



SPATIO AND TEMPORAL ANALYSIS OF FOREST COVER OF INDIA FROM 2003 TO 2021

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Abstract:

Forest cover is the total geographical area declared as forest by the government. As of 2021, the total forest cover in India is 80.9 million hectare , which is 24.62 percent of the total geographical area. There is a 1,540 sq.km increase in forest cover over 2019. Madhya Pradesh has the highest forest cover as per the area followed by the Arunachal Pradesh. Mizoram has the highest forest cover in terms of percentage of total geographical area. Ministry of the environment forest and climate change used the mid resolution satellite data on LISS-III data from [Indian remote sensing satellite](#). Minister of environment forest and climate change Bhupendra Yadav released the Indian forest survey report 2021-22 on the 13 January 2022. As per the report, 17 Indian states have a forest cover over 33%.

Keywords:-Forest cover, geographical area, climate change, Indian forest survey report, remote sensing satellite.

1. Introduction

According to Indian State of Forest Report of 2021, forest cover refers to the extent of land area that is covered by forest resources in the country. Forest Survey of India (FSI) initiated assessment of forest cover of the country for the first time in a year 1987 and since then forest cover mapping of the country is carried out using remote sensing-based methodology at biennial interval. This is 17th assessment in the series of continuous forest cover mapping in the country. All lands more than one hectare in area, with a tree canopy density of more than 10%, including tree orchards, bamboo palms etc. occurring within recorded forest & other government lands, private community or institutional lands, are included in the assessment of forest cover. The national Forest Policy of India 1988 envisages a goal of achieving 33% of the geographical area of the country of the forest & tree cover. The wall to wall mapping of the country's forest cover is carried out medium resolution satellite data (23.5m) on a scale of 1:50,000.

2.Objectives

The present study has been undertaken with the following objectives:

- To monitor forest cover at national and state level from 17th assessment (2021) to 8th assessment (2003) report.
- Analyse forest cover information and thematic maps by this 10 Year data of ISFR report.
- To provide information for international reporting.
- To understand and analyse the factors affecting in the change in forest cover from the year 2021 to 2003.
- To arrange all 10 Year data of forest cover for whole country.

4.Study Region

India is situated north of the equator between 8°4' N to 37°8'N latitude and 68°7' E to 97°25' E longitude. It is 7th largest country in the world with a total area of 3,287,263 square km. India's Forest cover accounts 23.84% of the total geographical area of the country & tree cover.

[India](#) is situated north of the equator between 8°4' north (the mainland) to 37°6' north latitude and 68°7' east to 97°25' east longitude. It is the [seventh-largest country in the world](#), with a total area of 3,287,263 square kilometer (1,269,219 sq mi). India measures 3,214 km (1,997 mi) from north to south and 2,933 km (1,822 mi) from east to west. It has a land frontier of 15,200 km (9,445 mi) and a coastline of 7,516.6 km (4,671 mi). On the south, India projects into and is bounded by the [Indian Ocean](#)—in particular, by the [Arabian Sea](#) on the west, the [Lakshadweep Sea](#) to the southwest, the [Bay of Bengal](#) on the east, and the [Indian Ocean](#) proper to the south. The [Palk Strait](#) and [Gulf of Mannar](#) separate India from [Sri Lanka](#) to its immediate southeast, and the [Maldives](#) are some 125 kilometres (78 mi) to the south of India's [Lakshadweep Islands](#) across the [Eight Degree Channel](#). India's [Andaman and Nicobar Islands](#), some 1,200 kilometres (750 mi) southeast of the mainland, share [maritime borders](#) with [Myanmar](#), [Thailand](#) and [Indonesia](#). The southernmost tip of the Indian mainland (8°4'38"N, 77°31'56"E) is just south of [Kanyakumari](#), while the southernmost point in India is [Indira Point](#) on [Great Nicobar Island](#). The northernmost point which is under Indian administration is Indira Col, Siachen Glacier.^[6] India's [territorial waters](#) extend into the sea to a distance of 12 [nautical miles](#) (13.8 mi; 22.2 km) from the coast baseline.^[7] India has the 18th largest [Exclusive Economic Zone](#) of 2,305,143 km² (890,021 sq mi).The northern frontiers of India are defined largely by the [Himalayan mountain range](#), where the country borders [China](#), [Bhutan](#), and [Nepal](#). Its [western border with Pakistan](#) lies in the [Karakoram](#) and [Western Himalayan ranges](#), [Punjab Plains](#), the [Thar Desert](#) and the [Rann of Kutch](#) salt marshes. In the far northeast, the [Chin Hills](#) and [Kachin Hills](#), deeply forested mountainous regions, separate India from Burma. On the east, [its border with Bangladesh](#) is largely defined by the [Khasi Hills](#) and [Mizo Hills](#), and the watershed region of the [Indo-Gangetic Plain](#) The [Ganges](#) is the longest river originating in India. The [Ganges–Brahmaputra](#) system occupies most of northern, central, and eastern India, while the [Deccan Plateau](#) occupies most of southern India. [Kangchenjunga](#), in the Indian state of [Sikkim](#), is the highest point in India at 8,586 m (28,169 ft) and the [world's third highest peak](#). The climate across India ranges from equatorial in the far south, to [alpine](#) and [tundra](#) in the upper regions of the Himalayas. Geologically, [India](#) lies on the [Indian Plate](#), the northern part of the [Indo-Australian Plate](#).

Herewith mentioning the comparative analysis of forest cover of India with respective years:-

State/ UT	Geographical Area	Forest Cover Area (2021)	Forest Cover Area (2019)	Forest Cover Area (2017)	Forest Cover Area (2015)	Forest Cover Area (2013)	Forest Cover Area (2011)	Forest Cover Area (2009)	Forest Cover Area (2005)	Forest Cover Area (2003)
Andhra Pradesh	1,62,968	29,784	29,137	28,147	24,424	46,116	46,389	45,102	44,372	44,419
Arunachal Pradesh	83,743	66,431	66,688	66,964	67,248	67,321	67,410	67,353	67,777	68,019
Assam	78,438	28,312	28,327	28,105	27,623	27,671	27,673	27,692	27,645	27,826
Bihar	94,163	7,381	7,306	7,299	7,288	7,291	6,845	6,804	5,579	5,558
Chattisgarh	1,35,192	55,717	55,611	55,547	55,586	55,621	55,674	55,870	55,863	55,998
Delhi	1,483	195	195	192	189	180	176	177	176	170
Goa	3,702	2,244	2,237	2,229	2,224	2,219	2,219	2,151	2,164	2,156
Gujrat	1,96,244	14,926	14,857	14,757	14,660	14,653	14,619	14,620	14,715	14,946
Haryana	44,212	1,603	1,602	1,588	1,584	1,586	1,608	1,594	1,587	1,517
Himachal Pradesh	55,673	15,443	15,434	15,100	14,696	14,683	14,679	14,668	14,369	14,353
Jharkhand	79,716	23,721	23,611	23,553	23,478	23,473	22,977	22,894	22,591	22,716
Karnataka	1,91,791	38,730	38,575	37,550	36,421	36,132	36,194	36,190	35,251	36,449
Kerala	38,852	21,253	21,144	20,321	19,239	17,922	17,300	17,324	15,595	15,577
Madhya Pradesh	3,08,252	77,493	77,482	77,414	77,462	77,522	77,700	77,700	76,013	76,429
Maharashtra	3,07,713	50,798	50,778	50,682	50,628	50,632	50,646	50,650	47,476	46,865
Manipur	22,327	16,598	16,847	17,346	16,994	16,990	17,090	17,280	17,086	17,219
Meghalaya	22,429	17,046	17,119	17,146	17,217	17,288	17,275	17,321	16,988	16,839
Mizoram	21,081	17,820	18,006	18,186	18,748	19,054	19,117	19,240	18,684	18,430
Nagaland	16,579	12,251	12,486	12,489	12,966	13,044	13,318	13,464	13,719	13,609
Odisha	1,55,707	52,156	51,679	51,345	50,354	50,347	48,903	48,855	48,374	48,366
Punjab	50,362	1,847	1,849	1,837	1,771	1,772	1,764	1,664	1,558	1,580
Rajastahn	3,42,239	16,655	16,630	16,572	16,171	16,086	16,087	16,036	15,850	15,826
Sikkim	7,096	3,341	3,342	3,344	3,357	3,358	3,359	3,357	3,262	3,262
Tamil Nadu	1,30,060	26,419	26,364	26,281	26,345	23,844	23,625	23,338	23,042	22,643
Telangana	1,12,077	21,214	20,582	20,419	21,591	0	0	0	0	0
Tripura	10,486	7,722	7,726	7,726	7,811	7,866	7,977	8,073	8,155	8,093
Uttar Pradesh	2,40,928	14,818	14,806	14,679	14,461	14,349	14,338	14,341	14,127	14,118
Uttrakhand	53,483	24,305	24,303	24,295	24,240	24,508	24,496	24,495	24,442	24,465
West Bengal	88,752	16,832	16,902	16,847	16,828	16,805	12,995	12,994	12,413	12,343
A&N Islands	8,249	6,744	6,743	6,742	6,751	6,711	6,724	6,662	6,629	6,964
Chandigarh	114	23	22	22	22	17	17	17	15	15

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Dadar&Nagar Haveli Daman&Diu	602	228	227	227	226	222	217	217	229	232
Jammu&Kashmir and Ladakh	2,22,236	23,659	23,612	23,241	22,988	22,538	22,539	22,686	21,273	21,267
Lakshadweep	30	27	27	27	27	27	27	26	25	23
Puducherry	490	53	52	53	55	50	50	44	42	40
Total	32,87,469	7,13,789	7,12,249	7,08,273	7,01,673	6,97,898	6,92,027	6,90,899	6,77,086	6,78,332

The above 10 years data showing forest cover of India from year 2021 to 2003 with respect to its geographical area in year 2021. The total forest coverage of India is 7,13,789 square kilometres with its total geographical area is 32,87,469 square kilometres. The highest contribution of forest cover states is Madhya Pradesh, Chhattisgarh, Odisha etc and lowest are Chandigarh Lakshadweep, Puducherry, Delhi etc. If we compare total forest cover of India of 2003 with 2021 we observe an increment from 8,332 square kilometre to 7,13,789 square kilometres. Andhra Pradesh shows its increasing forest cover only from year 2003 to 2013 after that its forest cover is badly decreased in year 2015, Madhya Pradesh is state which shows highest recorded forest cover that is 77,493 square kilometre of India in 2021 and lowest coverage is of Chandigarh that is only 23 square kilometre in same year. Chandigarh shows only 15 square kilometre forest cover in 2003 and after that it shows little increment that is 23 square kilometre in 2021. the state or union territory who shows its forest cover of 2021 in close proximity with their geographical areas are Lakshadweep is geographical area is 30 square kilometres and forest cover is 27 square km in 2021 Andaman and Nicobar Island is geographical area is 8,249 square kilometres and forest cover is 6,744 square kilometres, Tripura is also showing close proximity with their geographical areas which is 1,00,486 square kilometres and its forest coverage is 7,722 square kilometres, Nagaland geographical area 6,579 square kilometres and forest coverage is 12,251 square kilometre, Mizoram geographical area is 21,081 square kilometre and forest cover is 17,820 square kilometres, Meghalaya geographical area is 22,429 square kilometre forest cover is 17,046 square kilometres, Manipur Geographical area is 22,327 square kilometres its forest cover is 16,598 square kilometres and Goa geographical area is 3,702 square kilometres forest cover is 2,244 square kilometres are the states where shows closed proximity were the geographical areas.

Now observing those States which shows the vast difference between geographical area and their forest cover are Puducherry area is 490 square kilometres and forest cover is 53 square kilometres, Jammu Kashmir and Ladakh geographical area is 22,2236 square kilometres forest cover is 23,659 square kilometres, West Bengal geographical area is 88,752 square kilometre forest cover is 16,832 square kilometre, Uttar Pradesh geographical area 2,40,928 square kilometre and its forest cover is 14,818 square kilometre, Telangana geographical area 1,22,077 square kilometre forest cover 21,214 square kilometre, Tamil Nadu its geographical area 1,30,060 square kilometre forest cover 2,64,19 square kilometre, Rajasthan area 3,42,239

square kilometre it for its area 16,655 square kilometre and Punjab geographical area 50,362 square kilometres and it forest cover is 1,847 square kilometre only.

Now let's consider change in forest cover between two consecutive assessment which reflect actual change during the intervening period.

Total change in forest cover between two assessment is 1,540 square kilometres. maximum positive change in forest cover it visible in state like Andhra Pradesh which is 647 square kilometres, Orissa 537 square kilometres and Telangana 632 square kilometres. negative change in forest cover is observing in state Arunachal Pradesh 257 square kilometres, Manipur 249 square kilometres and Nagaland 235 square kilometres.

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Chandigarh	114	23	22	22	22	17	17	17	15	15
Lakshadweep	30	27	27	27	27	27	27	26	25	23
Puducherry	490	53	52	53	55	50	50	44	42	40
Delhi	1,483	195	195	192	189	180	176	177	176	170
Dadar&Nagar Haveli and Daman&Diu	602	228	227	227	226	222	217	217	229	232
Haryana	44,212	1,603	1,602	1,588	1,584	1,586	1,608	1,594	1,587	1,517
Punjab	50,362	1,847	1,849	1,837	1,771	1,772	1,764	1,664	1,558	1,580
Goa	3,702	2,244	2,237	2,229	2,224	2,219	2,219	2,151	2,164	2,156
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A&N Islands	8,249	6,744	6,743	6,742	6,751	6,711	6,724	6,662	6,629	6,964

The above table shows lowest forest cover states/union territories of India are as follows: -

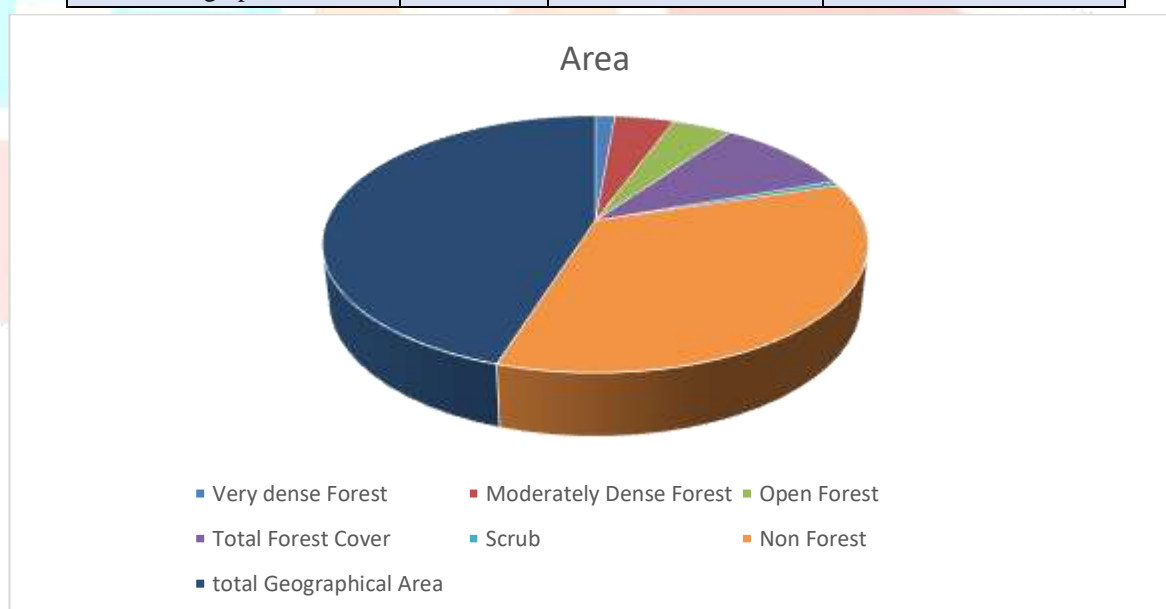
Chandigarh with their geographical area 114 square kilometre and there forest cover in year 2021 is 23 square kilometre, Lakshadweep its forest cover is 27 square kilometre as compare to its geographical area is 30 square kilometre, Puducherry 490 square kilometre is its geographical area and 53 square kilometre is its forest cover area while Delhi has its geographical area 1483 square kilometre with their forest cover is 195 square kilometre and Dadar and Nagar Haveli Daman and Diu its Geography area is 602 square kilometre with its forest cover area is 228 square kilometre.

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Tamil Nadu	1,30,060	26,419	26,364	26,281	26,345	23,844	23,625	23,338	23,042	22,643
Uttarakhand	53,483	24,305	24,303	24,295	24,240	24,508	24,496	24,495	24,442	24,465

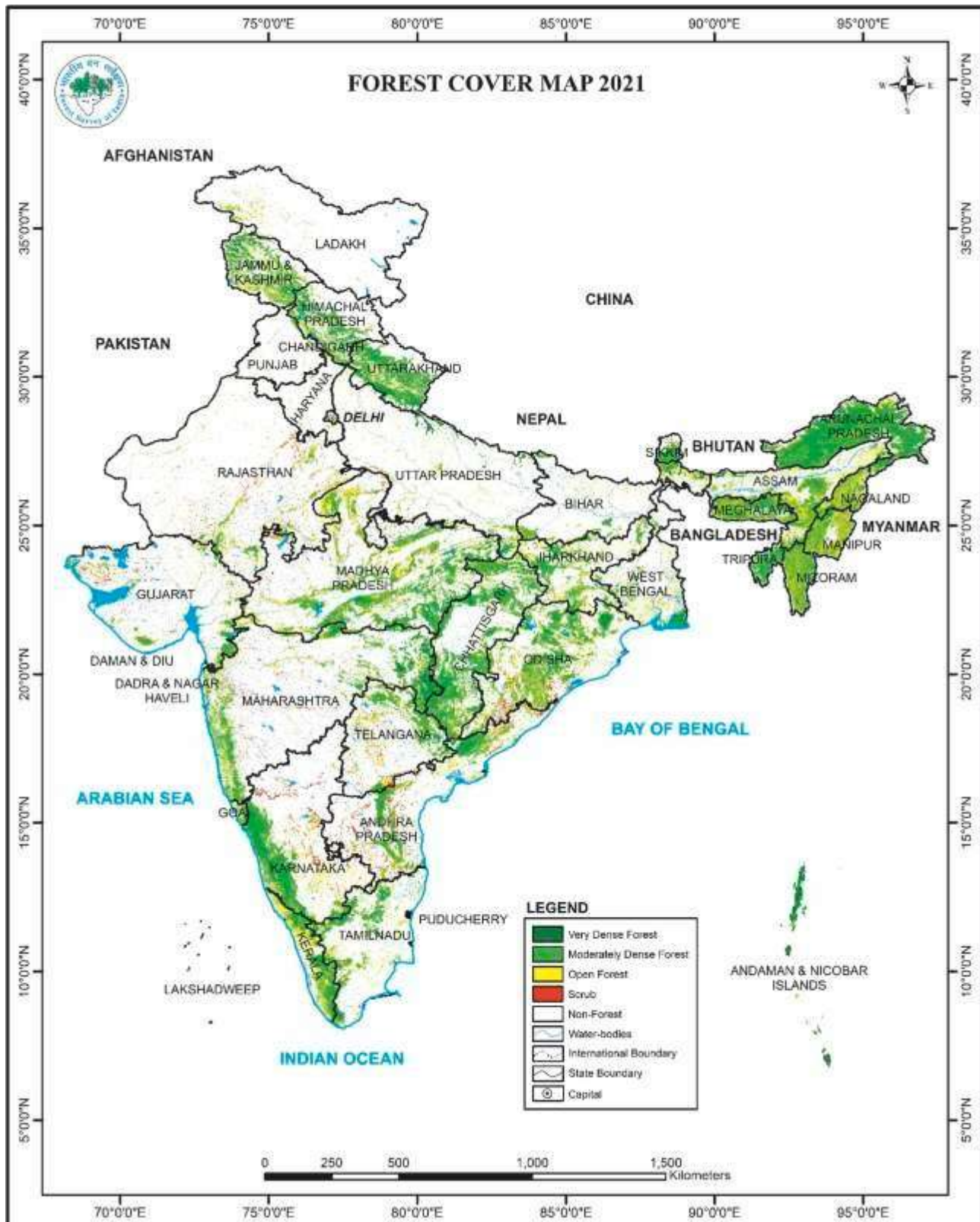
The above table show the highest forest cover of state and union territories of India are as follows: -

Madhya Pradesh its geographical area is 308252 square kilometre with its forest cover area in 2021 is 77493 square kilometre, Arunachal Pradesh also recording a second highest number of forest cover area in 2021 which is 66431 square kilometres as compared to its geographical area is 83743 square kilometre, Chhattisgarh is third highest forest area coverage state of India its coverage is 55717 square kilometre with its geographical area coverage is 135192 square kilometre, 4th highest forest coverage state of India is Orissa which account 5256 square kilometre compare to it geographical area is 155707 square kilometre and Maharashtra account 50798 square forest coverage area in 2021 with its geographical area is 307713 square kilometre.

Class	Area	Percentage of Geographical Area 2021	Percentage of Geographical Area 2003
Very dense Forest	99,779	3.04	1.56
Moderately Dense Forest	3,06,890	9.33	10.32
Open Forest	3,07,120	9.34	8.76
Total Forest Cover	7,13,789	21.71	20.64
Scrub	46,539	1.42	1.23
Non Forest	25,27,141	76.87	78.13
total Geographical Area	32,87,469	100	100



The total forest cover of the country as per the current assessment is 7,13,789 square kilometres which is 21.71% of the total Geographic area of the country in terms of canopy density classes area covered by VDF is 99,779 kilometres, 3.04% MDF is 3,06,890, 9.33% OF is 3,07,120 square kilometres which is 9.34%. In the current assessment dense forest and moderately dense forest together constitute 57% of the total forest cover of the country or its forest cover map of India is shown below: -



5. Conclusion

The report is based upon the survey of three types of forests namely, Very Dense Forests (having canopy density more than 70%) Moderately Dense Forests (having canopy density between 40% and 70%) Open Forests (having canopy density between 10% and 40%).

6. Suggestions

Forests are the essential part of our ecosystem, and thus it is our responsibility to preserve and protect it for our future generations, wildlife species and quality of life. We must not cut trees and plant more trees to

improve air quality. Regulated and Planned Cutting of Trees, Control over Forest Fire by adopting the latest techniques of fire fighting, Reforestation and Afforestation. Check over Forest Clearance for Agricultural and Habitation Purposes ,Protection of Forests from several forest diseases by use of chemical spray, antibiotics or by the development of disease-resistant strains of trees, Proper Utilisation of Forest and Forests Products and Active participation of Government in Forest Conservation.

5. References

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