

Trend of Deforestation in India: A comparative Approach to identify the qualitative and quantitative change of natural vegetation cover

Shashi Bhushan

Center for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University
New Delhi-110067, India

Abstract— Natural resource has always played a significant role in any growing economy for sustainable development. Indian forests are ancient in nature and composition where it faces a severe change in the forest cover during the last five decades, but the last two decades show fluent change, particularly in those regions, where forests have the potential to improve the livelihoods of forest dwelling people, especially tribal people, who are among the most disadvantaged groups in Indian society. My study deals with the growth, composition and structure of forest areas in India during post reform period from 1991 to 2009. Forest covers areas measured by the forest survey of India every two years after 1987 and continues till today. The first assessment in 1987 was done visually on 1:1 million scales. Thereafter, up to 1999 the assessment was done on 1:250,000 scale. My study focuses the qualitative and quantitative change in the forest areas through analyzing the different classes of forest cover growth and distribution among all districts. India obtains an overall positive change of forest cover in the past two decades but these growths have not taken place in all parts of India evenly. Mostly degradation of forest has been detected in eastern part of Indian districts because of mass population pressure, development activities, agricultural expansion and mining activities, where western and south-west part of India's districts recorded positive growth of the forest during 1991-99, caused by reforestation activities, participation of local people in management process with the help of local institution. On the other side in the period of 2001-09, declination of forest as continue to be in western part of India and northeastern part of India. But Kerala, north part of India and middle parts recorded an increase in forest areas because of reforestation activities, community forest management and proper policy implications.

Key Words: Forest Degradation, Management, Natural Resource, Community Participation, Reforestation and Sustainable Development

1. Introduction

Forest as a natural resource has always been an important component to determine the economic structure of livelihood around forested areas in some parts of India, which furnish the employment, fodder, fuel wood and other forest product for local livelihood. The importance of forest resource has never been ignored in ecological balancing through imbibing carbon from atmosphere. Deforestation and forest degradation contribute to atmospheric greenhouse-gas emissions through combustion of forest biomass and decomposition of remaining plant material and soil carbon (G. R. van der Werf, D.C. Morton, 2009). Deforestation is the single largest source with 17% of global greenhouse gas (GHG) emissions (Nabuurs,

Masera, Andrasko et al. (2007). In India, forests and people are inextricably linked since millions of people live adjacent to or within protected areas and harvest forest products (Kothari et al., 1989). The nature of forest growth during 1991-09 is such that it shows an overall growth in forest area among all classes. Moreover, betterment of forest cover of dense and open forest area are the other features of impact of better plan and management with new policy for forest protection by the help of local communities. Most of the studies on talks about a decline of forest after independence, yet it is important to see the change and its structure after the post reform period. It is important to see the changes at district level for qualitative and quantitative growth of forest area in India. Here the structure of forest areas refers to change the

forest growth and distribution of forest cover and see the pattern of land utilization within a period of time.

In India local impacts on forests have been attributed to poverty, population pressure, agricultural expansion and intensification and development of infrastructure (Godoy et al., 1997; Angelsen and Kaimowitz, 1999; Geist and Lambin, 2002). Forest has always considered the richest natural resource in India because of its importance by providing shelter and food for the local communities as well as comprise with mines. There is enough evidence to show this that Indian forests are ancient in nature and composition and once it was covered with dense forest. The fact that they have existed for very long time is proven from the ancient texts all of which have some mention of the forests. The people honored the forests and a large number of religious ceremonies centered on trees and plants since a long history. Deforestation is nothing new in India, during colonial periods forests were treated as the production of timber used for the British navy, for export, and for the creation of the railway network. Extensive tracts of forest were also converted into plantations of tea, coffee, rubber and other commercial crops (Basu, 2009). The forest policy of British administration directed towards commercial interests and agricultural development, which was the major source of revenue. These motives were documented in the Indian Forest Acts of 1865, 1878, and 1927 and National Forest policy of 1894 during the colonial era (Balooni and Inoue, 2009).

In the district of India, the nature, composition and distribution of forest has changed after independence especially after post reform period because of several reason which varies from one region to another. The recent change in forest cover has made strong impact on the socio-economic structure of several communities in different part of country. Last two decade has recorded the positive trend of forest growth in India, but these growths have not taken place universally in all corner of country. Some parts of country has recorded the positive growth of forest in first decade but in the last decade those region recorded as negative growth of forest, which are the result of inadequate policy implementation and lack of environmental friendly development. This study reviews and compares the best

recent estimates of deforestation rate and attempts to alleged causes and effects. We also want to see the qualitative (dense and open) and quantitative change of forest in relation to recent changing pattern of economy in India. Instead we use currently available data to derive policy recommendations regarding overall deforestation and illustrate the limitations imposed on such a process by the scale and inherent uncertainty in the data. This paper also reviews that, how methodological interpretation and used technique has made an impact to calculate the change in real forest covers in different period of time.

According to all the best available evidence, deforestation is a real trend in almost all states of India although the magnitude of the problem varies substantially. Despite the definitional problems, we have detected a surprising amount of agreement among estimates of deforestation on a state by state basis and much similarity in the rank ordering of states according to their rates of deforestation. There are two kind of activities which can potentially affect the process of deforestation, one is growth induced, which determined by the change in number of industries and total employment in that particular industries in a certain period of time. And other is to poverty induced processes, which based on the economy of the local people and their dependence on the forest. It may be noted here that protection of forests halt both processes, and thus it is worthwhile to enquire into the impact of both kinds of processes on deforestation. Logging is the major activities around the forest cover areas, where the large number of population are involved for their economy, but most of them are engaged in the informal sector affect the process of deforestation activities.

2. Methods

Using secondary data from above mentioned sources, the analysis of growth, change and distribution of forest has been done for post reform period. The data for calculating the growth of forest cover carried from FSI (Forest Survey of India), which provide both the data of qualitative and quantitative. FSI provide data bi-annually at district level since 1989, where data has been collected from state forest report. Growth in the forest area of all districts has been calculated using this formula-

$$r = ((Y_f - Y_b) / Y_b * 100) 1/n$$

Where,

r = growth rate

Y_f = final year

Y_b = base year

n = number of years

Also the comparisons have been made “between” (1991-99) & (2001-09) period in the growth of forest areas. State wise and district wise distribution, change and growth of all types of forest (dense forest, open forest & scrub) has been analysed by the given data of forest survey of India report of 1991, 1999, 2001 and 2009. Growth rate of forest area has been analysed of the period (1991-99) & (2001-09), then the comparative analysis has been done. Interpretation of land sat imagery pertaining to the period of 1987-89 on a scale of 1:250000, which continue till 1998-99, then it pertain to change during 2001-09 on a scale of 1:50000. The total change, growth and distribution have been discussed on the basis of their qualitative (total change in forest areas) and quantitative (total change in the dense & open areas).

3. History of Forest Change in India

Indian development started through the five year plan, which consist the several socioeconomic and environment component for sustainable development of economy, where forest was also considered as a major natural resources to manage. In the past history of India, around 3000 B.C, nearly 80% of India was forested (Warner, 1982). In India the recorded forest area in 1950-51 was reported to be 68 million ha and increased to 75 million ha in the early 1980s due to consolidation. The forest area was further reported to be 76.5 million ha in 1997. India possesses around 16 percent of the world's population and 15 percent of world's livestock, with only 2.4 percent of the world's land area and 1.7 percent of the world's forest stock. Obviously, land and forest resources are not commensurate with the proportionate burden of population and livestock on India's soil. If we see the land cover pattern of previous two decade (1991-2009) in India, then we will be able to analyze the real changes of forest cover among all categories.

As per the Forest Survey of India assessment in 2009, the current forest and tree cover of the country is estimated to have 78.34 million hectares accounting for 23.84% of the

geographic area of the country. Estimated forest cover, as per the estimate of the Forest Survey of India, is only 69.3 million hectares, which is just 21.02 % of its geographical area and is way below the stipulated target of 33% by the National Forest Policy document of 1988.

4. Composition of forest in India from 1991 to 2009

According to the Forest Survey of India the forest cover is broadly classified in three classes, namely dense forest, open forest and mangrove on the basis of their canopy density. It is hugely important to realize the composition of forest in terms of their real change in last two decades. As such, India has recorded the positive forest growth but this growth has not taken place universally in all areas and classes.

Table 1

Composition of Forest Cover from 1991 to 2009

Types of Forest	Percentage of total area	Percentage of total area	Percentage of total area	Percentage of total area
	1991	1999	2001	2009
Dense forest	11.71	11.48	11.88	12.24
Open forest	7.6	7.76	8.76	9.71
Mangrove	0.13	0.15	0.13	0.14
Total Forest Cover	19.44	19.39	20.77	22.09
Scrub	1.82	1.58	1.23	1.26
Non-Forest	78.16	79.03	78.13	77.72

Source: Forest Survey of India

According to table 1, overall forest area has declined up to 0.5% of total area in the period of 91-99, but substantially it has gone up to 1.32% in the last decade (2001-09). Dense forest cover faced the severe challenges during 91-99, when economic reform took place by several industrial set up in these regions, because these are rich in minerals resources. When we look the growth among different types of forest area during these periods, dense forest seems too followed up by the general trend of forest growth by declining 0.16% during 91-99 and grown up 0.36% during 01-09. On the other hand open forest area has recorded the growth in both period of time respectively 0.16% and 0.95%, because mostly afforestation

activities has been introduced as open forest in dry and barren land. Mangrove cover did not found any subsequent change and but scrub area has decreased within period of time, because most of the scrub area has been forested through proper plantation activities.

5. Distribution and Growth of forest

5.1 State wise distribution and growth of forest

The state level distribution of forest varies within study period consistently, where some of the state shows the positive growth of forest while some state recorded fast decline. According to assessment in 1991 forest report, total forest cover in country was 6, 39,182 sq. km. (excluding tea gardens) which is 19.44% of the total geographical area, but in the 2001 forest report, total forest cover increased up to 20.77 of total land cover. According to latest forest survey of India report during in 2009, most of the forests are concentrated in North Eastern region, Western Ghats and Himalayan region due to its climatic and physiographic situation, which is more than 60% of the total area. In other side Indian peninsular region are second highest concentrated region of forest, while northern plain are those regions, where lowest forest concentration are calculated due to maximum land utilization for agriculture expansion.

Table 2: State Level Forest Cover and Total Area under Forest from 1991 to 2009 (in sq. km.)

% Forest Area to Total Area				
States/Years	1991	1999	2001	2009
Andhra Pradesh	17.19	16.08	16.15	16.4
Arunachal Pradesh	82.1	82.13	81.22	80.43
Assam	31.55	30.19	35.48	35.3
Bihar	15.34	15.22	16.26	17.08
Delhi	1.47	5.89	11.46	11.94
Goa	33.85	33.79	58.24	58.1
Gujarat	6.07	6.61	7.62	7.46
Haryana	1.16	2.18	3.43	3.61
Himachal Pradesh	21.14	23.5	25.78	26.35
J & K	9.03	9.2	9.57	10.21
Karnataka	16.79	16.93	19.00	18.87
Kerala	26.48	26.54	40.08	44.58
M.P.	30.62	29.73	29.86	30.12
Maharashtra	14.31	15.17	15.23	16.46
Manipur	79.21	77.56	77.12	77.4

Meghalaya	70.78	69.47	75.08	77.23
Mizoram	89.43	86.6	87.42	91.27
Nagaland	86.38	84.99	82.09	81.1
Orissa	30.32	30.2	31.06	31.38
Punjab	2.67	2.8	3.14	3.3
Rajasthan	3.75	4.05	4.62	4.69
Sikkim	42.74	43.64	45.97	47.31
Tamil Nadu	13.62	13.13	17.41	17.94
Tripura	52.78	54.51	77.18	76.99
U.P.	11.42	11.55	13.11	13.19
West Bengal	9.03	9.42	13.91	14.64
Andaman & Nicobar	92.4	91.18	84.42	80.76
Chandigarh	4.39	5.91	13.16	14.91
Dadar Nagar Haveli	41.96	37.76	45.82	42.97
Daman & Diu	1.79	2.68	7.14	5.36
Lakshadweep	0	0	71.88	81.25
Pondicherry	0	0	8.33	9.17
All	19.44	19.39	20.77	22.09

Data Source: Forest Survey of India

When we see the last two decades of forest trend, major declination of forest has taken place in those regions where forest cover was already high. But in the first decades, lower forested regions has achieved positive growth of forest in compare to dense forested area, because this was the period when major forest policy introduced in these states as a primary objectives for increasing the forest area through conservation and afforestation process. Most of the hilly regions are the abidance of tribal people, who are dependent on forest for their livelihood, became concuss to manage the forest. As mentioned in table 2, North-Eastern states (Arunachal Pradesh, Nagaland, Mizoram, Meghalaya and Manipur) have highest concentration of forest to total area in all four years, where more than 70 percent of total areas are covered with forest. But forest in these regions are under pressure and most of the states recorded the declination of forest in last two decades due to population pressure, Jhum agriculture, hydro-project and logging activities for timber wood industries. In its 2001 preliminary ranking study of the hydroelectric potential of river basins in India the Central Electricity Authority identified 168 large dams in the Brahmaputra Basin to generate 63,328 MW of power (Menon et al. 2003). In other side states

situated in plain area like Punjab, Haryana, Bihar, Gujarat and Rajasthan have lowest forest cover with 10 percent of total area. States situated in peninsular regions has medium concentration of forest because of its hilly structure and average rainfall, where Orissa, Madhya Pradesh, Jharkhand, Chhattisgarh recorded the decline in total forest cover in last two decades due to mining activities, infrastructure & industrial set-up, encroachment of forest and population pressure. Most of the states are recorded the positive growth of forest in previous two decades but some of states like Kerala, West Bengal, Meghalaya and Tripura has observed the utmost growth in forest due to proper implementation of forest conservation policy, operation of Joint Forest Management and afforestation activities with help of local communities.

5.2 District level Growth of Forest During 1991-1999 and 2001-2009

India is one of the largest countries in the world in terms of its population and area, which carries various physical, cultural and ethical diversity. Indian states are further divided into districts for administrative purpose because of large areas of states. My district wise study tries to identify those pockets of regions inside the states, which is increased or decreased the forest cover during this period. Last two decades (91-09) were very crucial in terms of the change in forest area among Indian districts. Although forest is significant part of environment, it is important to see its growth pattern closely at micro level. As it is stated that total forest area increased during 1991-2009, so it's more important to find out the regions of loss and growth of forest and its reason.

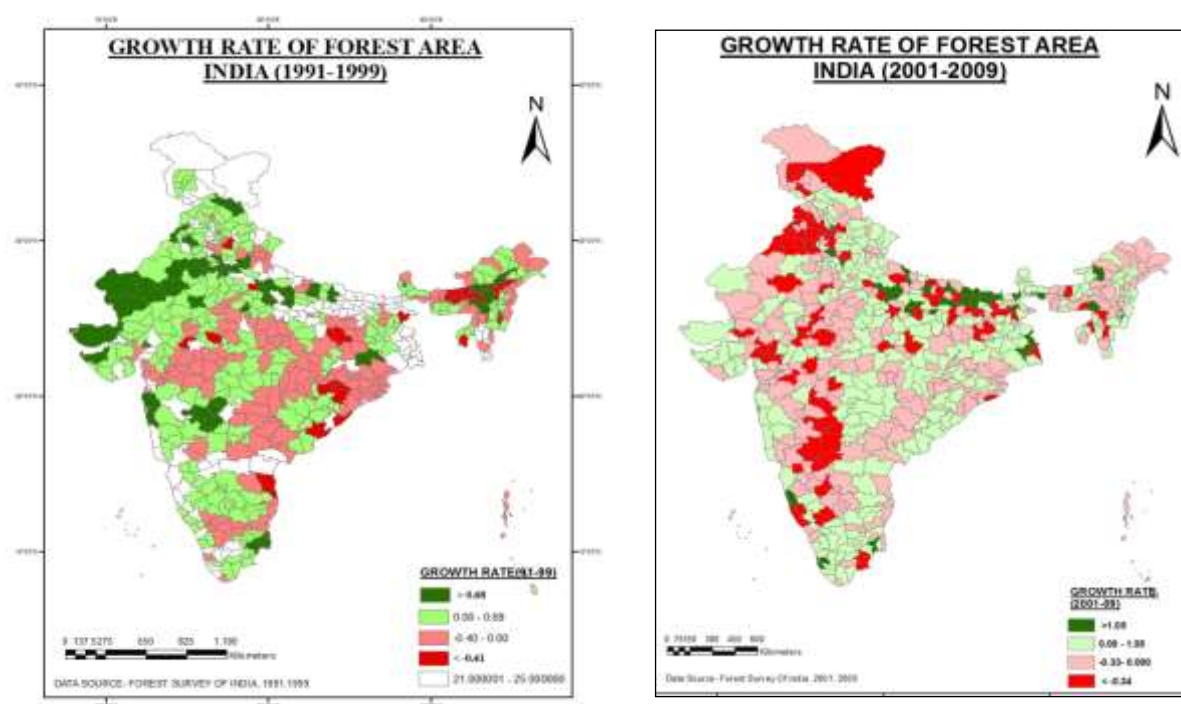


Figure 1A and 1B showing the growth rate of forest area between 1991-99 and 2001-09

According to figure 1A, districts located in the western Madhya Pradesh, Chhattisgarh, western Assam, Telangana region in Andhra Pradesh, almost all Orissa, middle east-west Tamil Nadu and some part of the North eastern states are recorded the highest rate of forest degradation between 1991-99. The cause behind the degradation of forest in these regions are; In Madhya Pradesh, Chhattisgarh and Orissa forest

area has been submerge in the catchment of dams' construction and also affected by the mining activities and industrial extension as well as agricultural expansion. North eastern forests are mainly affected by the shifting cultivation and biotic pressure. Decrease in forest cover in Assam in mainly attributed to illicit felling, encroachment in insurgency affected area and shifting cultivation practices. In the early period of time

there were more forest based industries, which leads to logging activities but in change of that proper plantation of forest could not take place. Punjab, Haryana, Himachal Pradesh, Delhi, present northern Uttar Pradesh, southern West Bengal, Gujarat, middle Madhya Pradesh, Maharashtra, Kerala and boarder area of Karnataka & Tamil Nadu was the other regions, which gained the forest area due to afforestation process and awareness for the conservation through forestry management communities. In Punjab and Haryana, afforestation process took place as linear forest through agro-forestry and plantation aside the roadways, railways and canal. Kerala and West Bengal are the best example of increasing the forest area through joint forestry management and participatory forest management.

But all districts in Rajasthan recorded the highest growth in forest area because, Rajasthan considering the increasing biotic pressure on the land in arid area and the trend of more intensive land cultivation on larger area there is need to accelerate the growth of forest in this region so that the natural base here could be improved to sustain the vital life support systems and also to help in bringing about favorable changes in the harsh climate of the region. The causes behind the drastic growth rate in Rajasthan's districts are the efforts towards afforestation process by the government with the help of local people. Rajasthan also focus on the eco tourism by implementing some strategies like by applying the help of local peoples and provide its benefits to those peoples.

If we see the image 1B for 2001-09 periods, then it can be easily identified that once again high deforestation has taken place in western parts of Indian districts. Punjab, Jammu & Kashmir, Western Maharashtra and some parts of Gujarat area most degraded regions while almost all parts of Rajasthan, lower & eastern Assam, Karnataka, north Maharashtra, Arunachal Pradesh and western Madhya Pradesh are the other degraded regions. Rajasthan, Punjab and Haryana are only regions, which has diverse growth of forest compare to previous decades because of high exploitation of forest area, industrial expansion, agricultural need due to high population growth, infrastructural development, mining activities and less focused on plantation activities. Kerala, West Bengal, Northern Bihar and some parts of Uttar Pradesh, coastal Andhra Pradesh has increased the

forest areas because of reforestation process and forest management. Kerala and West Bengal are the only states, who have recorded the growth of forest in both of the period 91-99 and 200-09 because of effective protection by the JFM, regeneration of forest and extensive plantation activities. Maximum districts are not from the north eastern part of India, but they are from north western part of India and south India, which recorded the negative growth of forest. Shekhpura district from Bihar has lowest growth rate of forest but most of the districts are from Punjab, Haryana and Karnataka.

6. Qualitative Changes in the Forest Cover

Most of the study discusses about forest growth throughout the total forest cover change, but forest areas are further classified in two major categories which growth also need to be consider to see the real change in forest cover. Dense and open forest areas are the major classification of forest, done by forest survey of India on the basis of its canopy size. Dense forest includes all lands with a forest cover of trees with a canopy density over 40 percent and open forest includes all lands with a forest cover of trees with a canopy density between 10 to 40 percent. We will be very clear to analyze the character of forest growth as we see the growth of dense and open forest cover change in districts of India. Most of the forest here belongs to the open forest cover in character which is generally concentrated around plateau and plain regions. Dense forest areas are mostly concentrated in the western coast, plateau region, islands and north eastern hilly parts of India.

6.1 Growth of Dense Forest Areas

Dense forest mainly concentrated in those regions where climatic conditions are favorable for plant growth like high rainfall and fertile soil. There has been prominent change in the dense forest areas in the districts of India during the 1991-2009, due to several climatic and human forced causes. According to figure 2A & 2B, which indicates the growth rate of dense forest areas of two periods of time i.e. 1991-99 and 2001-09, shows that major degradation of dense forest has been recorded in the districts of Madhya Pradesh, Chhattisgarh, Orissa, Western Assam, Arunachal Pradesh, Manipur and northern Andhra Pradesh during 91-99. These were the area, which concentrate the high amount of dense forest cover and also rich in mineral resource so the utmost degradation took

place here at the cost of different development processes and population pressure. But other side major parts of north-eastern districts, western Madhya Pradesh, Gujarat, Tamil Nadu, Eastern Rajasthan and some districts of Maharashtra

observed the positive growth of dense forest cover during due to reforestation activities, conservation process and several protection mission started including local people.

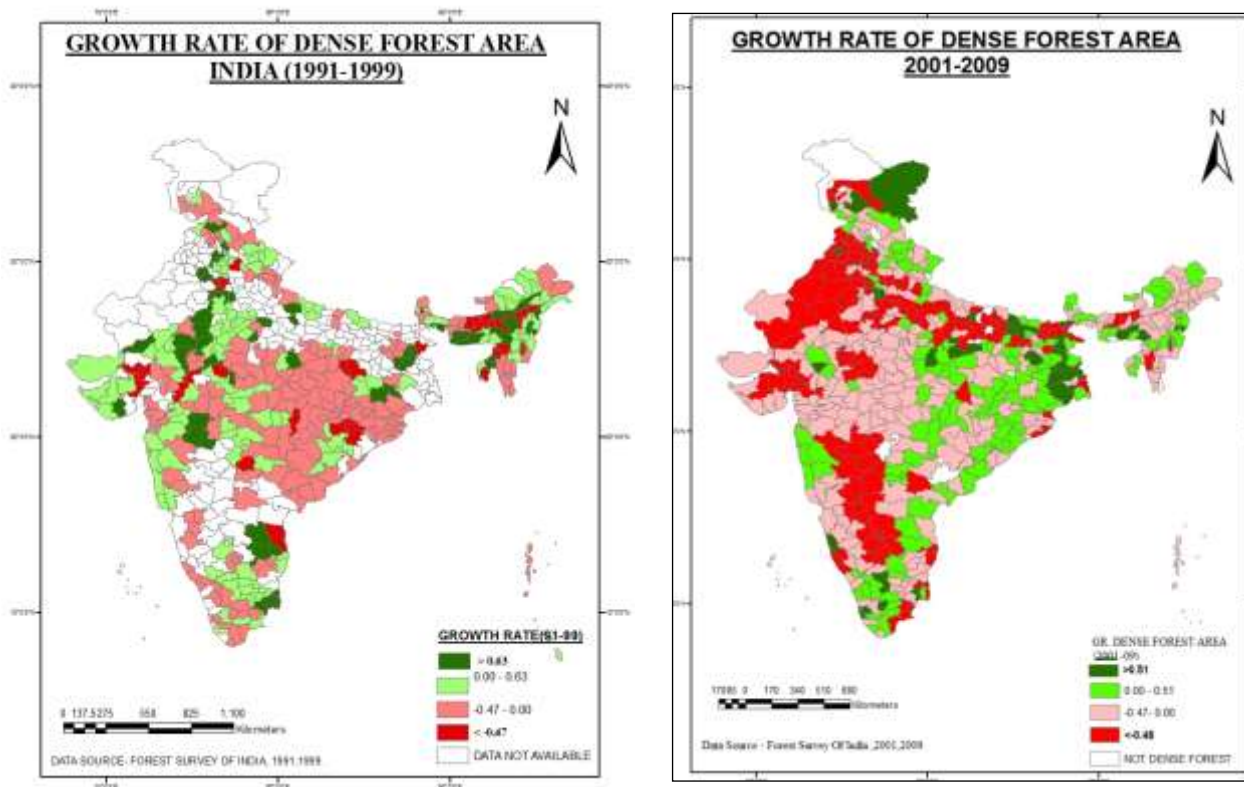


Figure 2A and 2B showing the growth rate of Dense forest area between 1991-99 and 2001-09

In the period of 2001-09, dense forest areas declined in western parts of India, where districts situated in north western Rajasthan, semi arid region of Karnataka, Western Uttar Pradesh and Maharashtra recorded the extreme decline due to harsh climatic condition, human interference and mining activities, agricultural expansion, population pressure, grazing, natural hazards and development activities. Most of the Indian tribal communities lives around the dense forest region and they are fully dependent on forest for their livelihood and economic structure, which also leads to pressure forest. The causes behind these declines in dense forest are also the change in the

structure of the dense forest areas or technical. On other side districts from Bihar, West Bengal, Kerala, Jharkhand and some part of Orissa registered the positive growth of forest because of the process of community forest management and mass afforestation activities.

6.2 Growth of Open Forest Areas

Most of the forest covers are open in nature among all forest cover in India because of Indian climatic existence and population distribution pattern. So it is more crucial to study the growth patterns of open forest for finding the appropriate outcome of actual forest change.

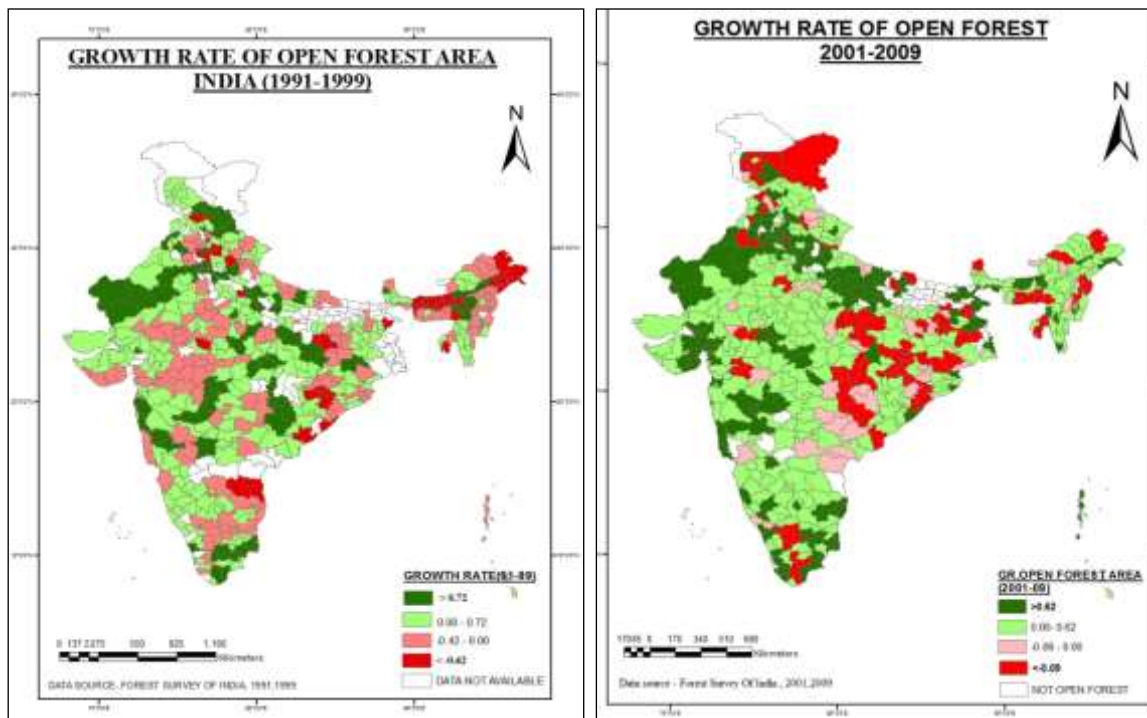


Figure 3A and 3B showing the growth rate of Open forest area between 1991-99 and 2001-09

Maximum open forest covers are spread over around the dense forest area, which indicates the climatic character in Indian regions. In given figure 3A & 3B, most of the districts show the positive growth of open forest in both period of time. In the districts with reach mineral resources have even faced decline in forest area but maximum districts from north plain region have registered the prominent growth in open forest area because of plantation and awareness towards protect forest. The other hidden fact with the growth in open forest cover is that, maximum dense forest are transformed in the open forest due to high accessed through animal grazing and logging activities. The economic structure and livelihood of people living around forest areas are linked with the growth of open forest, because it is easily accessible and easy to manage. The reason behind declining in open forest cover in North eastern states has registered as biotic pressure and shifting cultivation.

7. Conclusion.

As mentioned above, the importance of natural resource has been identified for environmental sustainability, where forest contributes a significant role. In the early 90's decade, when district level satellite data published were very crucial to see the quantitative and qualitative change in forest at micro level. These decades

were also important in terms of forest scenario, when new economic policy introduced, which allows to easy access of other natural resources close to forest areas. The past twenty years were the very important in terms of growth of the forest cover in India, where total forest area increased but these growths did not take place evenly in all regions. This growth among was the result of several administrative accomplish with help of local communities by conservation and reforestation activities. During 91-99, most of the degradation took place in plateau regions and northeastern states but in the period of 2001-09, It shifted to the north western and western part of India, which was the result of mining activities, industrial set up, population pressure, dam constructions, forest fire, shifting cultivation and agricultural & settlement expansion respectively. In last decade maximum dense forest area converted into open forest regions due to over grazing and logging activities.

Dense forest cover decreased in first decade but increased in last decade while open forest areas increased in both decades. During 91-99, mostly dense forest decreased in those regions, where concentration are prominent while open forest area increased in maximum district of India. Districts situated in Middle West parts and north east parts of countries are most affected in terms of dense forest area in first decade due to several

development activities in these regions. But it was not continued in those districts during 2001-2009, and maximum dense forests are degraded in northwestern and middle arid parts of countries due to its harsh climatic condition, agriculture expansion and lack of effective conservation. There were several industries based on the forest products like paper, furniture, mach box and lacks industries and the demand for these industries increased with the development activities. In the same period open forest cover increased among all districts of countries except some districts from Andhra Pradesh, Chhattisgarh, Orissa and Meghalaya due to plantation activities in open area and conversion of dense into open. In spite of implementing and introducing several policies for the protection of forest areas during 2001-09, declination of forest was not controlled in some part of country, because activities for deforestation was high than the afforestation. The uneven distribution of different forest cover in India resulted the imbalance growth of forest in previous decade, which was the result of several reasons like, mismanagement of forest, avoiding the role of tribal community, lack of proper policy and institutional commitment for environmental conservation. Maximum parts Indian Territory have average rainfall that suits to grow open forest cover, which can also be attained through plenty of afforestation activities by promoting agro forestry, linear forest plantation, urban and industrial forestry. Conservation of existing natural forest area is more significant than artificial plantation by participating local communities which should assure the involvement of different caste, religion and gender. Most of the tribal community lives around the forest area and they depend on the forest area for their livelihood, which should be allow to easy access because they contribute to protect forest area rather than deforestation. Industrial proprietor should also be compelled for reforestation and conservation activities by providing the financial support and technology to institution and local community. The framework of policy need to be reconsider, which should be vary by regional diversity and not to be favored for any particular community or entrepreneur.

References

1. S. JHA, and K. S. BAWA, *Population Growth, Human Development, and Deforestation in Biodiversity Hotspots*, source: Indian Forest department, New Delhi, India(2005).
2. Shyamsunder, S. and Parameswarappa, S., *Forestry in India: The Forester's View*, Source: *Ambio*, Vol. 16, No. 6 (1987), pp. 332-337.
3. Mahinder Chaudhry, *Global Population Growth, Economic Development and Environmental Impact Case-Study of India, 1991-2100*, Source: *Economic and Political Weekly*, Vol. 30, No. 49 (Dec. 9, 1995), pp. 3163-3167.
4. Richard Haeuber, *Development and Deforestation: Indian Forestry in Perspective*. Source: *The Journal of Developing Areas*, Vol. 27, No. 4 (Jul., 1993), pp. 485-514.
5. Tim Dyson, *On Development, Demography and Climate Change: The End of the World as We Know It?* Source: *Population and Environment*, Vol. 27, No. 2 (Nov., 2005), pp. 117-149.
6. Joachim von Amsberg, *Economic Parameters of Deforestation*, Source: *The World Bank Economic Review*, Vol. 12, No. 1 (Jan., 1998), pp. 133-153.
7. Tajbar S. Rawat*, B. L. Menaria, D. Dugaya and P. C. Kotwal, *Sustainable forest management in India*; *Current Science*, Vol. 94, No. 8, 25 April 2008, Pp 996-1001.
8. Tony Beck, Madan G Ghosh, *Common Property Resources and the Poor Findings from West Bengal*, *Economic and Political Weekly* January 15, 2000, pp 147-153.
9. Shama Perveen, *Population Growth and Sustainable Development*, *Economic and Political Weekly*.
10. R.M. Singhal¹, Sudhir Kumar² & V. Jeeva, *Forests and forestry research in India*, *Tropical Ecology*.
11. N. S. Jodha, *Population Growth and the Decline of Common Property Resources in Rajasthan, India*, *Population and Development Review*, Vol. 11, No. 2 (Jun., 1985), pp. 247-264.

12. Sudarshan Iyengar, *Common Property Land Resources in Gujarat: Some Findings about Their Size, Status and Use*, Economic and Political Weekly, Vol. 24, No. 25 (Jun. 24, 1989), pp. A67-A77.
13. G. K. Karanth, *Privatisation of Common Property Resources: Lessons from Rural Karnataka*, Economic and Political Weekly, Vol. 27, No. 31/32 (Aug. 1-8, 1992), pp. 1680-88.
14. Pradyumna P. Karan, *Environment and Development in Sikkim Himalaya: A Review*, *Human Ecology*, Vol. 17, No. 2, Human Ecology in the Himalaya (Jun., 1989), pp. 257-71.
15. Anuradha Vemuri (2008), *Joint Forest Management in India: An Unavoidable and Conflicting Common Property Regime in Natural, Resource Management*, *Journal of Development and Social Transformation*, Volume 5, November 2008.
16. J. Mark Baker, *The Effect of Community Structure on Social Forestry Outcomes: Insights from Chota Nagpur, India*, *Mountain Research and Development*, Vol. 18, No. 1 (Feb., 1998), pp. 51-62.
17. C. S. Jha†, C. B. S. Dutt†,* And K. S. Bawa, *Deforestation And Land Use Changes In Western Ghats, India*, *Current Science*, Vol. 79, No. 2, 25 July 2000, Pp 231-238.
18. Madhav Gadgil, S. Narendra Prasad, Rauf Ali, *Forest management and Forest Policy in India: A Critical Review*, *Social Action*, Vol. 33, April-June 1983, pp 127-157.
19. Madhav Gadgil, *India's Deforestation: Patterns and Process*, *Society And Natural Resources*, vol.3, pp 131-143.
20. Paul P. Appasamy, *Role of Non-Timber Forest Products in a Subsistence Economy: The Case of a Joint Forestry Project in India*, *Economic Botany*, Vol. 47, No. 3 (Jul. - Sep., 1993), pp. 258-267.

Author Profile



Shashi Bhushan submitted his PhD thesis in center for the study of regional development, school of social sciences, Jawaharlal Nehru University, New Delhi, India. During 2009-2016 of his research period, he pursued multiple research activity in the field of natural resources dedicated to forest management and climate change. Presently he is holding the post of assistant professor in the Geography department in Delhi University, New Delhi.