

2. Forest Cover

2.1 Introduction

The forest cover includes all lands which have a tree canopy density of 10 percent and above and have a minimum area of one hectare. The forest cover reported in the ISFR does not make any distinction between the origins of forest stand (whether natural or man-made) or tree species and encompasses all types of lands irrespective of their ownership, land use and legal status. Thus, all tree species along with bamboos, fruit bearing trees, coconut, palm, etc. and all areas including forest, private, community or institutional lands meeting the above defined criteria have been termed as forest cover.

The satellite based remote sensing data of LISS-III has been used in the forest cover assessment. The mapping has been carried out at a scale of 1:50,000 with Minimum Mapping Unit (MMU) of one ha. The digital image analysis of satellite data for forest cover mapping takes into consideration the reflectance behavior of different tree covers. The reflectance from the trees is

dependent on the crown foliage and chlorophyll content present in the leaves that is exposed to the incident radiation of the sun. In technical terms, it is the leaf area index (LAI) that determines the extent of the leaf area exposed to the radiation and accordingly being reflected back to the sensor. There are other factors as well that influence the reflectance behavior of the various features on the ground. The use of LISS-III sensor data of 23.5m x 23.5m pixel size, choice of 1:50,000 map scale and one hectare area as Minimum Mapping Unit (MMU) is based on various considerations such as large area of the country to be mapped, short periodicity of two years between successive cycles, country level perspective of reporting and data availability. The MMU of one hectare may be described as the cartographic limit of the stated map scale corresponding to a discernible polygon of 2 mm by 2 mm in size on the map.

Classification scheme for the purpose of assessment in this report is described as follows:

Class	Description
Very Dense Forest	All lands with tree canopy density of 70% and above.
Moderately Dense Forest	All lands with tree canopy density of 40% and more but less than 70%.
Open Forest	All lands with tree canopy density of 10% and more but less than 40%.
Scrub	Degraded forest lands with canopy density less than 10%.
Non-forest	Lands not included in any of the above classes.

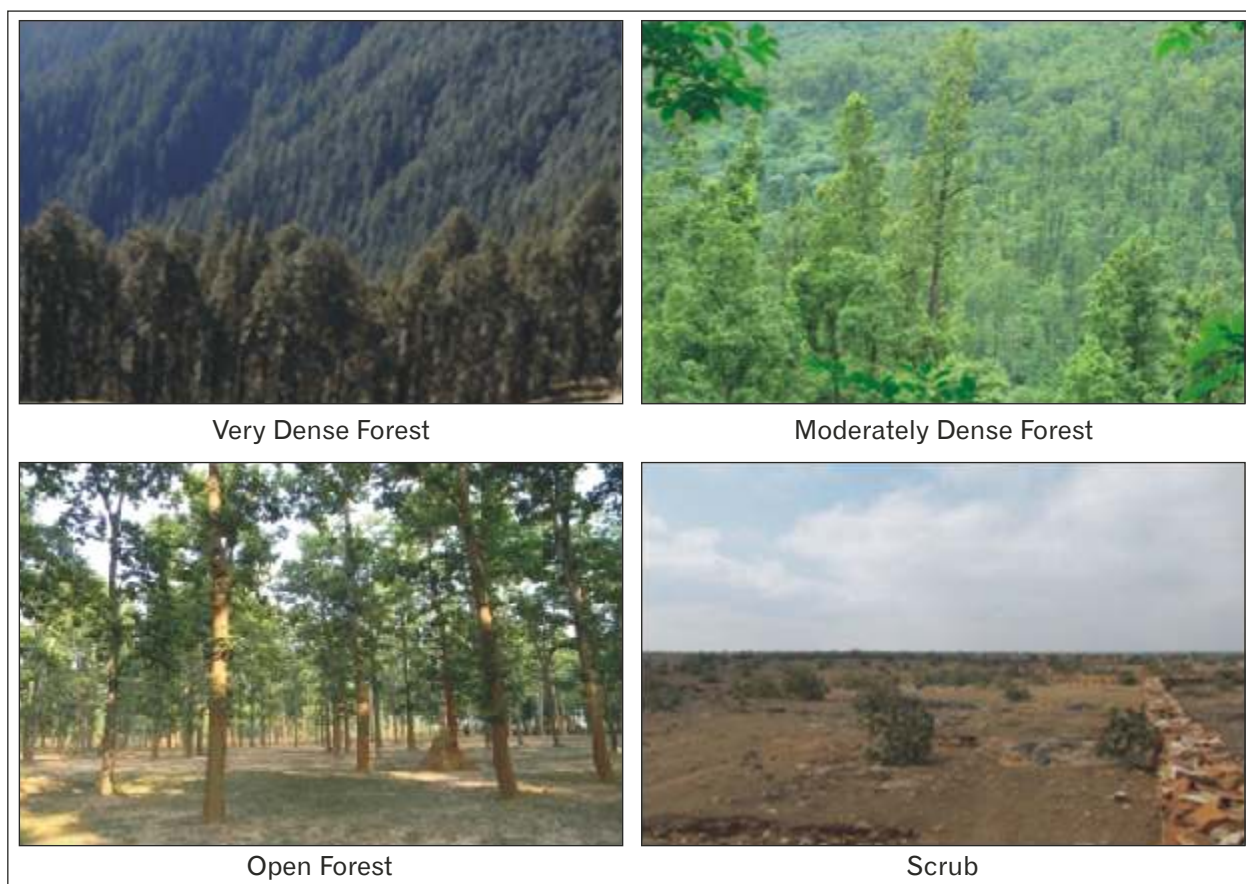


Photo: Vipin Rao & Anupam Ghosh, TA, FSI

Fig 2.1: Different Forest Density Classes and Scrub

2.2 Methodology

The forest cover mapping involves a series of steps as shown in the schematic diagram in Figure 2.2. The cloud free satellite data is procured from NRSC for the entire country for the period October to January. In the present report, standard UTM WGS84 has been used in the registration of images as per the universally accepted practices. The geometric rectification (co-registration) of the image data has been carried out primarily in reference to the previous cycle geo-referenced imageries to ensure that the successive forest cover maps have a high degree of image to image correspondence from the point of view of mapped features.

The hybrid classification approach followed in forest cover mapping utilizes the potential of the algorithms to generate clusters of pixels having close association and then assigning information class, i.e., appropriate forest cover density class to each cluster. This is further supported by the interpreter's knowledge, information from collateral sources and the observations made during ground truthing. Periodic ground data collected by field parties and the other ground truth information form the basis for the training data generation and accuracy assessment of the interpreted image data.

The forest cover assessment data of the previous cycles available with FSI serve as

important information for successive forest cover classification. The approach followed in the current assessment also involves comparison of the current satellite data with the previous forest cover map and analysing the discernible changes occurring due to improvement or degradation in the forest cover.

The interpretation work has been carried out taking 1°x1° SOI topographical sheets as the basis of extent. This has been followed by extensive field visits for ground truthing. In the current assessment around 3,000 points have been visited by teams of interpreters who carried out interpretation of the satellite data pertaining to those map sheets. The field observations have been incorporated in the

classified maps highlighting the forest cover changes compared to the previous assessment. The change maps were also sent to the State Forest Departments (SFDs) for validation. The feedback received from SFDs helped in improving the classification accuracy. For generating district level forest cover, district boundaries have been overlaid on sheet-wise forest cover.

2.2.1 Limitations of Remote Sensing Data

The remote sensing data has certain inherent limitations that affect the accuracy of the forest cover mapping. Some of these limitations are mentioned below:

- Since the resolution of the LISS-III sensor data is 23.5 m, the land cover having

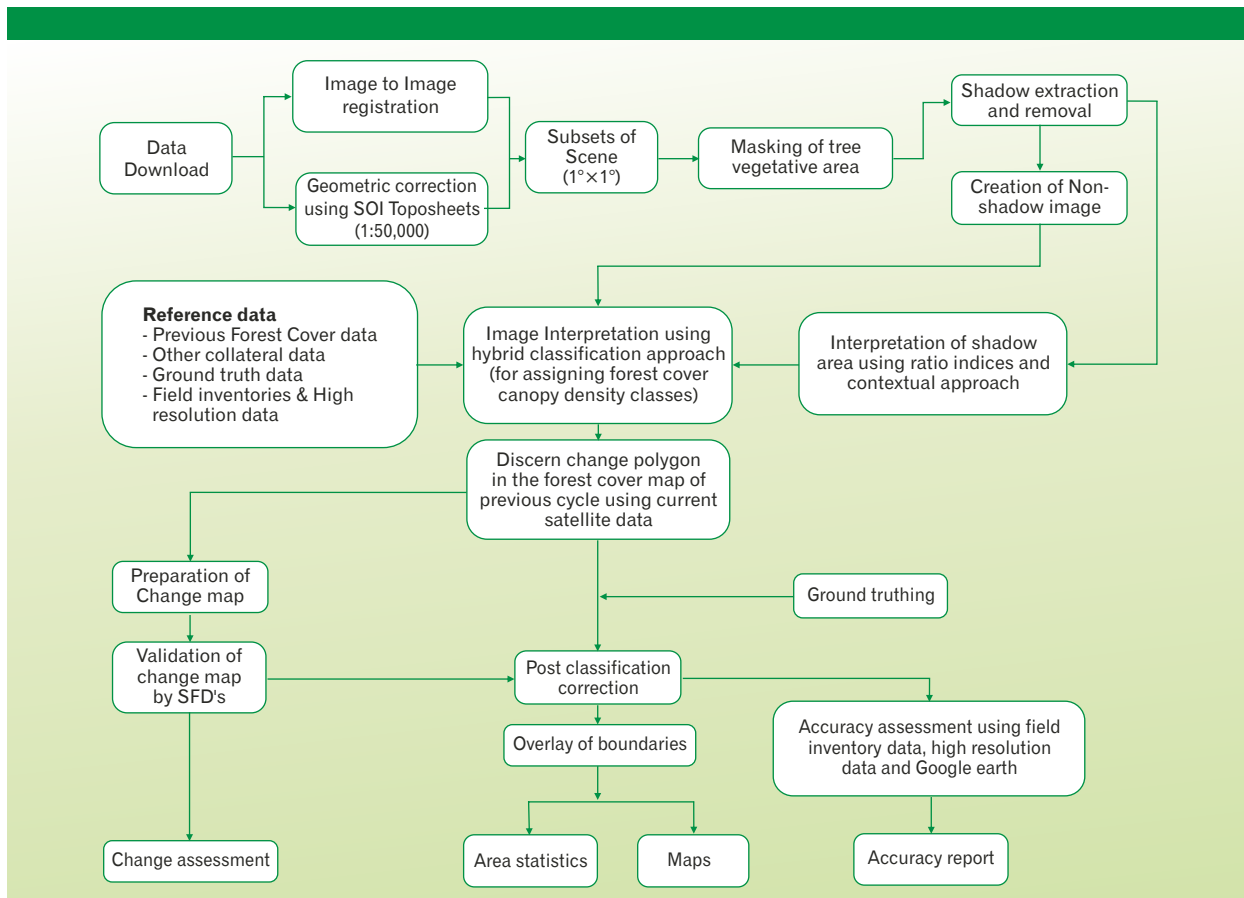


Fig 2.2: Schematic Diagram of the Methodology followed in Forest Cover Mapping

dimension less than the above are not captured.

- Young plantations and tree species with less chlorophyll or poor foliage are many a times not discernable on satellite images due to poor leaf area index and transmittance.
- Considerable ground details may sometimes be obscured due to clouds and shadows. Such areas are difficult to classify without the help of collateral data or ground truthing.
- Gregarious occurrence of weeds like lantana in forest areas and agricultural crops like sugarcane, cotton, etc. occurring in the vicinity of forest area cause mixing of the spectral signatures and often make forest cover delineation difficult.
- Where heterogeneity in crop composition is high, generalized classification may affect the accuracy level.
- Non-availability of appropriate season data sometimes leads to misinterpretation of the features.

2.3 Forest Cover: 2013 Assessment

The forest cover of the country has been classified on the basis of the canopy density into pre-defined classes, viz. Very Dense

Forest (VDF), Moderately Dense Forest (MDF) and Open Forest (OF). Scrub, though shown separately, is not counted in the forest cover. The country level forest cover is summarized in Table 2.1, and their proportion is depicted in a pie chart in Fig.2.3. The area under VDF, MDF and OF also includes mangrove cover of the corresponding density class.

As per current assessment, total forest cover of the country is 697,898 sq km which works out as 21.23 percent of the geographical area of the country. In terms of density classes, area covered by VDF is 83,502 sq km, that with MDF is 318,745 sq km and OF is 295,651 sq km. The VDF class constitutes 2.54 percent, the MDF class constitutes 9.70 percent and the OF class constitutes 8.99 percent of total geographical area of the country.

2.4 States/UTs-wise Forest Cover

Forest cover of each State and UT of the country has been shown in the Fig. 2.4 and presented in the Table 2.2. The States/UTs and patch classwise percentage of Forest Cover in contiguous patches out of total forest cover is given in Annexure-V. Details regarding contiguous patches of forest cover are given in

Table 2.1: Forest Cover of India

Class	Area (sq. km.)	Per cent of Geographical Area
Forest Cover		
a) Very Dense Forest	83,502	2.54
b) Moderately Dense Forest	318,745	9.70
c) Open Forest	295,651	8.99
Total Forest Cover*	697,898	21.23
Scrub	41,383	1.26
Non Forest	2,547,982	77.51
Total Geographic Area	3,287,263	100.00

* Includes 4,629 sq km under mangroves

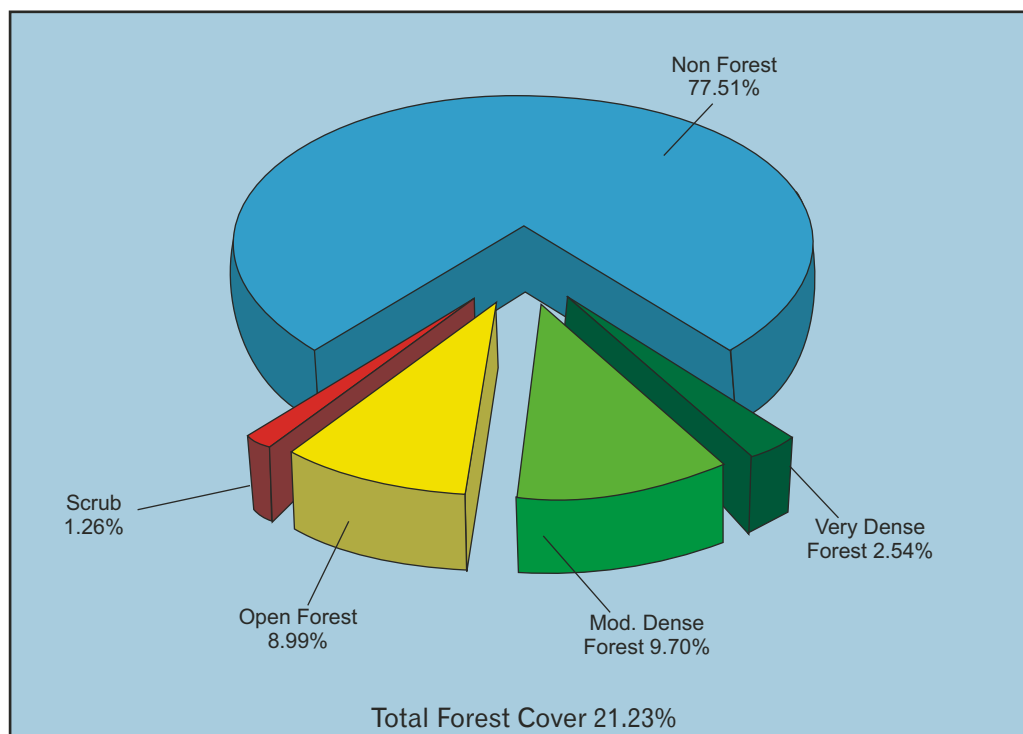


Fig. 2.3 : Pie-Chart showing Forest Cover of India

Annexure-V. Area wise, Madhya Pradesh has the largest forest cover (77,522 sq km) in the country followed by Arunachal Pradesh (67,321 sq km), Chhattisgarh (55,621 sq km), Maharashtra (50,632 sq km) and Odisha (50,347 sq km). In terms of percentage of forest cover with respect to total

geographical area, Mizoram with 90.38% has the highest forest cover, followed by Lakshadweep (84.56 percent), Andaman & Nicobar Islands (81.36 percent), Arunachal Pradesh (80.39 percent), Nagaland (78.68 percent), Meghalaya (77.08 percent), Manipur (76.10 percent) and Tripura (75.01 percent).

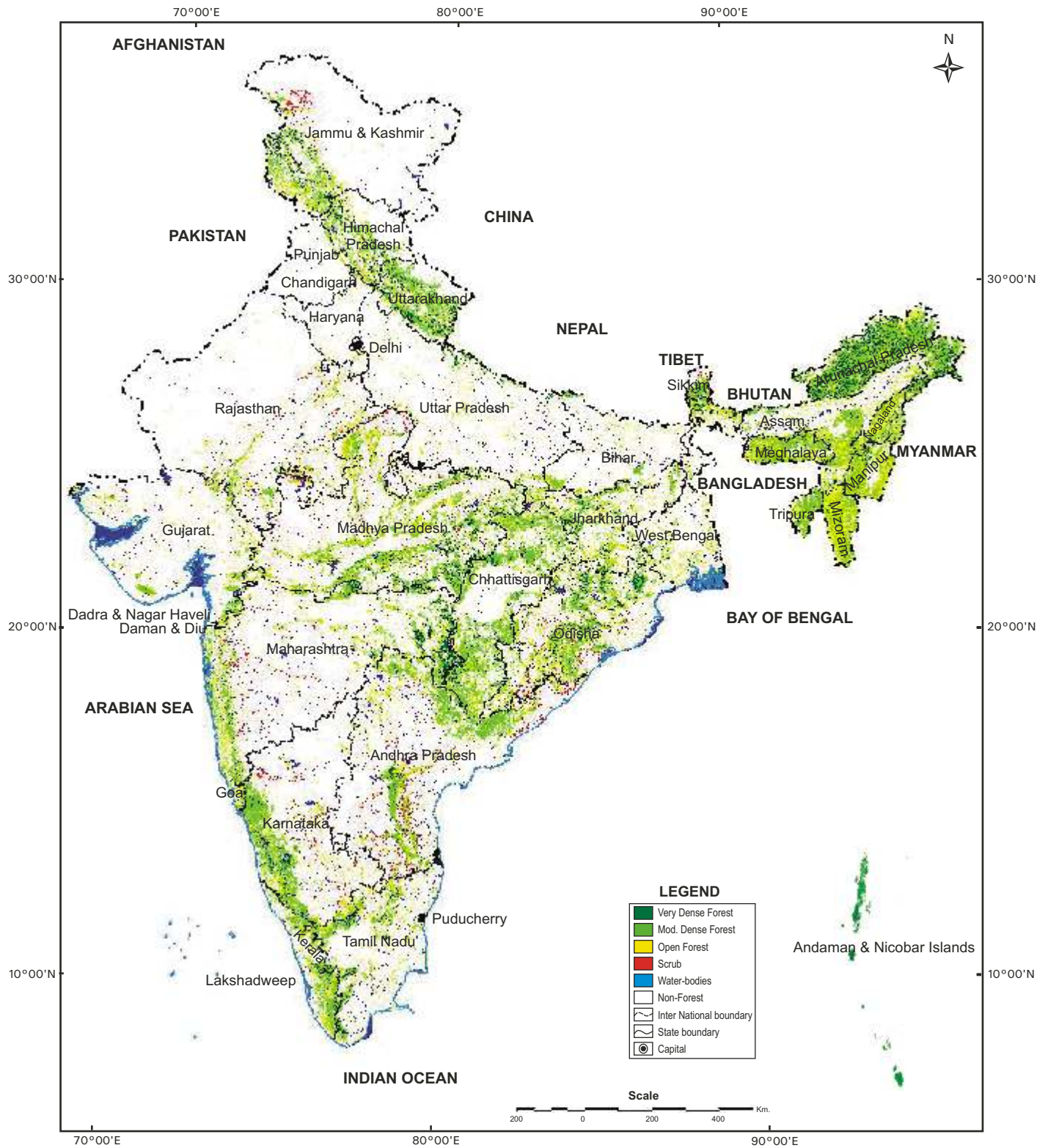


Fig. 2.4: Forest Cover Map of India

Table 2.2: Forest Cover in States/UTs in India (Area in km²)

States/UTs	Geographical Area	2013 Assessment				Per cent of Geographical Area	Change in Forest Cover wrt ISFR 2011	Change Percent	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest Forest	Total Forest Forest				
1	2	3	4	5	6	7	8	9	10
Andhra Pradesh	275,069	850	26,079	19,187	46,116	16.77	-273	-0.10	10,465
Arunachal Pradesh	83,743	20,828	31,414	15,079	67,321	80.39	-89	-0.11	121
Assam	78,438	1,444	11,345	14,882	27,671	35.28	-2	0.00	182
Bihar	94,163	247	3,380	3,664	7,291	7.74	446	0.47	115
Chhattisgarh	135,191	4,153	34,865	16,603	55,621	41.14	-53	-0.04	117
Delhi	1,483	6.76	49.38	123.67	179.81	12.12	3.61	0.24	2.24
Goa	3,702	543	585	1091	2219	59.94	0	0.00	0
Gujarat	196,022	376	5,220	9,057	14,653	7.48	34	0.02	1,492
Haryana	44,212	27	453	1,106	1,586	3.59	-22	-0.05	150
Himachal Pradesh	55,673	3,224	6,381	5,078	14,683	26.37	4	0.01	298
Jammu & Kashmir*	222,236	4,140	8,760	9,638	22,538	10.14	-1	0.00	2,105
Jharkhand	79,714	2,587	9,667	11,219	23,473	29.45	496	0.62	670
Karnataka	191,791	1,777	20,179	14,176	36,132	18.84	-62	-0.03	3,216
Kerala	38,863	1,529	9,401	6,992	17,922	46.12	622	1.60	29
Madhya Pradesh	308,245	6,632	34,921	35,969	77,522	25.15	-178 [#]	-0.06	6,389
Maharashtra	307,713	8,720	20,770	21,142	50,632	16.45	-14	0.00	4,157
Manipur	22,327	728	6,094	10,168	16,990	76.10	-100	-0.45	1
Meghalaya	22,429	449	9,689	7,150	17,288	77.08	13	0.06	372
Mizoram	21,081	138	5,900	13,016	19,054	90.38	-63	-0.30	0
Nagaland	16,579	1,298	4,736	7,010	13,044	78.68	-274	-1.65	2
Odisha	155,707	7,042	21,298	22,007	50,347	32.33	1444	0.93	4,424
Punjab	50,362	0	736	1,036	1,772	3.52	8	0.02	37
Rajasthan	342,239	72	4,424	11,590	16,086	4.70	-1	0.00	4,211
Sikkim	7,096	500	2,161	697	3,358	47.32	-1	-0.01	311
Tamil Nadu	130,058	2,948	10,199	10,697	23,844	18.33	219	0.17	1,212
Tripura	10,486	109	4,641	3,116	7,866	75.01	-111	-1.06	66
Uttar Pradesh	240,928	1,623	4,550	8,176	14,349	5.96	11	0.00	806
Uttarakhand	53,483	4,785	14,111	5,612	24,508	45.82	12	0.02	262
West Bengal	88,752	2,971	4,146	9,688	16,805	18.93	3810 [#]	4.29	111
A&N Islands	8,249	3,754	2,413	544	6,711	81.36	-13	-0.16	57
Chandigarh	114	1.36	9.66	6.24	17.26	15.14	0.26	0.23	0.56
Dadra & Nagar Haveli	491	0	114	99	213	43.38	2	0.41	1
Daman & Diu	12	0	1.87	7.4	9.27	8.28	3.27	2.92	0.96
Lakshadweep	32	0	17.18	9.88	27.06	84.56	0.06	0.19	0
Puducherry	480	0	35.23	14.83	50.06	10.43	0.06	0.01	0
Grand Total	3,287,263	83,502	318,745	295,651	697,898	21.23	5871	0.18	41,383

* Includes Jammu & Kashmir area outside LOC that is under illegal occupation of Pakistan and China.

The negative change in forest cover of Madhya Pradesh as compared to previous assessment is mainly attributed due to inclusion of some non forest area as forest cover. Similarly in West Bengal the change in forest cover in present assessment is due to exclusion of some areas as forest cover in the previous assessment due to poor quality satellite data.

Table 2.3: States/UTs with Forest Cover more than 33 per cent (Area in sq. km.)

States/UTs	Geographical Area	2013 Assessment				Scrub	Forest Cover per cent
		VDF	MDF	OF	Total		
1	2	3	4	5	6	7	8
Mizoram	21,081	138	5,900	13,016	19,054	0	90.38
Lakshadweep	32	0	17.18	9.88	27.06	0	84.56
A&N Islands	8,249	3,754	2,413	544	6,711	57	81.36
Arunachal Pradesh	83,743	20,828	31,414	15,079	67,321	121	80.39
Nagaland	16,579	1,298	4,736	7,010	13,044	2	78.68
Meghalaya	22,429	449	9,689	7,150	17,288	372	77.08
Manipur	22,327	728	6,094	10,168	16,990	1	76.10
Tripura	10,486	109	4,641	3,116	7,866	66	75.01
Goa	3,702	543	585	1,091	2,219	0	59.94
Sikkim	7,096	500	2,161	697	3,358	311	47.32
Kerala	38,863	1,529	9,401	6,992	17,922	29	46.12
Uttarakhand	53,483	4,785	14,111	5,612	24,508	262	45.82
Dadra & Nagar Haveli	491	0	114	99	213	1	43.38
Chhattisgarh	135,191	4,153	34,865	16,603	55,621	117	41.14
Assam	78,438	1,444	11,345	14,882	27,671	182	35.28

2.5 States having Forest Cover more than 33 percent

The present assessment shows that 15 states/UTs have above 33 percent of the geographical area under forest cover. Out of these states and UTs, eight states have more than 75 percent forest cover while seven states have forest cover between 33 percent and 75 percent. Table 2.3 gives forest cover details of these states in the descending order of the percentage of the forest cover.

2.6 Change in Forest Cover

Change in forest cover between the two assessment periods, reflects the change on the ground during the intervening period. The positive change can be attributed to conservation measures or management

interventions such as afforestation activities, participation of locals for better protection measures in plantation areas as well as in traditional forest areas etc., whereas the decrease in forest cover is due to harvesting of short rotational plantations, clearances in encroached areas, biotic pressures, shifting cultivation practices etc. The errors may also arise due to subjectivity involved in certain components of classification. The error in classification also pertains to the areas where the forest cover either went undetected due to snow or cloud cover, hill shadow effect, poor reflectance from trees due to leaf-fall or poor image quality at the time of previous assessment or classified as forest due to poor tonal variation. Sometimes, error also occurs due to lack of correct ground information or data from secondary sources. In the present assessment, better radiometric value of the satellite data has resulted in better delineation of features thereby resolving the

mixed nature of classes to some extent on the ground. In the present assessment, considerable use of high resolution collateral data has been made and time series Google

Earth Images for minimizing the interpretational errors and ascertaining the ground features in doubtful areas. Extensive field visits by the field teams along with

Table 2.4: Change in Forest Cover of States/UTs between 2011 and 2013 (Area in km²)

States/UTs	Geographical Area	2011 Assessment				2013 Assessment				Change			
		VDF	MDF	OF	Total	VDF	MDF	OF	Total	VDF	MDF	OF	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Andhra Pradesh	275,069	850	26,242	19,297	46,389	850	26,079	19,187	46,116	0	-163	-110	-273
Arunachal Pradesh	83,743	20,868	31,519	15,023	67,410	20,828	31,414	15,079	67,321	-40	-105	56	-89
Assam	78,438	1,444	11,404	14,825	27,673	1,444	11,345	14,882	27,671	0	-59	57	-2
Bihar	94,163	231	3,280	3,334	6,845	247	3,380	3,664	7,291	16	100	330	446
Chhattisgarh	135,191	4,163	34,911	16,600	55,674	4,153	34,865	16,603	55,621	-10	-46	3	-53
Delhi	1,483	6.76	49.48	119.96	176.2	6.76	49.38	123.67	180	0.00	-0.10	3.71	3.61
Goa	3,702	543	585	1,091	2,219	543	585	1,091	2,219	0.00	0.00	0.00	0.00
Gujarat	196,022	376	5,231	9,012	14,619	376	5,220	9,057	14,653	0	-11	45	34
Haryana	44,212	27	457	1,124	1,608	27	453	1,106	1,586	0	-4	-18	-22
Himachal Pradesh	55,673	3,224	6,381	5,074	14,679	3,224	6,381	5,078	14,683	0	0	4	4
Jammu & Kashmir*	222,236	4,140	8,760	9,639	22,539	4,140	8,760	9,638	22,538	0	0	-1	-1
Jharkhand	79,714	2,590	9,917	10,470	22,977	2,587	9,667	11,219	23,473	-3	-250	749	496
Karnataka	191,791	1,777	20,179	14,238	36,194	1,777	20,179	14,176	36,132	0	0	-62	-62
Kerala	38,863	1,442	9,394	6,464	17,300	1,529	9,401	6,992	17,922	87	7	528	622
Madhya Pradesh	308,245	6,640	34,986	36,074	77,700	6,632	34,921	35,969	77,522	-8	-65	-105	-178
Maharashtra	307,713	8,736	20,815	21,095	50,646	8,720	20,770	21,142	50,632	-16	-45	47	-14
Manipur	22,327	730	6,151	10,209	17,090	728	6,094	10,168	16,990	-2	-57	-41	-100
Meghalaya	22,429	433	9,775	7,067	17,275	449	9,689	7,150	17,288	16	-86	83	13
Mizoram	21,081	134	6,086	12,897	19,117	138	5,900	13,016	19,054	4	-186	119	-63
Nagaland	16,579	1,293	4,931	7,094	13,318	1,298	4,736	7,010	13,044	5	-195	-84	-274
Odisha	155,707	7,060	21,366	20,477	48,903	7,042	21,298	22,007	50,347	-18	-68	1,530	1,444
Punjab	50,362	0	736	1,028	1,764	0	736	1,036	1,772	0	0	8	8
Rajasthan	342,239	72	4,448	11,567	16,087	72	4,424	11,590	16,086	0	-24	23	-1
Sikkim	7,096	500	2,161	698	3,359	500	2,161	697	3,358	0	0	-1	-1
Tamil Nadu	130,058	2,948	10,321	10,356	23,625	2,948	10,199	10,697	23,844	0	-122	341	219
Tripura	10,486	109	4,686	3,182	7,977	109	4,641	3,116	7,866	0	-45	-66	-111
Uttar Pradesh	240,928	1,626	4,559	8,153	14,338	1,623	4,550	8,176	14,349	-3	-9	23	11
Uttarakhand	53,483	4,762	14,167	5,567	24,496	4,785	14,111	5,612	24,508	23	-56	45	12
West Bengal	88,752	2,984	4,646	5,365	12,995	2,971	4,146	9,688	16,805	-13	-500	4,323	3,810
A&N Islands	8,249	3761	2,416	547	6,724	3,754	2,413	544	6,711	-7	-3	-3	-13
Chandigarh	114	1	10	6	17	1.36	9.66	6.24	17.26	0.36	-0.34	0.24	0.26
Dadra & Nagar Haveli	491	0	114	97	211	0	114	99	213	0	0	2	2
Daman & Diu	112	0	0.62	5.53	6.15	0	1.87	7.4	9.27	0	1.25	1.82	3.12
Lakshadweep	32	0	17.18	9.88	27.06	0	17.18	9.88	27.06	0	0	0	0
Puducherry	480	0	35.37	14.69	50.06	0	35.23	14.83	50.06	0	-0.14	0.14	0
Grand Total	3,287,263	83,471	320,736	287,820	692,027	83,502	318,745	295,651	697,898	31	-1,991	7,831	5,871

* Includes Jammu & Kashmir area outside LOC that is under illegal occupation of Pakistan and China.

collateral information from the SFDs have also contributed in improving the interpretation in some of areas.

After taking into account the changes observed during the two assessments periods i.e. ISFR 2011 and ISFR 2013, there has been an increase of 5,871 sq km forest cover at the national level. Two states namely West Bengal and Odisha have contributed to an increase of 3,810 sq km and 1,444 sq km respectively. Other states where significant increase has been observed are Kerala, Bihar, Jharkhand and Tamil Nadu. It is to be mentioned here that the some of the changes as reported in this ISFR may pertain to the years preceding ISFR 2011, due to limitation as described above and in para 2.2. The change of forest cover for ISFR 2013 and 2011 has been presented in Table 2.4. Table 2.4 gives the change in forest cover for all the States/UTs in all the three canopy density classes. There is a total increase of 5,871 sq km in the forest cover of the country as compared to the previous assessment of 2011. The States/UTs which have shown considerably positive changes are West Bengal (3,810 sq km), Odisha (1,444 sq km), Kerala (622 sq km), Jharkhand (496 sq km), Bihar (446 sq km), Tamil Nadu (219 sq km), Gujarat (34 sq km), whereas, states like Nagaland (274 sq km), Andhra Pradesh (273 sq km), Madhya Pradesh (178 sq km), Tripura (111 sq km), Manipur (100 sq km), Arunachal Pradesh (89 sq km), Mizoram (63 sq km), Karnataka (62 sq km), Chhattisgarh (53 sq km) have shown considerable negative changes. At the country level, there is an increase of 31 sq km in VDF areas and decrease of 1,999 sq km in MDF areas, while there is an increase of 7,831 sq km in OF areas.

2.7 Assessment of Forest Cover within and outside Greenwash area

In the SOI topographic sheets, some of area has been shown by green colour which is generally referred as green wash area. This green wash area represents the forest areas at the time of survey carried out to prepare such topographic sheets. The areas of green wash in topographic sheets by and large correspond to recorded forest area of the country. The changes taking place in the Country's/State's forest cover are not necessarily due to the changes within the recorded forest area alone. However, due to non availability of digitized forest boundaries (only few states have digitized their boundary), it has not been possible to assess and analyse changes within the recorded forest areas (RFA) that are under the control of States Forest Departments. Therefore, FSI has attempted to give forest cover within and outside the greenwash area in the present ISFR to analyse the change in forest cover within and outside the green wash with respect to ISFR 2011. In order to carry out this exercise, the green wash boundary of the country has been digitized based on the topographic sheets at 1:250,000 scale. The greenwash area of the country including the total land use land cover comes out to be 736,054 sq km that accounts for 22.39 percent of the total geographical area of the country. Based on the greenwash boundary, the forest cover within and outside greenwash have been extracted using a GIS overlay and the figures generated separately for the two areas has been given in Table 2.5.

Table 2.5: Forest Cover of States/UTs for 2013 based on Green Wash Area (Area in km²)

States/UTs	2013 Assessment								Change with respect to ISFR 2011							
	Forest Cover within Green wash				Forest Cover outside Green wash				Within Green wash				Outside Green wash			
	VDF	MDF	OF	Total	VDF	MDF	OF	Total	VDF	MDF	OF	Total	VDF	MDF	OF	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Andhra Pradesh	841	24,167	15,862	40,870	9	1,912	3,325	5,246	0	-193	-3	-196	0	30	-107	-77
Arunachal Pradesh	13,182	20,674	9,698	43,554	7,646	10,740	5,381	23,767	-16	-20	12	-24	-24	-85	44	-65
Assam	1,343	9,724	8,771	19,838	101	1,621	6,111	7,833	-3	-50	70	17	3	-9	-13	-19
Bihar	236	2,470	1,997	4,703	11	910	1,667	2,588	19	26	-80	-35	-3	74	410	481
Chhattisgarh	4,054	32,161	13,707	49,922	99	2,704	2,896	5,699	-8	-16	25	1	-2	-30	-22	-54
Delhi	1.49	4.99	1.67	8.15	5.27	44.39	122	171.66	-0.01	0	0.12	0.11	0.01	-0.1	3.59	3.5
Goa	516	405	608	1,529	27	180	483	690	0	0	0	0	0	0	0	0
Gujarat	364	4,258	4,518	9,140	12	962	4,539	5,513	1	-11	56	46	-1	0	-11	-12
Haryana	25	205	216	446	2	248	890	1,140	0	0	-1	-1	0	-4	-17	-21
Himachal Pradesh	2,644	3,776	2,328	8,748	580	2,605	2,750	5,935	0	0	0	0	0	0	4	4
Jammu & Kashmir	3,134	5,549	4,733	13,416	1,006	3,211	4,905	9,122	0	0	0	0	0	0	-1	-1
Jharkhand	2,387	7,830	7,565	17,782	200	1,837	3,654	5,691	-16	-77	296	203	13	-173	453	293
Karnataka	1,677	16,235	9,603	27,515	100	3,944	4,573	8,617	0	4	-6	-2	0	-4	-56	-60
Kerala	1,437	5,590	2,924	9,951	92	3,811	4,068	7,971	134	-384	60	-190	-47	391	468	812
Madhya Pradesh	6,136	30,794	28,303	65,233	496	4,127	7,666	12,289	-2	-59	-126	-187	-6	-6	21	9
Maharashtra	8,369	15,962	13,132	37,463	351	4,808	8,010	13,169	-16	-44	40	-20	0	-1	7	6
Manipur	725	5,583	8,794	15,102	3	511	1,374	1,888	0	-28	18	-10	-2	-29	-59	-90
Meghalaya	416	7,992	6,473	14,881	33	1,697	677	2,407	31	-65	80	46	-15	-21	3	-33
Mizoram	130	5,841	12,690	18,661	8	59	326	393	-2	77	16	91	6	-263	103	-154
Nagaland	1,161	3,337	4,449	8,947	137	1,399	2,561	4,097	-5	-95	-31	-131	10	-100	-53	-143
Odisha	6,780	19,646	17,555	43,981	262	1,652	4,452	6,366	-35	-76	580	469	17	8	950	975
Punjab	0	336	290	626	0	400	746	1,146	0	0	0	0	0	0	8	8
Rajasthan	72	3,974	7,869	11,915	0	450	3,721	4,171	0	2	-3	-1	0	-26	26	0
Sikkim	341	1,385	295	2,021	159	776	402	1,337	0	-2	1	-1	0	2	-2	0
Tamil Nadu	2,600	7,777	6,308	16,685	348	2,422	4,389	7,159	-4	-51	62	7	4	-71	279	212
Tripura	96	4,036	2,469	6,601	13	605	647	1,265	-1	-27	-31	-59	1	-18	-35	-52
Uttar Pradesh	1,546	3,487	3,924	8,957	77	1,063	4,252	5,392	-3	-6	5	-4	0	-3	18	15
Uttarakhand	3,997	10,758	3,699	18,454	788	3,353	1,913	6,054	20	-55	47	12	3	-1	-2	0
West Bengal	2,668	2,399	2,135	7,202	303	1,747	7,553	9,603	-23	-548	688	117	10	48	3,635	3,693
A&N Islands	3,717	2,350	512	6,579	37	63	32	132	-7	-3	-3	-13	0	0	0	0
Chandigarh	0.41	0.1	0	0.51	0.95	9.56	6.24	16.75	0	0	0	0	0	0	0	0
Dadra & Nagar Haveli	0	1	46	47	0	113	53	166	0	0	-3	-3	0	0	5	5
Daman & Diu	0	0	0	0	0	1.87	7.4	9.27	0	0	0	0	0	1.25	1.87	3.12
Lakshadweep	0	0	0	0	0	17.18	9.88	27.06	0	0	0	0	0	0	0	0
Puducherry	0	0	0.9	0.9	0	35.23	13.93	49.16	0	0	0	0	0	-0.14	0.14	0.00
Grand Total	70,596	258,707	201,476	530,779	12,906	60,038	94,175	167,119	64	-1,701	1,769	132	-33	-290	6,062	5,739

An analysis of the above table reveals that an increase in OF category in both inside and outside greenwash areas has been observed

at the country level. This may be attributed to the conservation, plantation and promotional initiatives by SFDs and other agencies.

However, a decrease in MDF category within greenwash has also been observed. This may be attributed to several reasons including shifting cultivation particularly in the north east, rotational and departmental felling in the states like Andhra Pradesh and encroachments across the country. Overall, of the total increase of 5,871 sq km at the country level, 132 sq km increase in forest cover is observed within greenwash area while remaining 5,739 sq km has been observed outside.

2.8 Reasons for Change

An important component of the mapping exercise is to validate the interpreted data through adequate ground truthing. During ground truthing for the current cycle, efforts have been made to ascertain the reasons for change in forest cover in the respective States/UTs. Based on the information collected by the FSI officials in consultation with the field officials of the State Forest Departments (SFD), main reasons for aforesaid changes are summarized in Table 2.6.

Table 2.6: Reasons for Change

States	Reason
Andhra Pradesh	Main reasons for decrease in forest cover has been the open cast coal mining, rotational felling of fast growing species and encroachment on forest lands.
Arunachal Pradesh	Decrease in forest cover of the state is due to shifting cultivation practices and biotic pressure in many districts. However in some areas regeneration of bamboos and other miscellaneous species and plantation by SFD is also observed.
Assam	Encroachment, biotic pressure and shifting cultivation practices.
Bihar	Afforestation activities, inclusion of TOF.
Chhattisgarh	Developmental activities, mining, encroachment.
Delhi	Plantation.
Gujarat	Change in forest cover is attributed to conservation efforts and afforestation within and outside recorded forest areas.
Haryana	Developmental activities, rotational felling in agroforestry area.
Jammu & Kashmir	Developmental activities.
Jharkhand	Plantation, inclusion of TOF areas.
Karnataka	Rotational felling.
Kerala	Afforestation and conservation activities, inclusion of TOF area.
Madhya Pradesh	Encroachment, mining, submergence of area.
Maharashtra	Encroachment.
Manipur	Decrease in forest cover of the state is due to shifting cultivation practices and biotic pressure in major parts of the state.
Meghalaya	Conservation leading to regeneration and afforestation.
Mizoram	Main reason for the change in forest cover is shifting cultivation, soil erosion and biotic pressure.
Nagaland	Main reason for decrease in forest cover is biotic pressure, particularly the shortening of shifting cultivation cycle.

States	Reason
Odisha	Main reason for the change in forest cover is due to conservation initiatives by State Forest Department and through Van Sanrakshan Samiti (VSS) alongwith availability of better quality satellite data.
Punjab	Plantation.
Rajasthan	Biotic pressure and mining.
Sikkim	Earthquake induced landslide leading to loss of forest.
Tamil Nadu	Main reason for increase in forest cover is better protection and conservation of forests leading to increase in MDF and OF areas and inclusion of TOF.
Tripura	Main reason for change in forest cover is shifting cultivation widely practiced across the state.
Uttar Pradesh	Plantation and conservation initiatives.
Uttarakhand	Conservation and afforestation activities.
West Bengal	Increase in the forest cover of the state is mainly due to coppice growth and afforestation inside the forests, growth of commercial plantations and shade trees in tea gardens, inclusion of TOF areas.
A&N Islands	Loss in mangrove vegetation.
Dadra&NagarHaveli	Plantation and conservation initiatives.
Daman and Diu	Conservation of degraded forest area.

Based on the analysis of the changes observed across the country, a change matrix has been generated indicating the change in forest cover classes. The change matrix given in Table 2.7 indicates the change in forest cover in the three density classes, scrub and non-forest areas.

Current assessment reveals that there is an improvement of 433 sq km MDF and 4 sq km Open Forest to VDF category. Similarly 820 sq km Open Forest, 3 sq km Scrub and 657 sq km NF has been converted into MDF category. On the other hand 255 sq km VDF has converted to MDF, 45 sq km to Open Forest and 106 sq km to NF.

Table 2.7: Forest Cover Change Matrix for India between ISFR 2011 and ISFR 2013. (Area in km²)

Class	VDF	MDF	OF	Scrub	NF	Total ISFR 2011
Very Dense Forest	83,065	255	45	0	106	83,471
Moderately Dense Forest	433	317,010	1,786	2	1,505	320,736
Open Forest	4	820	285,084	60	1,852	287,820
Scrub	0	3	606	40,871	696	42,176
Non Forest	0	657	8,130	450	2,543,823	2,553,060
Total ISFR 2013	83,502	318,745	295,651	41,383	2,547,982	3,287,263
Net change	31	-1,991	7,831	-793	-5,078	

■ Gain
■ Loss

2.9 Forest Cover in Hill Districts

An attempt has always been made in the previous assessment of ISFR's to report the forest cover of the hill districts as a separate entity keeping in view the topographical characteristics of the region that have a direct or indirect influence on the presence of forest cover and forest types in a region. As such the

hill districts as identified by the Planning Commission for Hill Areas and Western Ghats Development Programme are taken into consideration for forest cover analysis thereof. In all, there are 124 hill districts as marked by superscript 'H' in the district-wise table of forest cover in Chapter 9. Table 2.8 gives a state wise summary of forest cover in the hill districts of the country.

Table 2.8: Forest Cover in Hill Districts (Area in km²)

States	No. of Hill Districts	Geographical Area	Forest Cover 2013				Per cent of G.A.	Change w.r.t. ISFR 2011	Scrub
			VDF	MDF	OF	Total			
Arunachal Pradesh	13	83,743	20,828	31,414	15,079	67,321	80.39	-89	121
Assam	3	19,153	741	5,696	6,587	13,024	68.00	39	33
Himachal Pradesh	12	55,673	3,224	6,381	5,078	14,683	26.37	4	298
Jammu & Kashmir	(a) 14	101,388	2,814	6,288	6,951	16,053	15.83	-3	295
	(b) *	120,848	1,326	2,472	2,687	6,485	5.37	2	1,810
Karnataka	6	48,046	1,492	14,920	6,728	23,140	48.16	-60	508
Kerala	10	29,572	1,178	7,159	5,760	14,097	47.67	410	29
Maharashtra	7	69,905	318	7,234	7,966	15,518	22.20	16	1,384
Manipur	9	22,327	728	6,094	10,168	16,990	76.10	-100	1
Meghalaya	7	22,429	449	9,689	7,150	17,288	77.08	13	372
Mizoram	8	21,081	138	5,900	13,016	19,054	90.38	-63	0
Nagaland	8	16,579	1,298	4,736	7,010	13,044	78.68	-274	2
Sikkim	4	7,096	500	2,161	697	3,358	47.32	-1	311
Tamil Nadu	5	22,789	944	3,387	2,197	6,528	28.65	156	207
Tripura	4	10,486	109	4,641	3,116	7,866	75.01	-111	66
Uttarakhand	13	53,483	4,785	14,111	5,612	24,508	45.82	12	262
West Bengal	1	3,149	724	650	1,004	2,378	75.52	89	5
Grand Total	124	707,747	41,596	132,933	106,806	281,335	39.75	40	5,704

* Refers to area outside LOC that is under illegal occupation of Pakistan and China.

Forest cover in the hill districts of the country is 281,335 sq km, which is 39.75 percent of the total geographic area of these districts. All districts of the States of Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Uttarakhand are hill districts.

The percentage of forest cover in these nine states is 62.86 percent of their geographical area. The current assessment shows a net increase of 40 sq km in hill districts of the country out of which -177 sq km is found inside forest area and 217 sq km outside forest areas.

2.10 Forest Cover in Tribal Districts

Tribal and their communities have been a part of the forest ecosystem and their means and methods of livelihood have been deeply influenced by the forest. Forests play a very significant role in tribal economy and all their socio-cultural practices are woven around forests. The ISFR also provides the forest cover in the tribal regions keeping in view the fact that changes in the forest cover in such

region has an influence on the tribal community. In this section, an overview of forest cover in the tribal districts of the country has been presented. In all, there are 189 tribal districts in 26 States/UTs as identified by the Government of India under the Integrated Tribal Development Programme (marked with superscript 'T') in the district-wise table of forest cover in Chapter 9. Table 2.9 presents a summary of forest cover in tribal districts of the country.

Table 2.9: Forest Cover in Tribal Districts (Area in km²)

States	No. of Hill Districts	Geographical Area	Forest Cover 2013				Per cent of G.A.	Change w.r.t. ISFR 2011	Scrub
			VDF	MDF	OF	Total			
Andhra Pradesh	8	87,090	239	16,465	8,359	25,063	28.78	-238	2,364
Arunachal Pradesh	13	83,743	20,828	31,414	15,079	67,321	80.39	-89	121
Assam	16	50,137	648	4,570	6,730	11,948	23.83	-48	93
Chhattisgarh	9	92,656	3,605	24,437	11,975	40,017	43.19	-40	87
Gujarat	8	48,409	322	2,937	3,512	6,771	13.99	5	395
Himachal Pradesh	3	26,764	950	1,067	1,218	3,235	12.09	4	118
Jharkhand	8	44,413	1,705	6,006	6,590	14,301	32.20	339	320
Karnataka	5	26,597	1,248	7,642	4,249	13,139	49.40	0	55
Kerala	9	27,228	1,147	6,846	5,414	13,407	49.24	311	29
Madhya Pradesh	18	139,448	5,631	20,235	16,362	42,228	30.28	-73	2,097
Maharashtra	12	144,233	7,261	11,775	11,665	30,701	21.29	-25	2,157
Manipur	9	22,327	728	6,094	10,168	16,990	76.10	-100	1
Meghalaya	7	22,429	449	9,689	7,150	17,288	77.08	13	372
Mizoram	8	21,081	138	5,900	13,016	19,054	90.38	-63	0
Nagaland	8	16,579	1,298	4,736	7,010	13,044	78.68	-274	2
Odisha	12	86,124	5,249	14,356	14,237	33,842	39.29	544	2,472
Rajasthan	5	38,218	0	2,442	3,897	6,339	16.59	-10	903
Sikkim	4	7,096	500	2,161	697	3,358	47.32	-1	311
Tamil Nadu	6	30,720	715	2,359	3,693	6,767	22.03	25	458
Tripura	4	10,486	109	4,641	3,116	7,866	75.01	-111	66
Uttar Pradesh	1	7,680	409	475	427	1,311	17.07	-8	1
West Bengal	11	69,403	2,957	3,709	7,880	14,546	20.96	2,246	111
A&N Islands	2	8,249	3,754	2,413	544	6,711	81.36	-13	57
Dadra & Nagar Haveli	1	491	0	114	99	213	43.38	2	1
Daman & Diu	1	72	0	1	3	4	5.01	-0.01	0
Lakshadweep	1	32	0	17	10	27	84.56	0	0
Grand Total	189	1,111,705	59,890	192,501	163,100	415,491	37.37	2,396	12,591

The total forest cover in the tribal districts is 415,491 sq km which is 37.37 percent of the geographical area of these districts. The current assessment shows a net increase of 2,396 sq km out of which there is a decrease of 32 sq km inside forest (greenwash) area and increase of 2,428 sq km outside forest (greenwash) areas in all the tribal districts of the country.

2.11 Forest Cover in the North-Eastern States

North-Eastern region of the country comprising eight states namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura is endowed with rich forest resources. The region, which constitutes only 7.98 percent of the geographical area of the country, accounts for nearly one fourth of its forest cover. Because of its biodiversity richness, the region has been identified as one of the 18 biodiversity hot spots of the world. One distinct feature of land use is the prevalence of shifting cultivation in hilly parts of almost all the states of this region. Shifting cultivation has traditionally been the main source of

livelihood of the tribal people and is intricately linked to their socio-cultural life.

As per the present assessment, the total forest cover in the region is 172,592 sq km, which is 65.83 percent of its geographical area in comparison to the national forest cover of 21.23 percent. Very dense, moderately dense and open forests constitute 14.77 percent, 44.02 percent and 41.21 percent respectively. The current assessment shows a decrease of forest cover to the extent of 627 sq km in the North-Eastern region. The main reason for this decrease is attributed to the biotic pressure and shifting cultivation in the region. State-wise forest cover in the region, along with the changes as compared to the previous assessment is shown in Table 2.10.

2.12 Forest Cover in Different Altitude Zones

Forest cover in higher altitudes has special ecological significance. Therefore, information on distribution of forest cover in different altitude zones is useful from policy and planning perspective for hill states.

Table 2.10: Forest Cover in the North-Eastern States (Area in km²)

States	Geographical Area	Forest Cover 2013				Per cent of GA	Change w.r.t. ISFR 2011	Scrub
		VDF	MDF	OF	Total			
Arunachal Pradesh	83,743	20,828	31,414	15,079	67,321	80.39	-89	121
Assam	78,438	1,444	11,345	14,882	27,671	35.28	-2	182
Manipur	22,327	728	6,094	10,168	16,990	76.10	-100	1
Meghalaya	22,429	449	9,689	7,150	17,288	77.08	13	372
Mizoram	21,081	138	5,900	13,016	19,054	90.38	-63	0
Nagaland	16,579	1,298	4,736	7,010	13,044	76.69	-274	2
Sikkim	7,096	500	2,161	697	3,358	47.32	-1	311
Tripura	10,486	109	4,641	3,116	7,866	74.98	-111	66
Grand Total	262,179	25,494	75,980	71,118	172,592	65.83	-627	1,055

Digital Elevation Model from data of Shuttle Radar Topography Mission (2006) has been generated to determine forest cover in different altitude zones in all the states and UTs. The altitude zones for the purpose of analysis have been taken as 0-500m, 500-1000m, 1000-2000m, 2000-3000m, 3000-4000m and above 4000m. The Digital Elevation Model

(DEM) used in the analysis has a resolution of 90m, which is appropriate for national/sub-national level information of this kind. In the current cycle, same approach has been followed. Altitude zone wise forest cover of the country is given in Table 2.11. The State wise information has been given in the respective sections of Chapter 9.

Table 2.11: Forest Cover in Altitude Zones (Area in km²)

Altitude Zone	VDF	MDF	OF	Total	Per cent of Total FC	Per cent of GA of Zone
0-500m	29,212	156,552	180,238	366,002	52.44	16.17
500-1000m	21,724	97,324	77,344	196,392	28.14	32.42
1000-2000m	14,787	37,140	24,556	76,483	10.96	65.48
2000-3000m	14,306	19,288	7,126	40,720	5.83	70.86
3000-4000m	3,432	8,139	5,778	17,349	2.49	7.17
Above 4000 m	41	302	609	952	0.14	0.39
Total	83,502	318,745	295,651	697,898	100.00	21.23

Zone-wise geographical area worked out on the basis of SRTM DEM.

2.13 (a) Negative Change Detected in False Color Composite (FCC) Image

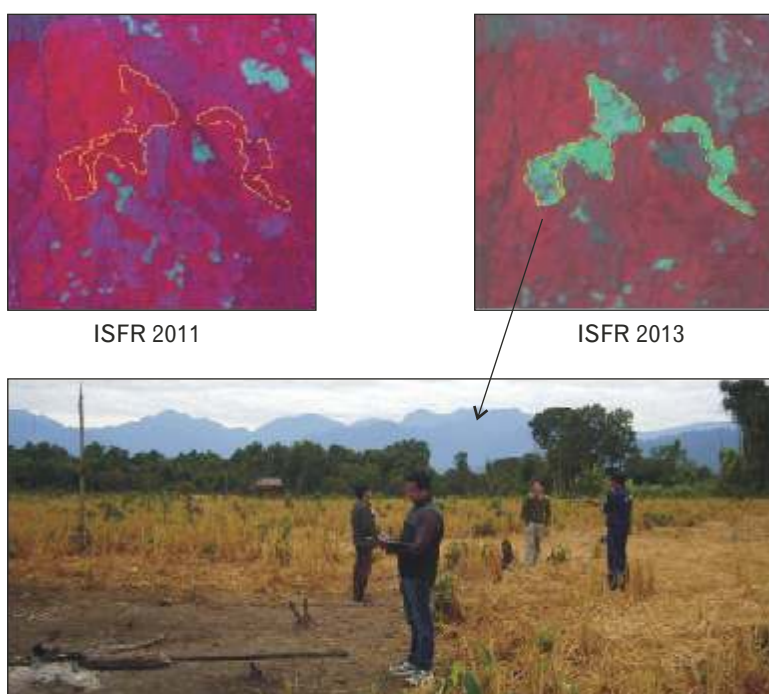


Photo - Ashutosh Singh, FSI

Photo showing shifting cultivation in Siang East district, Arunachal Pradesh, Dec. 2012

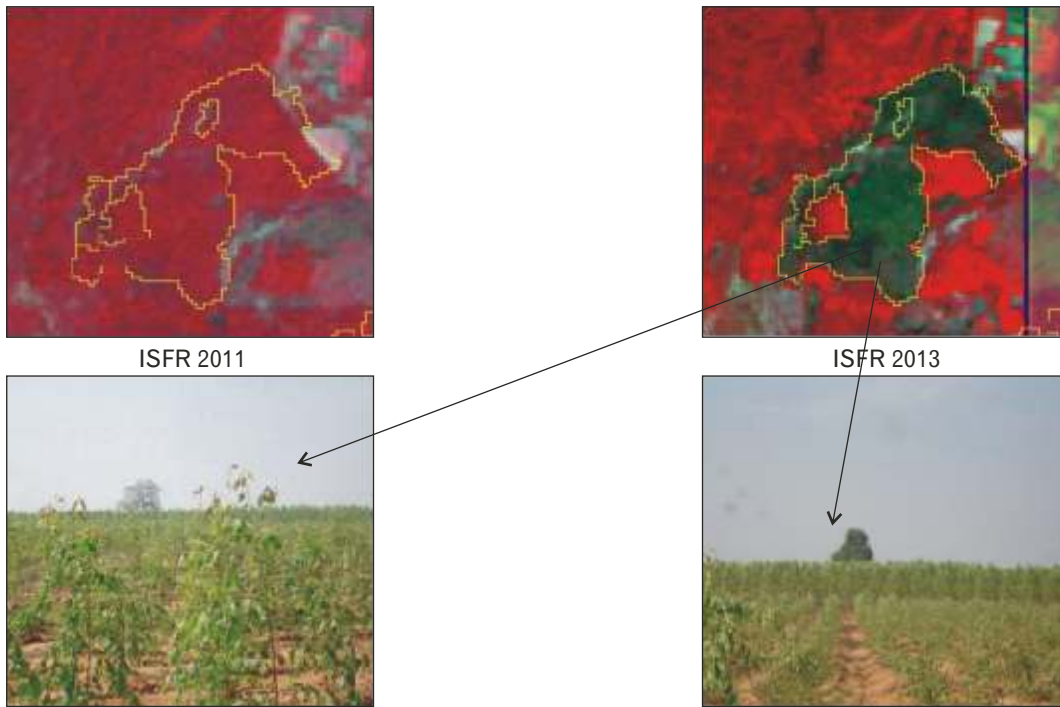


Photo - Chander M.S. Bisht, FSI
 Photo showing rotational felling in Khammam district Andhra Pradesh, Dec. 2012

2.13 (b) Positive Change Detected in False Color Composite (FCC) Image

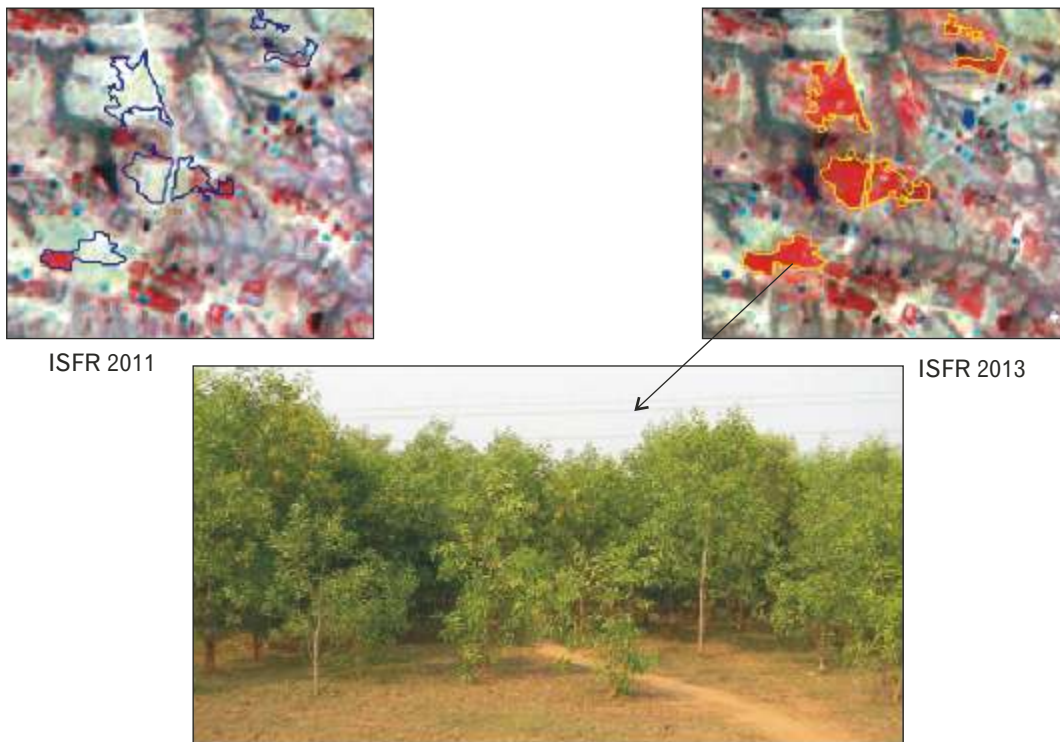
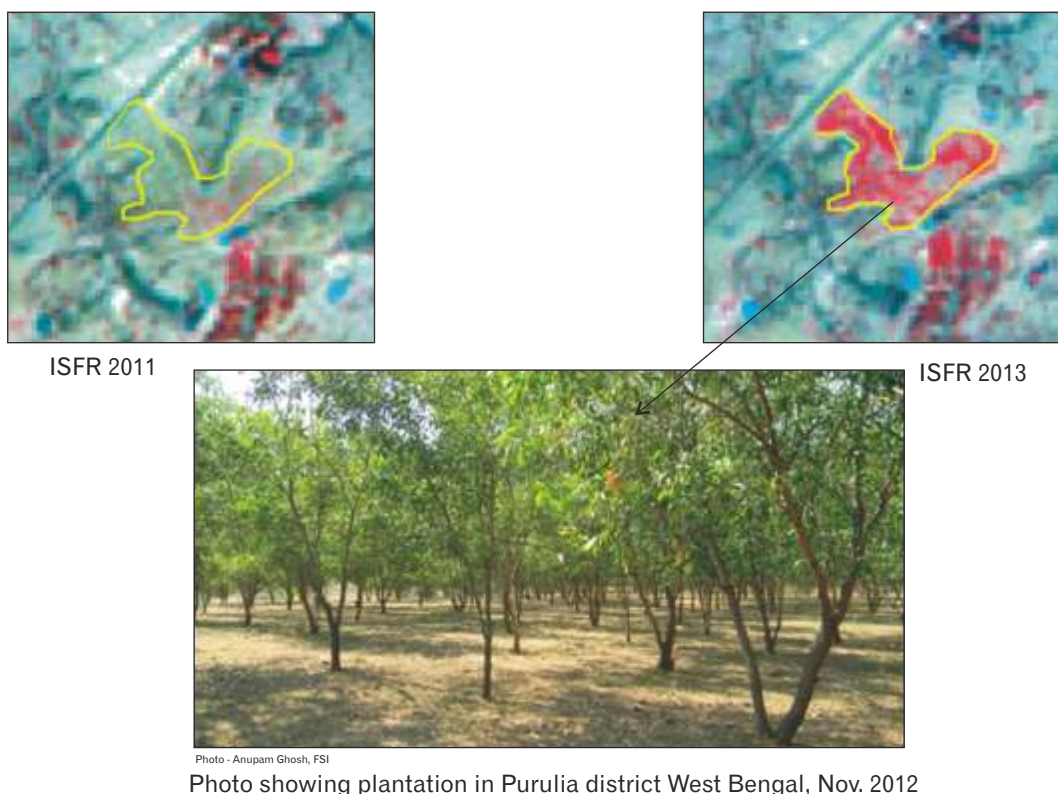


Photo - Anupam Ghosh, FSI
 Photo showing plantation in Purulia district West Bengal, Nov. 2012



2.14 Accuracy Assessment of Forest Cover

The assessment of forest cover is based on the interpretation of satellite data. Though, all efforts have been made for the highest accuracy of the forest cover assessment, yet some errors may arise in interpretation and classification due to cloud or shadow effects, seasonal variation in the canopy of deciduous trees, bushy and agricultural vegetation getting mixed with forest crop, human errors etc. While classifying the remote sensing data all these errors influence the accuracy of the assessment.

2.14.1 Methodology

For assessing the accuracy of classification based on remote sensing data, generally an error matrix (also termed as confusion matrix)

is prepared by comparing agreement and disagreement between remote sensing derived classification with the reference data (ground truth) on a class-by-class basis at randomly selected locations. Error matrix is an array of numbers arranged in rows (generally, map classification) and columns (generally, ground truth). It is a square matrix as both numbers of rows and columns are equal, representing different classes (VDF, MDF, OF etc) whose classification accuracy is to be assessed. The randomly selected locations or sampling units, which are presented in the matrix, can be pixel or a group of pixels or a polygon. In this study, group of pixels is the sampling units. An entry made along the major diagonal of the error matrix implies agreement which means that the classification at a sampling unit matches with the corresponding ground truth and, therefore, suggests that the classification is

correct. The non-diagonal elements indicate disagreement or wrong classification.

The percentage of correctly classified sampling units (i.e. sum of all diagonal elements) out of the total considered sampling units in the error matrix provides measure of 'overall accuracy' of the assessment. Similarly, accuracy of each class can be measured by calculating the percentage of correctly classified sampling units (diagonal element) out of the total sampling units considered for that class in row or column. It is pertinent to mention here that the accuracy assessment in this chapter signifies accuracy of classification. It does not relate to cartographic accuracy. Moreover, it also does not speak about the accuracy of area statistics given under different density classes.

The sampling design used for assessing the accuracy of classification should ensure the representation of the entire spatial population. Ideally, the sampling units should be randomly selected from the entire assessment area, i.e. country and ground truth data should be collected from all such points, but there are certain limitations in this approach. The other alternative is to use forest inventory data along with high resolution satellite data (LISS-IV Mx) of the same period as reference for validation. This approach has been followed for accuracy assessment in the current report.

For the purpose of preparing error matrix, 54 districts have been selected which are well spread over the entire country and, therefore, form a representative sample. A total of 4,132 number of points have been selected for

Classification Classes	Ground truth (based on field inventory data)						User's Accuracy (Per cent)
	VDF	MDF	OF	Scrub	NF	Total	
VDF	210	22	3	1	1	237	88.81
MDF	17	1,221	60	4	8	1,310	93.21
OF	7	80	1,137	9	16	1,249	91.03
Scrub	1	9	12	192	7	221	86.88
NF	3	37	39	17	1,019	1,115	91.39
Total	238	1,369	1,251	223	1,051	4,132	
Producer's Accuracy (%)	88.24	89.19	90.89	86.10	96.96		
Overall Accuracy (%)	91.46						
Overall Kappa Statistics	0.88						

Classification Classes	Ground truth (based on field inventory data)			User's Accuracy (%)
	Forest	Non-Forest	Total	
Forest	2,757	39	2,796	98.61
Non-Forest	101	1,235	1,336	92.44
Total	2,858	1,274	4,132	
Producer's Accuracy (%)	96.47	96.94		
Overall Accuracy (%)	96.61			
Overall Kappa Statistics	0.92			

preparation of error matrix. The district-wise list of points has been sent to the units responsible for forest cover classification. At each point, a grid of one ha has been prepared and forest density class as given in the classified map has been recorded in the grid. The same exercise has been done in the inventory unit using forest inventory data and the high resolution satellite data. Thus with the help of two sets of information, error matrix has been generated.

2.14.2 Findings

The error matrix has been prepared for a total of 4,132 sample points and given in Table 2.12. For example, the diagonal element at C_{11} , that is, the number 210 for very dense forest (VDF) at row 1 and column 1 implies that all the 210 sampling points have been correctly classified as VDF. Whereas, the off-diagonal number 22 in row 1 (VDF) and column 2 (MDF) implies that 22 sampling points, which are registered as MDF during the ground survey have been classified as VDF. Further, a simplified error matrix has been prepared by grouping land use classes into “forest” and “non-forest”. This is done by combining VDF, MDF and OF into one class viz. “forest”. The scrub and the non-forest class have been combined into “non-forest”. The simplified error matrix is given in Table 2.13.

The error matrix at Table 2.12 shows that out of the total 4,132 sampling points where observations were made, classification made at 3,779 sampling points (the sum of the elements along the main diagonal of the matrix) was found correct. The 'overall accuracy' of classification, therefore, works

out to be 91.46 percent. This is quite high implying that classification procedure followed at FSI is well above the acceptable limit. In the remote sensing technology, accuracy of more than 85 percent is considered satisfactory.

In the simplified error matrix Table 2.13, classification of 3,992 sample points has been found to be correct, yielding an overall accuracy of 96.61 percent.

Besides the overall accuracy, accuracy of individual classes has also been determined by calculating producer's accuracy and user's accuracy.

The producer's accuracy is derived by dividing the number of correct sampling points in one class divided by the total number of points as derived from reference data. The producer's accuracy measures how well a certain area has been classified. It includes the error of omission which refers to the proportion of observed features on the ground that are not classified in the map. The more is the error of omission, the lower is producer's accuracy.

Similarly, user's accuracy can be obtained by dividing the correct classified units in a class by the total number of units that were classified in that class. The user's accuracy is therefore a measure of the reliability of the map. It informs the user how well the map represents what is really on the ground. One class in the map can have two types of classes on the ground. The 'right' class, which refers to the same land-cover-class in the map and on the ground, and 'wrong' classes, which show a different land-cover on the ground than predicted on the map. The latter classes are

referred to as errors of commission. The more errors of commission exist, the lower the user's accuracy.

From Table 2.12, it is found that the user's accuracy for VDF, MDF, OF, Scrub and Non-forest classes are 88.81, 93.21, 91.03, 86.88 and 91.39 percent, respectively. Similarly, producer's accuracy for these classes are 88.24, 89.19, 90.89, 86.10 and 96.96 percent, respectively. These levels of accuracy are satisfactory and acceptable. The producer's accuracy for forest and non-forest classes are found to be 96.47 and 96.94 percent respectively while user's accuracy for these classes are 98.61 and 92.44 percent, respectively.

To further authenticate the results of accuracy, the Kappa analysis, which is a multivariate technique, provides a statistics

known as K_{HAT} . This coefficient gives a measure of overall agreement of matrix. In contrast to the overall accuracy- the ratio of the sum of diagonal values to total number of sampling units in the matrix- the Kappa coefficient takes also non-diagonal elements into account. This statistics usually ranges between 0 and 1 and is used to indicate whether the correct values of the error matrix are due to true agreement or due to chance agreement. Any classification having kappa coefficient more than 0.6 is considered as statistically sound. K_{HAT} calculated from the error matrix given at Table 2.12 is equal to 0.88, which indicates that an observed classification is 88 percent better than one resulting from chance. For the simplified matrix, the K_{HAT} comes out to be 0.92 which can be similarly interpreted.

Area above tree line in the country including cold deserts is 182,183 sq km which is unsuitable for any tree growth. If this area is excluded from the total geographical area of the country, the forest and tree cover of the country will increase from present 24.01 percent of geographical area of the country to 25.42 percent.