



প্রতিধ্বনি the Echo

**Pratidhwani the Echo**

*A Peer-Reviewed Indexed International Journal of Humanities & Social Science*

Published by: Dept. of Bengali

Karimganj College, Karimganj, Assam, India

Website: <https://www.thecho.in>

ISSN: 2278-5264 (Online) 2321-9319 (Print)

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## **Forest Dynamics and Prospects of Forest Resource Management in North East India**

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### **Abstract**

*Forests are precious resource given by nature. It is often termed as multipurpose resource. Once, North east India was considered as rich in forest resources. But reckless cutting of trees and clearing of forest and lack of concerted effort in afforestation have greatly affected the forest resources of the region. Unsustainable extraction of forest resources has disrupted the forest ecosystem and resulted in tremendous loss of biodiversity. Exploitation of forest resources and excessive deforestation has put tremendous stress and stain in environmental sustainability which in turn affects the quality of life for both present and future generation. This study attempts to examine the trend of forest dynamics and degradation and also to make an assessment of the causes responsible for forest depletion. Based collected information and data the study further tries to uphold the concept of sustainable management of forest resources by promoting environmentally sound forest conservation measures.*

**Keywords:** *Forest dynamics, forest ecosystem, forest resources, deforestation, sustainable management.*

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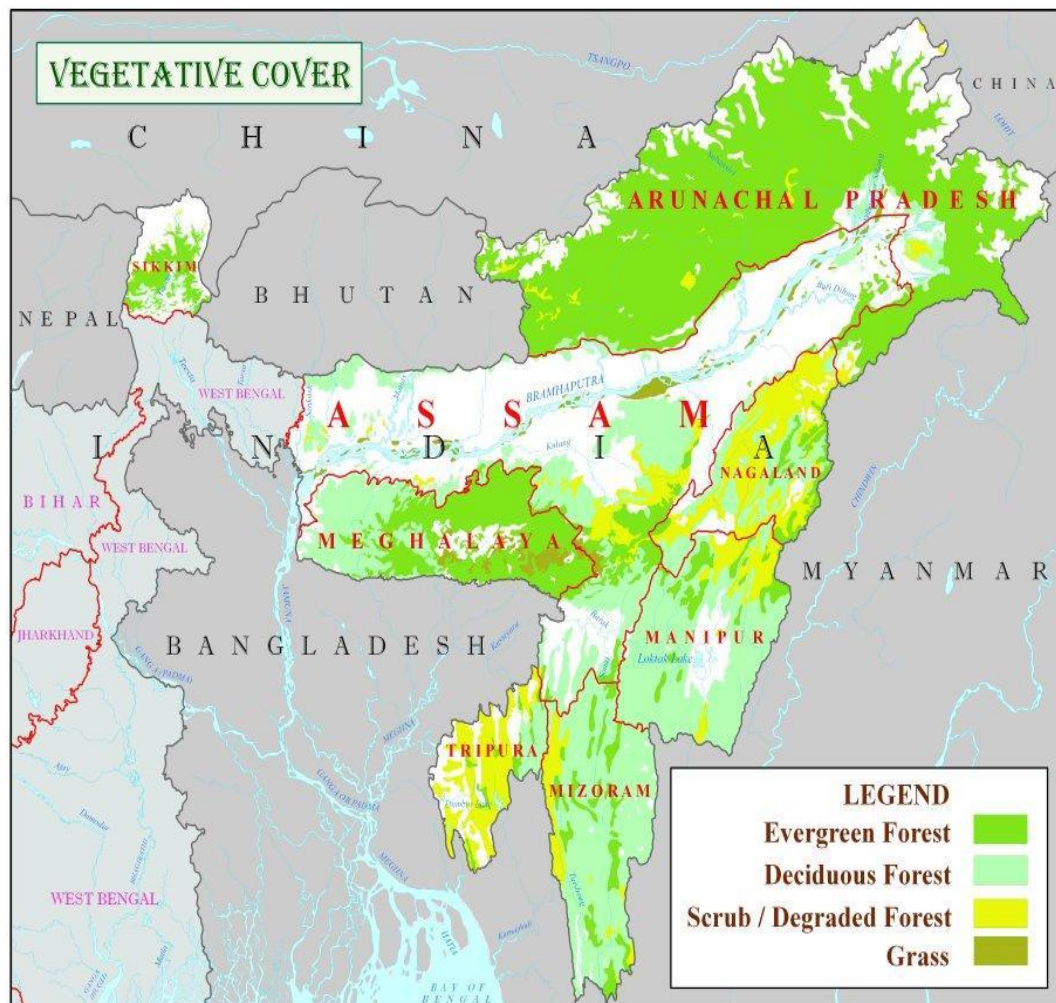
**Introduction:** Forest-a community of living trees are the renewable resources occupy an important place among the natural resources of a country. Now the forest resources are in danger with the encounter of various economic problems and going to decline day by day due to population explosion, soil erosion, ignorance, illegal cutting of trees. The increasing global concern about conservation of the world's natural resources has resulted in the formation of long term perspective plans for conserving forests. Forests help to maintain ecological balance, conserving biodiversity and enhance the quality of environment by checking soil erosion, water retention and conservation, regulate water cycle, act as a carbon sink which balances the carbon dioxide and oxygen in the atmosphere and facilitate in the reduction of the greenhouse gases effect etc. But excessive population and livestock pressure and the requirements of forest products for fuelwood, fodder, timber, lumber, paper etc which in turn triggers a forest depletion process. North Eastern Region (NER) was very rich in respect of forest resources. Forests once covered about 65.17 per cent of the total geographical area of the NER. Total area covered by forest in 2001 was 1.224 lakh sq. Km. being reduced to 46% of the total area. Among the eight States of NER, the concentration of forest is highest in Arunachal Pradesh, with area under forest cover being 5154 thousand hectare, which accounts for about 61 per cent of the reporting area. In Assam, the area under forest is nearly 19.30 lakh hectare which is about 25 per cent of the total area of the State. In the other six states, the proportions of areas under forest are quite high with 52 per cent in Nagaland, 89 per cent in Mizoram, 27 per cent in Manipur, 42 per cent in Meghalaya, 36 per cent in Sikkim and 58 per cent in Tripura. Out of the total forest area of the NER, reserve forests cover only one-third. Various valuable trees like Agar, Sal, Neem, Champa, Teak, Bansom, Simul, Sishu, Gamari, Sarol, Halokh, bamboo, cane, valuable medicinal and ornamental plants, vegetables, fruits are found in the North East Region. The forests of the North East India are also rich in fauna. Birds and animals are available in plenty in the forests of North East Region. Hoolock gibbon, one horned rhinoceros, wild buffalo, golden langur, crapped langur, elephants, the

four horned antelope, deer, barking deer, musk deer, pigmy hog, bear, bison, wild boar, Royal Bengal Tiger, leopard, wild cats, civet cats, snow leopard, Himalayan bear, marsh crocodile, fresh water gharial, turtle, tortoise, monitors, chameleons, lizards and snakes, python, cobra, stork, peacock, pelican, ducks, vulture, eagle, doves, parrots, wren etc. On the basis of the forest resources of the NER, various types of forest based industries such as plywood mills, match manufacture, bamboo and grass for paper and pulp mills, saw-mills etc. have been established.

**Study area:** The study Area, North East India spreads over an area of 2,62,179 square kilometers and consists of 8 states: Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim. (Sikkim has become a member state of North East Council in 2002). It is stretched between 89°46' E to 91°30' East longitude and 21°57' to 29°30' North latitude. Comprising only 7.86% of the country's geographical area, the North East is home to a total of 39,035,582 people (2001 census), which is 3.80% of country's population. The region is undulating and mountainous with average height varying from 1000m to 2000m above mean sea level. Maximum temperature is 5° c in winter. Rainfall is very high in the whole states and average rainfall varies from 1200 mm in Manipur to 11,000 mm in Meghalaya. The climate of the region is a warm humid, tropical, subtropical. The climate is very much suitable for dense vegetation cover. Major trees are tropical semi evergreen, sub-tropical pines, mountain wet temperate and tropical moist evergreen vegetation. Under these circumstances, forests as a natural resource play a vital role in order to maintain the ecological balance.



Source: Internet

**Objectives:**

The main objectives of the present work are:

1. To examine the trend of forest dynamics and degradation.
2. To make an assessment of the causes responsible for forest depletion.
3. To uphold the concept of sustainable management of forest resources.
4. To promote environmentally sound forest conservation measures.

**Methodology:** Data pertaining to the study is mostly based on secondary sources of information. In this paper, data on forest cover of North Eastern States of India (1987 to 2005) is collected from Forest Survey of India, MOEF, and annual change of forest cover is calculated out in percentage. Total population of the region, urbanization and industrialization are collected from Census of India, ministry of NEC.

**Observation:** Institutional arrangements for forestry management in North Eastern Region:

Unlike the other regions of India, administrative control of forest in the North Eastern Region is predominantly by community, with much of forests listed as 'unclassified'.

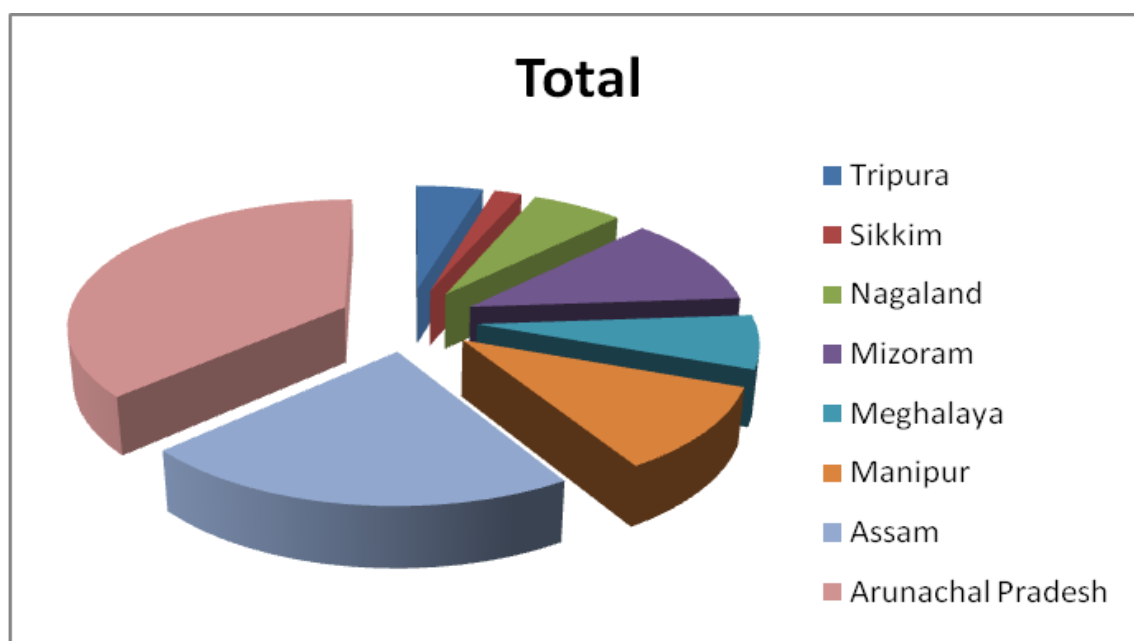
As in other parts of India, the state forest departments, administrator 'reserved' and 'protected' forest. The reluctance of state forest departments to consider changing the 'unclassified category' to reflect community claims as much of these forests remains an ongoing source of tension. The region's forests are experience an extensive process of forest fragmentation, degradation and outright deforestation and forest conservation. The management of the forest has suffered in the recent past due to pressure of land, the decreasing cycle of shifting cultivation, exploitation of forest for timber and lack of scientific management strategy. Shifting cultivation has been an important factor responsible for much

of the forest being classified as ‘open forest’ especially in states like Manipur, Mizoram, Meghalaya and Nagaland where much of the land designated as unclassified forest in part of Jhum where shifting cultivation is practiced.

Administrative classification of the forest covers of the North East India

States	Total	Reserved	Protected	Unclassified	Total	Shifting Classification (1987-97)
Tripura	0.63	0.36	0.05	0.22	0.63	0.06
Sikkim	0.26	0.22	0.03	0.01	0.26	
Nagaland	0.86	0.01	0.05	0.80	0.86	0.39
Mizoram	1.59	0.71	0.36	0.52	1.59	0.38
Meghalaya	0.95	0.10	0.01	0.85	0.96	0.18
Manipur	1.50	0.14	0.40	0.96	1.50	0.36
Assam	3.07	1.81	0.40	0.86	3.07	0.13
Arunachal Pradesh	5.15	1.53	3.61	0.01	5.15	0.23

Source: Forest Survey of India



The forest cover data collected from forest survey indicates an increase in forest cover of 7896 km<sup>2</sup>, at an annual rate of increase of 0.25% for North East India between 1987 and 2005. However the trend analysis of the forest cover data since 1987 onwards to 2005 reveals the trend of declination. The entire period from 1987-2005 is divided into 3 divisions. The first period (1987-1991) indicate an increase in forest cover of 3371 km<sup>2</sup> (annual growth of 0.4%) increase in forest cover of Arunachal Pradesh (4870 km<sup>2</sup>) and Manipur (210 km<sup>2</sup>) in 1989 and Meghalaya (2130 km<sup>2</sup>) and Mizoram (683 km<sup>2</sup>) in 1991 are the main drivers of growth during this period. While Assam, Meghalaya and Tripura along with the states like Arunachal Pradesh and Nagaland also witnessed considerable loss in the forest cover during that period.

## Forest cover of the states of North East India

States	Geographical Area (km <sup>2</sup> )	Forest Cover									
		1987	1989	1991	1993	1995	1997	1999	2001	2003	2005
Arunachal Pradesh	83743	64132	69002	68757	68661	68621	68602	68847	68045	61692	67777
Assam	78438	25160	24832	24751	24505	24061	23824	23688	27714	21135	21645
Manipur	22327	17475	17685	17685	17621	17558	17418	17384	16926	11259	11086
Meghalaya	22429	16466	15645	15875	15769	15714	15657	15633	15584	16925	16988
Mizoram	21081	19084	18170	18853	18697	18576	18173	18335	17494	18583	18664
Nagaland	16579	14394	14399	14321	14348	14291	14221	14164	13345	14013	13119
Sikkim	7096	2756	3041	3014	3119	3127	3129	3118	3193	3262	3262
Tripura	10486	5953	5535	5535	5538	5538	5546	5745	7065	8123	8155

Source: Forest Survey of India

The growth of forest cover in between 1987-1991 in the region could not be maintained and in 1991-2001, only 575 km<sup>2</sup> forest cover was increased in the region with an annual growth of 0.03%. During this period, the growth of forest of Assam and Tripura was maximum than any other states in the region. However, in the period of 2001-2005, there is maximum increase in forest cover of 3950 km<sup>2</sup> with an annual growth rate of 0.46%.

State	1987-1989	1989-1991	1991-1993	1993-1995	1995-1997	1997-1999	1999-2001	2001-2003	2003-2005
Arunachal Pradesh	3.53	-0.18	-0.07	-0.03	0.01	-0.18	-0.59	-0.26	0.06
Assam	0.66	-0.16	-0.50	-0.93	-0.50	-0.19	7.26	0.04	-0.16
Manipur	0.59	0.00	-0.18	-0.18	-0.10	-0.10	-1.35	0.96	-0.51
Meghalaya	-2.62	0.72	-0.34	-0.18	0.18	-0.08	-0.16	3.96	0.19
Mizoram	-2.52	1.81	-0.42	-0.33	0.53	-1.19	-2.41	2.93	0.27
Nagaland	0.02	-0.27	0.09	-0.20	-0.25	-0.20	-3.07	2.39	-1.08
Sikkim	4.69	-0.45	1.68	0.13	0.03	-0.18	1.17	1.06	0.00
Tripura	-3.78	0.00	0.03	0.00	0.07	0.73	9.34	6.51	0.20
N.E. Total	0.86	0.14	-0.16	-0.23	-0.09	-0.08	0.72	1.22	-0.08

Source: FSI

### Trend of forest dynamics:

1. **Population Pressure:** According to the census of India, the population of North East India is 38.50 million in 2001. Assam alone accounts for 26.64 million and Mizoram shows the lowest population of less than a million that is only 0.891 million. The average population density in the region is 147 persons per square kilometer. Assam and Tripura have a fairly high population density of 340 and 304 persons per square kilometer respectively. Arunachal Pradesh has only 13.

The increasing population and population density trends are reflected in the per capita availability of forest land. Between 1981 and 1995, for example the forest land available per person has described by over 50% or more in Nagaland and Meghalaya and by 30% or more in Mizoram, Manipur and Assam. This reflects the combined impact of population growth and forestland loss.

States	Geographical Area(Sq.Km)	Total Population(.000)			
		1971	1981	1991	2001
Arunachal Pradesh	83743	468	628	864	1091
Assam	78438	-	-	22414	26638
Meghalaya	22489	1012	1328	1774	2306
Mizoram	21081	332	488	689	891
Manipur	22327	1073	1434	1837	2388
Tripura	10486	1556	2060	2757	3171
Nagaland	16579	516	773	1209	1988

## Decadal growth rate of population in North-East India

States	1771-1981	1981-1991	1991-2001
Arunachal Pradesh	35.15	36.83	26.21
Assam	50.05	56.08	64.41
Meghalaya	32.46	29.29	30.02
Mizoram	48.53	39.70	29.18
Manipur	31.92	34.30	13.74
Tripura	32.04	32.86	29.94
Nagaland	23.36	24.22	18.85

**2. Economic Activities:**

**A. Shifting Cultivation:** Hill areas of North East India are predominantly inhabited by tribal communities whose livelihood is primarily dependent on agriculture, forest products, and limited horticulture, cash crops. In this region, there is often no clear cut demarcation of forest and agricultural land. In shifting cultivation areas, the same piece of land can be under agriculture at one time and under regenerating forest at another time.

**Forest area and shifting cultivation in the North East India:**

State	Total Forest Area	Area under Jhum 1987-1997(km <sup>2</sup> )	% of forest area under Jhum 1987-1997
Arunachal Pradesh	51,500	2,300	4.5
Assam	27,000	1,300	4.8
Manipur	17,400	3,600	20.7
Meghalaya	9,500	1,800	18.9
Mizoram	15,900	3,800	23.9
Nagaland	8,600	3,900	45.3
Tripura	7000	600	8.6
Total North East	136,900	17,300	12.6

Source: FSI 1999

As table indicates from 1987 to 1997 nearly 13% of all forests were under Jhum cultivation. Further in the hill states of Manipur, Meghalaya, Mizoram and Nagaland the proportion of forests under Jhum varied from 19 to 45%. Other forest areas may also be a part of older Jhum cycle.

**Land use trend in north east India:**

- Total area affected by Jhum has been increasing.
- Fallow period of Jhum is shortening, resulting in poor forest generation.
- Soil forestry is declining, resulting in reduced or stagnant agricultural productivity.
- Availability of forest products and services is declining.
- Natural resource management systems are becoming increasingly unstable.
- Income from agriculture and forest is falling.
- The rural poor are becoming poorer.

- Community lands are being converted into private lands.
- Privatization of land is leading converted into private lands.
- Privatization of land is leading to landlessness and social insecurity.
- Jhum lands are being brought into plantation and cash crops.
- Traditional community institutions are losing authority.
- Government's encouraging afforestation of Jhum lands.
- Rising of plantation and cash crops reduces land available for subsistence food crops.
- Rural poor are increasingly migrating to urban centres

### B. Industrialization:

North East India is industrially backward compared to other states of the country. Large and medium industries in North East Region (as in March 2000)

State	No. of units	Percentage
Arunachal Pradesh	17	9.39
Assam	129	71.27
Manipur	12	6.63
Meghalaya	10	5.52
Mizoram	1	0.55
Nagaland	7	3.87
Sikkim	3	1.66
Tripura	2	1.10
Total	181	100.00

Source: Basic statistical of NER 2002(NEC)

Apart from some small agro-based industries and mineral based industries, it has practically no manufacturing industry worth the name. Assam, among the other states of North East India holds the maximum share of industrialization followed by Arunachal Pradesh with a big gap.

### 3. Rate of Urbanization:

Urbanization pattern of North East India:  
Percentage of urban population

States	1971	1981	1991	2001
Assam	8.82	9.88	11.09	12.72
Arunachal Pradesh	3.70	6.32	12.21	3.70
Meghalaya	14.55	18.03	18.69	19.63
Manipur	13.19	26.44	27.59	23.88
Mizoram	11.36	25.17	46.2	49.5
Tripura	10.43	10.98	15.26	17.02
Nagaland	9.95	15.54	17.28	17.74

Source: Census of India

Urbanization progressed in a slow pace in North East India. The percentage of the urban population to the total population is quite higher in the hilly states only. It is because of dearth of the fertile plains. The most of the people of hilly states live in the administrative towns or the capital towns only. On the other hand, a slow development of urban concentrations is found to see in Assam as the people spread over the river valleys.

### Causes responsible for forest depletion:

The main causes of forest depletion are:

1. Land use changes: Increasing population growth at fast rate has put enormous pressure on the area because it becomes necessary to clear the virgin forest covers and convert them into

agricultural land so that the agricultural production may increased and sufficient food may be provided for the human consumption.

2. Transformation of forests into pastures: Transformation of forest areas into pasture land has been responsible for rapid rate of loss of forest cover. Most of the cattle of nearby village people are reared in the forest areas.
3. Overgrazing: Overgrazing is another factor of forest degradation, with the increase of human population and needs, there have also been increase in the number of animals for domestic use. Forest villages nearby forest area with many cultivable land, a large number of animal are present for agriculture which need large vegetation cover area for grazing. So, a wide area of forest is degraded due to overgrazing by large herd of cattle.
4. Lumbering: Lumbering for domestic and commercial purposes is the real cause of large scale destruction of forest covers. Most of the people used wood from the forest for cooking, house building, boat building, furniture making. Etc. ever increasing demand of timber by rapidly increasing population has done great damage to natural forest covers of the reserve forest. Collection of fodder and firewood by the village population from the depleted forest covers has further degenerated already improvised forest covers.
5. Forest fires: forest fires whether natural or man-made are effective destroyers of forest covers. It destroys and retard and taboo regeneration of trees but also cause tremendous damage to the biological communities and thus cause ecological imbalance.
6. Biological factor: biological factor also involves in destroying the natural vegetation. Conversion of forest covers into agricultural farms has resulted into tremendous pressure of animals on existing forests. Further use of chemical fertilizers, pesticides and herbicides in the agricultural field nearer to the forest has driven out micro organisms such as insects and termites towards the adjoining forests where these cause serious damages to the plants.
7. Physical factors: forest are also degraded by the physical factors as through accelerated rate of soil erosion by rill and gully erosion consequent upon rapid rate of deforestation.

**Sustainable management of forest resources:** Sustainable management is very much needed to promote the conservation of forest resources. We know that sustainable development is a pattern of growth in which resource aims to meet human needs while preserving the environment so that these needs can be meeting not only in the present, but also for the future generation. These are:

1. operating industrial activities in a more eco-friendly way.
2. environmental impact must be minimum.
3. control of indiscriminate destruction of forest.
4. regenerate of forest trees through social forestry income.
5. replacement of shifting cultivation.
6. creating awareness among people.
7. involvement of NGOs.
8. encouraging the ideas of environmental education.

**Measures for conservation:** Conservation of resources is the essential prerequisite for environmental planning. Conservation does not mean stoppage of development activities rather it adds value to the available resources though appropriate the technology and thus accelerates growth processes. The wildlife act has the provision for

1. The control and supervision of possession trapping, shooting, hunting and clopping of wild animals.
2. Protection to endangered and threatened animal species.
3. Graded protection to other wild animals according to the size of their population.

The conservation of ecological resources may approached in three ways

1. Through species preservation
2. Through assemblage protection.
3. Through habitat protection and preservation.



**Resource management policies of the Government and NGOs:** Management implies a conscious choice from variety of alteration proposals and further more that such a choice involves purposeful commitment to recognized and desired objectives. On account of this, the Assam Forest Department and a Joint Forest Management Project are expected to benefit the forest villagers from the scheme.

**Biodiversity Conservation and Management:** It is necessary to take some steps legally or by other means to protect the forest area to conserve the forest resources. Therefore the following steps are found to be necessary to protect and conserve forest resources.

1. control of shifting cultivation
2. check on poaching activities
3. check on encroachment and eviction of encroachers
4. scientific exploitation of forest resources is necessary.
5. alternative means of fuel and timber are to be exercised.
6. consciousness of people and media communication and adoption of some eco-friendly measures.
7. encourage entrepreneurship.

**Conclusion:** Now the forest area of North East India has experienced human occupants of varied nature resulting from either the decision of taking refuge on the tradition directed strategies for survival and development of forest environment. Whatever may be the driving forces, most of the forest villagers have evolved their livelihood based on principles of traditional subsistence strategies and the transformation caused by various internal as well as external processes from the very past. In conclusion, the forest area are degraded day by day with the abuse of natural resources and thus the policies of biodiversity conservation should be changed in view of long term conservation practices. The study of forest resources, goods for livelihood impact of indigenous society on establishment of forest area should be evaluated and policy should be prepared in such a manner that traditionally associated forest villagers could be benefited from the conservation and management of biodiversity of forest cover. Moreover, for the cause of some of indicators that collectively present a gloomy picture of ecological security of the forest area. Therefore through some conservation and sustainable management policies which can be generated to mitigate the problems at various spatial and temporal levels by appropriate understanding of emerging situation to evolve right kind of action and plans for conserving the forest ecosystem and minimize current environmental problems would be possible.

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