E1 Dwarf <i>Rhododendron</i> scrub	11.44	0.30
10.	15/E2 Dwarf juniper scrub	187.94	4.96
Sub Total		3,515.90	92.88
11.	TOF/Plantation	133.24	3.52
Total (Forest Cover & Scrub)		3,649.14	
Grassland forest type (outside forest cover)			
12.	15/C3 Alpine pastures	136.28	3.60
Grand Total		3,785.42	100.00

*Forest Types have been assigned to the natural forest formations under forest cover and scrub categories shown in forest cover mapping (ISFR, 2019). Grassland forest type outside forest cover has also been mapped. The total mapped area, therefore, is sum of forest cover, scrub and grassland forest types (found in non-forest).

13.23.3 Fire Prone Forest Areas

Forest Cover under different classes of forest fire proneness is given in following table.

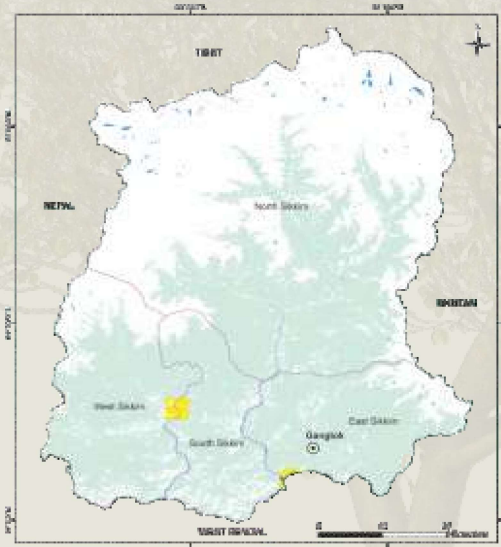
Table 13.23.9 Forest Fire Prone Classes (in sq km)

Sl. No.	Forest Fire Prone Classes	Forest Cover	% of Total Forest Cover
1.	Extremely fire prone	0.00	0.00
2.	Very highly fire prone	0.00	0.00
3.	Highly fire prone	0.00	0.00
4.	Moderately fire prone	25.30	0.76
5.	Less fire prone	3,315.70	99.24
Total		3,341.00	100.00

LEGEND

	Extremely Fire Prone
	Very Highly Fire Prone
	Highly Fire Prone
	Moderately Fire Prone
	Less Fire Prone
	Water-bodies
	International Boundary
	State Boundary
	District Boundary
	Capital

Figure 13.23.4 Fire prone forest areas under different fire prone classes



13.23.4 Tree Cover

Tree cover is defined as all tree patches of size less than 1 ha occurring outside the recorded forest area. Tree cover includes trees in all formations including scattered trees. Tree cover in Sikkim has been estimated as given in following table.

Table 13.23.10 Tree Cover in Sikkim (in sq km)

2019 Assessment	2021 Assessment	Change wrt 2019 Assessment
36	39	3

13.23.5 Extent of Trees Outside Forest (TOF)

Trees outside Forests (TOF) refer to tree resources found outside the forests as defined in the Government records. 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 following table.

Table 13.23.11 Extent of TOF in Sikkim (in sq km)

Forest Cover outside the RFA/GW	Tree Cover	Extent of TOF
1,287	39	1,326

13.23.6 Growing Stock in Forest

Growing stock in the recorded forest areas (RFA) in Sikkim is given in the Table 13.23.12. Diameter class-wise distribution of top 5 species in numbers derived from the forest inventory data is presented in the table 13.23.13.

Table 13.23.12 Growing Stock in Sikkim (in m cum)

Sl. No.	Growing Stock (GS)	2019 Assessment	2021 Assessment	Change wrt 2019 Assessment	% of Country's GS
1.	Growing Stock in Recorded Forest Area	35.32	33.91	-1.41	0.77
2.	Growing Stock in TOF	1.94	1.73	-0.21	0.10

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Table 13.23.13 Diameter class distribution of top five tree species inside RFA in Sikkim

(in '000)

Sl. No.	Species	Dia class (cm)		
		10-30	30-60	>60
1.	<i>Schima wallichii</i>	4,073	1,284	97
2.	<i>Castanopsis</i> spp.	2,617	1,720	700
3.	<i>Shorea robusta</i>	2,869	1,127	216
4.	<i>Machilus</i> spp.	620	679	401
5.	<i>Alnus</i> spp.	475	852	100

13.23.7 Dominant tree species in Trees Outside Forests (TOF)

Top five species in numbers in Trees Outside Forests in Sikkim in Rural and Urban areas are given in the Table 13.23.14 and Table 13.23.15 respectively.

Table 13.23.14 Top five tree species in TOF (Rural) in Sikkim

Sl. No.	Species	Relative Abundance (%)
1.	<i>Schima wallichii</i>	19.50
2.	<i>Alnus</i> spp.	8.80
3.	<i>Ficus</i> spp.	6.45
4.	<i>Macaranga</i> spp.	5.22
5.	<i>Castanopsis</i> spp.	4.13

Table 13.23.15 Top five tree species in TOF (Urban) in Sikkim

Sl. No.	Species	Relative Abundance (%)
1.	<i>Crypomeria japonica</i>	11.96
2.	<i>Schima wallichii</i>	11.77
3.	<i>Macaranga</i> spp.	9.00
4.	<i>Ficus</i> spp.	7.87
5.	<i>Prunus cornata</i>	5.41

13.23.8 Carbon Stock in Forest

The total Carbon stock of forest in the State including the TOF patches which are more than 1ha in size is 55.54 million tonnes (203.65 million tonnes of CO₂ equivalent) which is 0.77 % of total forest carbon of the country. Pool wise forest carbon in Sikkim is given in the following table.

Table 13.23.16 Forest Carbon in Sikkim in different pools

(in '000 tonnes)

Sl. No.	Carbon Pools	Forest Carbon
1.	AGB	18,024
2.	BGB	5,466
3.	Dead wood	498
4.	Litter	607
5.	SOC	30,944
Total		55,539

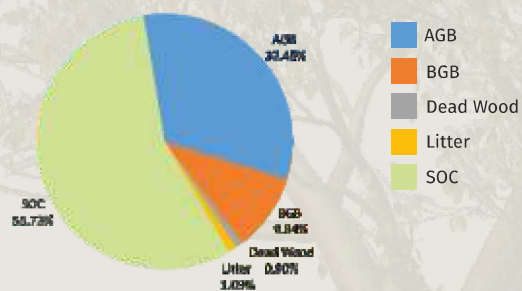


Figure 13.23.5 Forest Carbon in Sikkim

13.23.9 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 following table.

Table 13.23.17 Growing Stock of Bamboo in Sikkim

Growing Stock (GS)		% of Country's GS of Bamboo
Bamboo bearing area inside RFA/Green Wash (in sq km)	994	0.67
Total number of culms (in millions)	326	0.61
Total equivalent green weight (in '000 tonnes)	624	0.16

13.23.10 Major NTFP and Invasive Species

Major NTFP and invasive species as assessed from forest inventory data are presented in the Table 13.23.18 and Table 13.23.19 respectively.

Table 13.23.18 Major NTFP Species in Sikkim

Sl. No.	Species	Plant Type	Relative Abundance (%)
1.	<i>Nephrolepis</i> spp.	Herbs	81.31
2.	<i>Spondias axillaris</i>	Tree	4.67
3.	<i>Diplagium</i> spp.	Herbs	4.67
4.	<i>Thysanolaena latifolia</i>	Shrub	4.67
5.	<i>Polygonum</i> spp.	Shrub	2.80

Table 13.23.19 Major invasive species in the State inside the RFA/Green Wash in Sikkim (in sq km)

Sl. No.	Species	Estimated Extent
1.	<i>Glinisoga parviflora</i>	10
2.	<i>Acacia farnesiana</i>	7
3.	<i>Parthenium hysterophorus</i>	2
4.	<i>Solanum viarum</i>	1
5.	<i>Lantana camara</i>	0.44

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

