



TREND OF DEFORESTATION IN MAHARASHTRA: DISTRICT-WISE ANALYSIS BETWEEN 2011 AND 2015

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ABSTRACT:

Forests are an important natural resource that support biodiversity, regulate climate, protect soil and water resources, and provide livelihood opportunities to rural and tribal communities. Maharashtra has considerable forest resources, but their distribution is highly uneven among districts. The present study examines the trend of forest-cover change in the districts of Maharashtra between 2011 and 2015. The study is based mainly on secondary data obtained from the Forest Survey of India (FSI), particularly the India State of Forest Report (ISFR) series. FSI assesses forest cover using satellite data on a biennial basis and provides information at state and district levels. Maharashtra's total forest cover was 50,646 km² in 2011, 50,632 km² in 2013 and 50,628 km² in 2015. Thus, the state experienced a small net decline of 18 km² between 2011 and 2015. The district-level pattern was uneven: forest-rich districts such as Gadchiroli, Ratnagiri, Sindhudurg, Raigad, Chandrapur and Gondiya retained substantially higher forest-cover proportions, whereas districts such as Latur, Osmanabad, Parbhani, Jalna, Beed and Ahmednagar had very low forest-cover proportions. The study indicates that Maharashtra did not experience a uniform decline; rather, it showed localized degradation, stability and small improvements in different districts.

Keywords: *Deforestation, Forest Cover, Maharashtra, Districts, GIS, Satellite Data, Forest Survey of India, Environmental Change.*

INTRODUCTION:

Forests constitute one of the most important components of the natural environment. They provide timber, fuelwood, fodder, medicinal plants and other forest products while also supporting wildlife and maintaining ecological

balance. Forests regulate the hydrological cycle, reduce soil erosion, store carbon and contribute to climate regulation.

Deforestation refers broadly to the permanent or semi-permanent removal of forest vegetation and conversion of forest land to other uses. Forest degradation, in contrast, may involve a reduction in forest density, quality or ecological condition without complete removal of forest cover. Population growth, agricultural expansion, urbanization, industrial development, mining, construction of roads and dams, forest fires and excessive exploitation of forest resources can contribute to forest degradation. A geographical study of Maharashtra identifies developmental activities, agricultural expansion, mining, construction, urbanization and other human pressures among the important causes associated with forest degradation.

Maharashtra is geographically diverse, extending from the Arabian Sea in the west to the eastern districts bordering Madhya Pradesh and Chhattisgarh. Forest resources are concentrated particularly in parts of Vidarbha, the Western Ghats and the Konkan region. The eastern districts, especially Gadchiroli and Chandrapur, contain extensive forest areas, while several districts of the Deccan plateau have relatively little forest cover.

The Forest Survey of India undertakes forest-cover assessment using satellite data approximately every two years. District-wise information has been available since the third forest-cover assessment. The assessments for 2011, 2013 and 2015 used satellite imagery and digital interpretation techniques.

The present research therefore examines the district-wise trend of forest cover in Maharashtra during 2011–2015, with particular emphasis on identifying districts showing decline, stability and relatively higher forest-cover proportions.

CONCEPTS:

A forest is a complex ecosystem dominated by trees and associated vegetation, wildlife, soil and microorganisms. It performs ecological, economic and social functions. Forest cover refers to land having tree canopy meeting the criteria used by the Forest Survey of India. Importantly, FSI's forest-cover assessment is based on actual tree canopy detected from satellite imagery and is not identical to legally recorded forest land.

Deforestation is the conversion or removal of forest vegetation, generally resulting in a permanent or long-term reduction in forested land. Forest degradation means a decline in the quality, density, ecological function or productivity of a forest without necessarily converting the entire area to non-forest use.

Very Dense, Moderately Dense and Open Forest:

FSI classifies forest cover according to canopy density into:

- **Very Dense Forest (VDF):** canopy density of 70% and above.
- **Moderately Dense Forest (MDF):** canopy density of 40% or more but less than 70%.
- **Open Forest (OF):** canopy density of 10% or more but less than 40%.

STUDY AREA:

Maharashtra is located in western and central India. It extends approximately between 15°35' N and 22°02' N latitude and 72°36' E and 80°54' E longitude. The state has a geographical area of approximately 307,713 km². The state has considerable physiographic diversity. The major physical regions include the Konkan coastal belt, Sahyadri/Western Ghats and the Deccan Plateau. The major rivers include the Godavari, Krishna, Bhima, Tapi-Purna and Wardha-Wainganga systems.

The forest distribution is highly uneven. Eastern Maharashtra, particularly the Gadchiroli-Chandrapur-Gondiya region, has extensive forest cover. The Western Ghats and Konkan districts such as Ratnagiri and Sindhudurg also have substantial forest cover. In contrast, parts of Marathwada and the drought-prone Deccan plateau have comparatively low forest cover.

For the period under investigation, the analysis covers the 35-district framework represented in the FSI datasets. A boundary-related limitation should be noted: Palghar district was created from Thane in 2014, so comparisons involving the Thane/Palghar area need to be interpreted carefully.

OBJECTIVES:

1. To examine the distribution of forest cover in Maharashtra during 2011–2015.
2. To analyze district-wise changes in forest cover between 2011 and 2015.

3. To identify districts with relatively high and low forest-cover percentages.

METHODOLOGY:

The study is based primarily on secondary data. The principal source is the Forest Survey of India, an organization under the Ministry of Environment, Forest and Climate Change, Government of India. The FSI publishes the *India State of Forest Report* biennially and provides state- and district-level forest-cover information. The official FSI publication archive contains ISFR reports for 2011, 2013 and 2015.

Data Sources:

The main sources used are:

- *India State of Forest Report 2011*, Forest Survey of India.
- *India State of Forest Report 2013*, Forest Survey of India.
- *India State of Forest Report 2015*, Forest Survey of India.
- Government of Maharashtra Forest Department reports.
- Supporting published geographical studies on Maharashtra's forest cover.

The 2011 district data report a total forest cover of **50,646 km²** for Maharashtra. The 2013 assessment reported **50,632 km²**, while the 2015 assessment reported **50,628 km²**.

Analytical Techniques:

- **Percentage of forest cover:**

$$\text{Forest Cover Percentage} = \frac{\text{Forest Cover}}{\text{Geographical Area}} \times 100$$

- **Absolute change:**

$$\text{Change} = F_{2015} - F_{2011}$$

where F represents forest cover.

- **Percentage change:**

$$\text{Percentage Change} = \frac{F_{2015} - F_{2011}}{F_{2011}} \times 100$$

For the present paper, district-wise forest-cover percentages are used to compare the spatial pattern. Tables and graphs can subsequently be prepared using MS Excel, QGIS or other statistical/GIS software.

DISTRICT-WISE FOREST COVER, 2011–2015:

The following table is compiled from the district-wise 2011 FSI data and the 2015 district assessment reproduced from Maharashtra Forest statistics. The

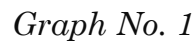
2011 source gives district forest cover and percentage of geographical area, while the 2015 table reports district forest-cover percentage.

Table No. 1: District-wise Forest Cover, 2011–2015

No.	District	Forest Cover 2011 (% of GA)	Forest Cover 2015 (% of GA)	Change (percentage points)
1	Ahmednagar	1.68	1.66	-0.02
2	Akola	5.97	5.97	0.00
3	Amravati	26.10	26.10	0.00
4	Aurangabad	5.51	5.51	0.00
5	Bhandara	24.78	24.64	-0.14
6	Beed	1.64	1.64	0.00
7	Buldhana	6.11	6.11	0.00
8	Chandrapur	35.64	35.59	-0.05
9	Dhule	4.47	4.40	-0.07
10	Gadchiroli	70.04	70.06	+0.02
11	Gondiya	35.08	35.03	-0.05
12	Hingoli	2.43	2.43	0.00
13	Jalgaon	10.07	10.06	-0.01
14	Jalna	0.84	0.84	0.00
15	Kolhapur	23.10	23.19	+0.09
16	Latur	0.07	0.07	0.00
17	Mumbai City	1.27	1.27	0.00
18	Mumbai Suburban	26.91	27.13	+0.22
19	Nagpur	20.45	20.33	-0.12
20	Nanded	8.68	8.68	0.00
21	Nandurbar	20.37	20.18	-0.19
22	Nashik	7.01	7.01	0.00
23	Osmanabad	0.57	0.57	0.00
24	Parbhani	0.79	0.79	0.00
25	Pune	11.07	11.08	+0.01
26	Raigad	40.04	40.20	+0.16
27	Ratnagiri	51.15	51.12	-0.03
28	Sangli	1.68	1.69	+0.01
29	Satara	12.18	12.18	0.00
30	Solapur	0.32	0.32	0.00
31	Sindhudurg	49.32	49.49	+0.17
32	Thane	30.47	30.42	-0.05
33	Wardha	13.62	13.62	0.00
34	Washim	6.40	6.40	0.00
35	Yavatmal	19.18	19.17	-0.01

(Source: Compiled from Forest Survey of India 2011 and 2015 district-wise forest-cover data.)

Note: “GA” means geographical area. Small differences may reflect rounding and methodological/boundary considerations rather than actual physical change.



Assessment year	Total forest cover (km ²)	% of geographical area
2011	50,646	16.46
2013	50,632	16.45
2015	50,628	16.45

(Source: FSI/ISFR.)

- 2011–2013: decline of **14 km²**.
- 2013–2015: decline of **4 km²**.
- 2011–2015: total decline of **18 km²**.

Highest Forest Cover:

The forest-cover distribution is strongly concentrated in a limited number of districts. Gadchiroli had by far the highest proportion of forest cover, with

approximately 70.04% in 2011 and 70.06% in 2015. It was followed by: Ratnagiri – about 51%, Sindhudurg – about 49%, Raigad – about 40%, Chandrapur – about 35.6%, Gondiya – about 35%, Thane – about 30%, Amravati – about 26%.

The high forest cover of these districts is associated with their topography, rainfall, Western Ghats vegetation, extensive forest landscapes and, in eastern Maharashtra, large tracts of relatively continuous forest.

Low Forest Cover:

Several districts had less than 2% of their geographical area under forest cover. These include: Latur – 0.07%., Solapur – 0.32%., Osmanabad – 0.57%., Parbhani – 0.79%., Jalna – 0.84%. Ahmednagar – 1.66%., Sangli – approximately 1.7%., Beed – approximately 1.64%.

These districts are generally associated with relatively dry climatic conditions, extensive agricultural land use and long-term human utilization of land resources.

Districts Showing Decline:

The district-level data show relatively small declines in several districts. Among the larger negative changes were: Nandurbar: -0.19 percentage points., Bhandara: -0.14, Nagpur: -0.12, Dhule: -0.07, Chandrapur: -0.05, Gondiya: -0.05, Thane: -0.05, Ratnagiri: -0.03, Ahmednagar: -0.02.

These changes are relatively small, but they are important because forest quality can deteriorate even when total forest-cover area changes only slightly.

Districts Showing Improvement or Stability:

Mumbai Suburban: +0.22 percentage points, Sindhudurg: +0.17, Raigad: +0.16, Kolhapur: +0.09, Gadchiroli: +0.02, Pune and Sangli: approximately +0.01, Many districts remained effectively unchanged. This indicates that the forest-cover situation was spatially heterogeneous rather than uniformly declining.

Change in Forest Quality:

An important feature of forest change is that total forest cover alone does not describe forest quality. Maharashtra's 2015 assessment recorded approximately 8,712 km² of very dense forest, 20,747 km² of moderately dense forest and 21,169 km² of open forest.

The same analysis found that between 2013 and 2015:

Very Dense Forest declined by about 8 km², Moderately Dense Forest declined by about 23 km², Open Forest increased by about 27 km², Total forest cover declined by about 4 km². This is significant because an increase in open forest combined with a decrease in denser forest categories may indicate forest degradation or reduction in canopy density, even where total forest cover remains relatively stable.

MAJOR CAUSES OF DEFORESTATION AND FOREST DEGRADATION:

Several factors may contribute to forest degradation in Maharashtra.

- 1. Agricultural Expansion:** Conversion of forest and marginal lands for cultivation can reduce natural vegetation, especially in areas experiencing population pressure.
- 2. Urbanization:** Rapid growth of cities and settlements creates pressure on surrounding land resources. Expansion of residential, industrial and transport infrastructure can fragment forest areas.
- 3. Mining:** Mining activities, particularly in mineral-rich districts, can result in direct removal of vegetation and fragmentation of forest landscapes.
- 4. Roads and Infrastructure:** Road construction, dams, transmission lines and other infrastructure projects can cause direct forest diversion and fragmentation.
- 5. Fuelwood and Timber Collection:** Dependence on fuelwood, timber and other forest products may contribute to forest degradation when extraction exceeds natural regeneration.
- 6. Forest Fires:** Forest fires can reduce vegetation density and affect forest regeneration. Fire is identified as an important threat to forest ecosystems.
- 7. Grazing:** Uncontrolled grazing can prevent natural regeneration and gradually reduce forest density.
- 8. Climate and Rainfall Variability:** Maharashtra contains both humid forest regions and drought-prone areas. Variability in rainfall and prolonged dry periods can influence forest regeneration and increase vulnerability to fires.

CONCLUSION:

The present study examined the trend of deforestation/forest-cover change in Maharashtra during 2011–2015 using district-level Forest Survey of India data.

Maharashtra had 50,646 km² of forest cover in 2011, which decreased marginally to 50,628 km² in 2015. The state therefore experienced a net decline of approximately 18 km² during the study period. Forest-cover distribution was highly uneven among districts. Gadchiroli was the most forested district, with approximately 70% of its geographical area under forest cover. Ratnagiri, Sindhudurg, Raigad, Chandrapur and Gondiya were also among the major forest-rich districts. Latur, Solapur, Osmanabad, Parbhani, Jalna, Beed and Ahmednagar had very low proportions of forest cover. Nandurbar, Bhandara and Nagpur showed some of the more noticeable percentage declines during the period. Sindhudurg, Raigad, Mumbai Suburban and Kolhapur showed small increases. A large number of districts remained relatively stable. The results demonstrate that deforestation in Maharashtra was spatially uneven rather than uniform. Total forest-cover statistics alone cannot fully explain forest degradation; changes in canopy density and the shift from dense to open forest should also be considered. Effective conservation requires protection of existing natural forests, restoration of degraded areas, prevention of forest fires, sustainable extraction of forest products and greater participation of local communities. Overall, the period 2011–2015 can be characterized as a period of near stability in the total area of forest cover, accompanied by localized degradation and improvement across different districts. Future research should combine FSI forest-cover data with GIS analysis, land-use/land-cover change, rainfall, population, mining, roads and agricultural expansion to identify the precise causes of district-level forest change.

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