

GROWING STOCK OF MANIPUR FORESTS: ITS CHANGING SCENARIO

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ABSTRACT

An attempt has been made to examine and assess the extent of forest cover change matrix of Manipur forests and to make a comparative analysis of the prevailing growing stock of wood (volume) within and outside forests and its changing scenario. The present study is based on the secondary sources of data generated by the Forest Survey of India (FSI), the erstwhile Pre Investment Survey of Forest Resources (PISFR). The present study reveals that the changes in the existing forest cover is due to shortening of shifting cultivation cycle and biotic pressure and the growing stock of Manipur forests shows abysmally changing from 95.452m.cu.m in 1995; 115.35m.cu.m in 2003; 71.93m.cu.m in 2005; 78.85m.cu.m in 2009 and 81.57m.cu.m in 2011. Whereas the growing stock of bamboo forests also shows a declining trend to the tune of 14.48 lakh tones in 1976; 11.47 lakh tones in 1991 and 13.74 lakh tones in 2011. However, it is encouraging to note that the extent of bamboo bearing areas in the forest of Manipur has been increased from 3,263.43 sq.km in 1976 to 9,303 sq.km in 2011. In order to arrest the declining trend in the growing stock of Manipur forests, it is a dire necessity to take up policy measures to control the shifting cultivation practices and to implement the scientific principles for Scientific Management of Forests as formulated in various Forest Working Plans of Manipur.

Key words:

Growing Stock, Shifting Cultivation Cycle, Scientific Management of Forests, Forest Working Plan, Sustainable Yield.

INTRODUCTION:

Forest lands and trees growing on it along with the soil on which it exist taken together represent the growing stock in a forest. The crop composition and volume of the tree growth and site quality of a particular region exert much influence on the growing stock of a forest. Site quality indicates how much timber can go on a given area. Stocking measures the extent to which the potential productive capacity of a forest is being in terms of volume in cubic meters or in terms of basal area i.e., the total cross sectional areas of the trees in a forest stand in hectare or square kilometer. This help in deciding the quality of annual cut that can be harvested a forest area. The information on growing stock is essential to understand the productive capacity of forest in order to develop national policies and strategies for the sustainable use of the forest resources (Singh, A.S.: 1999, P.58). In addition, the growing stock estimate leads to quantifications of biomass which, in turn, is essential to assess the amount of carbon stored in the forests. As per the estimate of the Forest Survey of India, the total growing stock of the country accounts for 4,498.66 million cubic meters in forests and 1,599.57 m.cu.m. in trees outside forests (GOI: 2009, P.46). The carbon stock stored in India's forest and tree cover areas accounts for 6,245 million tones in 1995 which increased to 6,622 million tones in 2005 and annual increment of carbon stock is 38 (equivalent to 138 million tones of CO₂) (GOI: 2009, P.47).

OBJECTIVES:

The general objectives of the present study is to make an assessment of the growing stock of Manipur forests and its prevailing trends, *inter alia* attempted:

1. To trace the changing pattern of forest cover matrix of Manipur Forests; and
2. To make a comparative analysis of the growing stock of Manipur forests and its prevailing changing scenario.

METHODOLOGY:

The present study is based on secondary sources of data generated by the Forest Survey of India (FSI) specially data from the India State of Forest Report (ISFR) (various volumes) published biennially and estimates of growing stock of Manipur forests was done through Forest Cover Map, Forest Type Map and Forest Inventory Survey data. The potential annual cut and the total growing stock of Manipur forests was estimated by applying the

Smythies' Safeguarding formula by the FSI, the erstwhile Pre Investment Survey of Forest Resources (PISFR). The formula is given by :

$$X = \frac{f}{t} (II - Z\% \text{ of } II)$$

Then, Yield = $\left(\frac{X}{\text{class I} + \frac{X}{2}}\right)$ of N

Where,

X = the number of class II trees per acre which pass into class I within the felling cycle.

f = felling cycle.

t = time taken for class II trees to pass into class I trees.

z % = percentage of class II trees which do not pass into class I trees due to various reasons i.e., mortality percentage due death, illicit felling and silvicultural rotation etc.

$$N = \frac{\text{number of class I trees}}{\text{feling cycle.}}$$

Assuming 30 years felling cycle and 25% mortality rate, time taken for class II trees to go into class I trees in 30 years, then Smythies' formula gives:

$$x = \frac{30}{30} (75\% \text{ of } II) = 75\% \text{ of } II$$

If t = 25 years, then

$$x = \frac{30}{25} (75\% \text{ of } II) = \frac{6}{5} (75\% \text{ of } II)$$

Then we can estimate the forest yield.

For estimating the rate of annual increment of growing stock, FSI adopted the Von Mental's formula:

$$I = \frac{2GS}{R}$$

Where, I = annual increment of growing stock.

GS = growing stock.

R = rotation.

While estimating the annual increment of the growing stock of various forest types of Manipur, rotation is fixed at 50 years by Von Mental.

FOREST COVER OF MANIPUR:

The State of Manipur is a small hilly State (22,327 sq.km.) covering 0.68% of the country's land area and having a population of 2.72 million (Census 2011) which constitutes 0.22% of the country's population. The recorded forest area of the State is 17,418 sq.km

which is 78.01% of its geographical area and 2.5% of the country's forest cover. The Reserved Forests of Manipur constitute only 8.42%; Protected Forests 23.95% and Unclassed Forests 69.63% of the recorded forest area. The forest cover of Manipur during the period from 2003 to 2011 is depicted in the following Table 1:

Table-1
Forest Cover of Manipur

Year of assessment	Dense Forest.(sq.km)	Moderately Dense Forest (sq.km)	Open Forest (sq.km)	TOTAL	% of State's Geog. Area	% of Country's Forest cover
2003	720	5,818	10,681	17,219	77.12	2.54
2005	923	5,541	10,662	17,086	76.53	2.52
2009	701	5,474	11,105	17,280	77.40	2.50
2011	730	6,151	10,209	17,090	76.54	2.47

Sources: Compiled from:

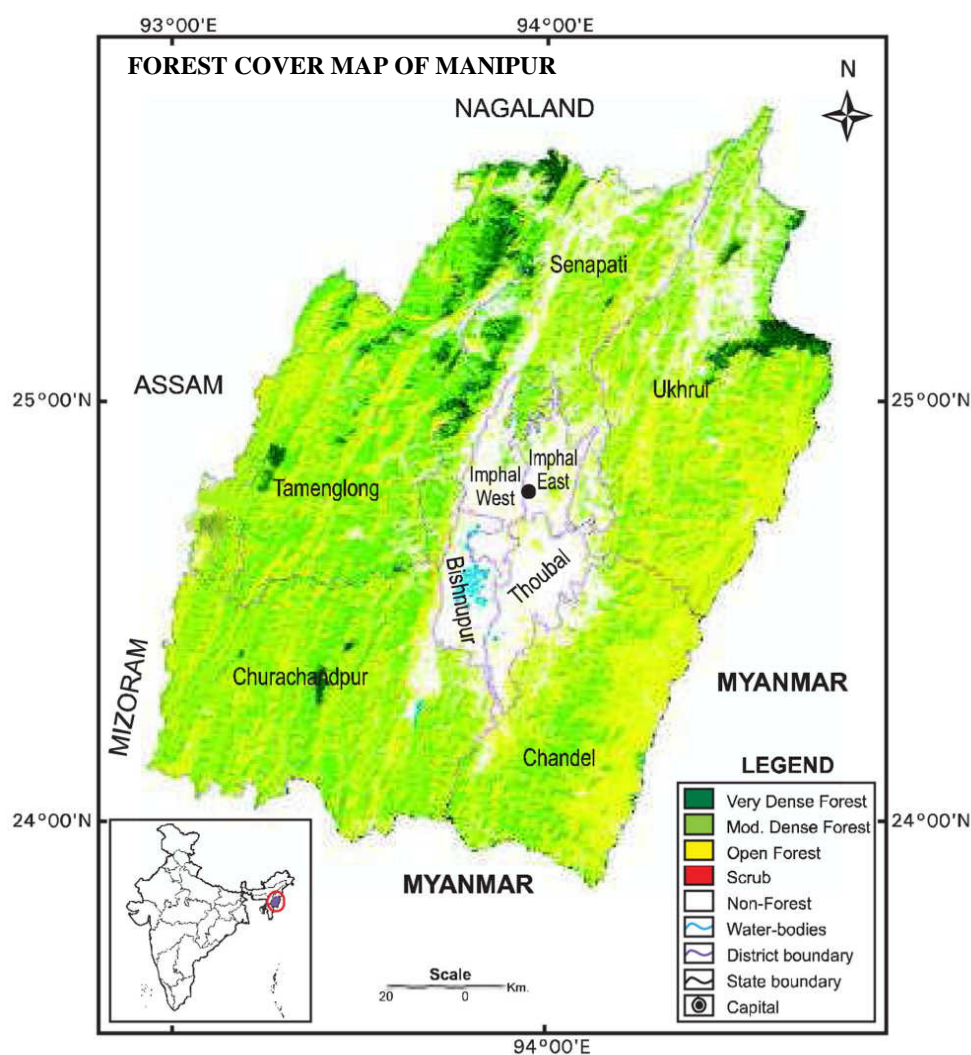
1. GOI: (2003) : State of Forest Report FSI, Dehra Dun.
2. GOI: (2005, 2009, 2011) : India State of Forest Report, FSI, Dehra Dun.

Table I clearly reveals that an increase of 10 sq.km in very dense forest and 333 sq.km in moderately dense forest and a decrease of 172 sq.km in open forest has been assessed during the period from 2003 to 2011. Further, 129 sq.km of forest has been lost due to severe practices of shifting cultivation and shortening cycle of shifting cultivation and biotic pressure in the State of Manipur (GOI: 2011, P.21).

Further, as per assessment made by the FSI, the forest cover change matrix of Manipur forests shows variations in various canopy density classes of forest area viz. very dense forest, moderately dense forest, open forest and scrub areas. In 2003, there has been an increase of 828 sq.km in very dense forests area and a decrease of 535 sq.km in open forest, and 116 sq.km in scrub area (GOI: 2003, P.80). In 2005, there has been decrease of 7 sq.km in very dense forest area, 54 sq.km in moderately dense forest area and a decrease of 35 sq.km in scrub area (GOI: 2005, P.103). In 2009, an increase of 12 sq.km in very dense forest area, 364 sq.km in open forest areas whereas a decrease of 48 sq.km in moderately dense

forest area has been assessed (GOI: 2009, P.119). In 2011, an increase of 29 sq.km in very dense forest, 677 sq.km in moderately dense forest and a decrease of 896 sq.km in open forest area have been assessed (GOI: 2011, P.179).

The distribution of forest cover of Manipur by various canopy densities is depicted in Map 1 and represented by the following Pie Chart 1:



Map 1: Forest Cover Map of Manipur of 2011

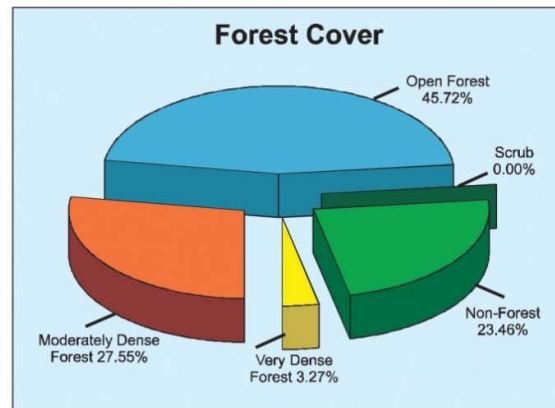


Chart 1: Pie Chart showing the Forest Cover of Manipur of 2011

Changing Scenario of Growing Stock of Manipur Forests:

The growing stock of Manipur forests represent the total volume of tree forests and trees outside forests expressed in terms of cubic meters. It is out of the growing stock that the annual potential cuts are to be achieved. The production potential of the State forests represent the maximum amount of output per annum that can be removed or harvested from the forest without reducing the total growing stock. In other words, the annual production potentials are equal in quantum to the annual increment in the growing stock. The measurement of growing stock and its annual increment are the major tasks for Scientific Management of Forests (SMF). The assessment of growing stock of Manipur Forests and its present trend has been widely used for analyzing forest resource trend for better management of forest on scientific lines (Singh, M.I. 1989, P.6).

As per assessment made by Forest Survey, in 1995, the growing stock of Manipur Forest accounts for 95.452 m.cu.m., the annual increment of 1.889.m.cu.m and volume per hectare were 54.1 cubic meters as against the all India level of growing stock of 4,740.858 m.cu.m.; 87.622 m.cu.m. of annual increment and 74.12 cu.m. of volume per hectare (Table 2). The total growing stock of Manipur forests has been increased from 95.452 m.cu.m. in 1995 to 115.351m.cu.m in 2003, but it has declined to 71.93 m.cu.m in 2005 and further it has increased from 78.85 m.cu.m in 2009 to 81.57m.cu.m in 2011(Table 3).

The stratum-wise growing stock of Manipur forests as per Forest Survey of India assessment 1995 is depicted in Table 2. It clearly reveals that the upland hardwoods has the highest growing stock of 11.39% of the total growing stock; Bamboo (Tree crops in bamboo) growing stock stood at 3.32% and Khasi Pine at 1.94%. These forest resources can be used as raw materials for various forest-based industries in the State of Manipur.

Table 2
Stratum-wise Growing Stock of Manipur Forests (1995)

Sl. No.	Forest Stratum	Estimated Growing Stock ('000 cu.m)	% to total Growing Stock
1	Chir Pine	416	0.44
2	Hardwood mixed with Conifers	723	0.76
3	Upland Hardwood	10,874	11.39
4	Teak	-----	-----
5	Sal	260	0.27
6	Bamboo (tree crops in bamboo)	3,081	3.23
7	Diptocarpus	983	0.72
8	Khasi Pine	1,855	1.94
9	Miscellaneous	77,560	81.26
Total:		95,452	100.00
		Manipur	All India
Total Growing stock		95,452('000cu.m)	47,40,858('000cu.m)
Annual increment		1,889('000cu.m)	87,622('000cu.m)
Volume per Hectare		54.1 cu.m	74.42 cu.m

Sources: GOI (1995): State of Forest Report, FSI, Dehra Dun. PP.74-77.

Table 3
Growing Stock of Manipur Forest (Assessment years from 2003 to 2011)

Sl. No.	Survey Year	Report Published	Forest Area Inventoried (sq.km)	Actual forest cover (sq.km)	% to total Geog. Area	Volume of growing stock (in million cu.m)		Total
						Forests	Tree Outside Forests	
1	2002	2003	17,418	17,219	77.73	111.072	4.279	115.351
2	2004-05	2005	17,418	17,086	76.53	48.73*	14.90*	71.930*
3	2006-07	2009	17,418	17,280	77.40	69.24	9.61	78.850
4	2009	2011	17,418	17,090	76.54	70.88	10.70	81.570

* Figures related to averages to all the North Eastern States.

Source: GOI (2003-2011): India State of Forest Report (various volumes).

GROWING STOCK OF BAMBOO FORESTS:

Pure bamboo brakes are found in the Western, South-Western and Southern part of the State of Manipur occupying nearly 30% of the total forest area. The extent of bamboo bearing areas in the forest of the State has been decreased from 3,268.43 sq.km in 1976 to 3,192.01 sq.km in 1991 but it has increased more than three times in 2011 i.e 9,303 sq.km as shown in Table 4:

Table 4
Growing Stock of Bamboo Forests

Assessment year	Recorded Forest Area (Sq.Km)	Bamboo Forest Area (sq.km)	Total growing stock of bamboo (lakh tones)
1976	15,154	3,268.43	14.48
1991	17,418	3,192.01	11.47
2011	17,481	9,303.00	13.74

Sources: Compiled from:

- 1) GOI (1976): Report on Manipur Forest, PISFR, Dehra Dun.
- 2) GOI (1991): State of Forest Report, FSI Dehra Dun.
- 3) GOI (2011): India State of Forest Report, FSI, Dehra Dun.

The total growing stock of bamboo forests has been declined from 14.48 lakh tones in 1976 to 11.47 lakh tones in 1991 and it has increased to 13.47 lakh tones in 2011. However it is encouraging to note that the extent of bamboo bearing areas in the forest of Manipur has been increased from 3,268.43 sq.km in 1976 to 9,303 sq.km in 2011 (Table 4). The extent of bamboo bearing areas by density-wise classification and estimated number of bamboo culms and equivalent green weights which represents the growing stock of bamboo forest are given in Table 5 and Table 6 below:

Table 5
Bamboo Bearing Areas in Manipur Forests:
(Area in sq.km)

Recorded Forest Area	Pure Bamboo	Dense Bamboo	Scattered Bamboo	Clumps Hacked	Bamboo Regeneration	No. of Bamboo
17,418	192	5,825	3,101	124	61	8,115

Sources: GOI (2011): India State of Forest Report FSI, Dehra Dun, P.180.

Table 6
Estimated number of bamboo bearing culms and equivalent green weights:

No. of culms (in million)			Equivalent green weight (in million tones)			
Green	Dry	Decayed	Total	Green	Dry	Total
2,035	192	70	2,297	11.617	2.121	13.738

Sources: GOI (2011): ibid.

Scientific Management of Forests and Growing Stock:

Though Manipur forests are managed on the basis of the Scientific Forest Working Plan (FWP) framed in different Forest Divisions of the State by the Forest Department of Manipur, there is a wide gap between the theoretical and practical application of scientific forestry practices as laid down in the FWP. This is due to the fact that in Manipur State, the trained forestry personnel and labour force to work in the forests are very meager. So, it is very difficult to introduce scientific forestry practices while managing the forests of Manipur. So, far Selection System of Felling trees is used as the only silvicultural system in the

management of the reserved forests of Manipur. But the system was found defective as the purchasers selected the trees to be felled according to their immediate needs without considering the prescribed silvicultural requirements at the time of harvesting. The practice is far inadequate to achieve the objective of sustained yield which is the basis of the Scientific Management of Forests.

Nonetheless, the scientific prescriptions laid down by Smythies' Safe Guarding Formula (also known as Smytheies' Conservation Formula) and Von Mental's formula are not strictly followed in the actual management of Manipur Forests. The felling cycle is limited to only 10 years which coincides with the period of the FWP as against 25 to 30 years as suggested by Smythies' Conservation Formula. While estimating the annual increment of the growing stock of Manipur forests, rotation year is fixed at 30 years as against 50 years as suggested by Von Mental's Formula. It is considered view of the forest scientists who look after the Manipur Forests that 30 years may be the acceptable period in view of the soil and climatic conditions of the State of Manipur. Still, no worthwhile prescriptions for rotation have been given so far in the FWPs of Manipur as most of the trees planted have not yet attend the maturity stage and the extent of the areas covered under FWP is very inadequate for Scientific Management of Forests.

Implementation of scientific forestry principles laid down in the FWPs will have large perspectives only when there is a wide coverage of forests areas in the FWP formulation of the State. Hence, there is need for inclusion of more forest areas under the FWP and conversion of un-classed forests into reserved forests (50 % of the total forest area should be converted into reserved forests as suggested by the Forests Department of Manipur in the Draft Forest Policy of Manipur, 1997) and it is a dire necessity for Scientific Management of Forest in the State of Manipur. It has also been observed that the present FWPs of Manipur should be supplemented by the scientific practices adopted by the Forest Survey of India, the erstwhile Pre Investment Survey of Forest Resources (PISFR) so that Manipur forests can be managed on scientific lines. If the existing forest resources of Manipur are managed on scientific lines without decreasing the present growing stock, there is a good scope for supplying raw materials required by various forests-based industries as well as meeting the basic requirements of the increasing population of the State of Manipur.

Conclusion:

Forest Survey of India (FSI), the erstwhile Pre Investment Survey of Forest Resources (PISFR) make an assessment of the extent of forest cover and estimate the growing stock of Manipur forests within and outside the forests including bamboo forests. FSI adopted a robust statistical design viz. Smythies' Safeguarding formula for estimating annual potential cut of trees and Von Mental's formula for estimating the rate of annual increment per hectare based on the Forest Inventory Survey data, Forest Cover Maps, Forest Type Maps. Accordingly, the growing stock of wood (volume) within and trees outside forests of Manipur were estimated at 95.452m.cu.m in 1975;115.35 m.cu.m in 2003; 71,93m.cu.m in 2005;78.05m.cu.m in 2009 and 81.57 m.cu.m in 2011 which shows abysmally changing trend. Whereas the growing stock of bamboo forests has also been decreased to the tune of 14.48 lakh tones in 1976 to 11.47 lakh tones in 1991 and it increases to 13.74 lakh tones in 2011. However, it is encouraging to note that the extent of bamboo bearing areas in the forest of Manipur has been increased from, 3,268.43 sq.km in 1976 to 9,303 sq.km in 2011. The study also reveals that the changing scenario of the extent of forest cover and the growing stock of Manipur forest was due to severe practices of shifting cultivation and biotic pressure. It is imperative to take up steps to control shifting cultivation practices by providing alternative arrangements and to implement the scientific principles for Scientific Management Forest in order to achieve the objective of sustainable yield of forest as formulated in various Forest Working Plans of Manipur.

References:

1	GOI(1991-2005)	:	State of Forest Report, FSI, Dehra Dun (various volumes).
2	GOI(2009-2011)	:	India State Forest Report, FSI, Dehra Dun (various volumes).
3	GOI (1976)	:	Report on Forest Resources of Manipur, PISFR, Dehra Dun.
4	GOI(1991)	:	Forest Resources of Manipur (A Status Report), Forest Resources Survey Division, Forest Dept. of Manipur.
5	GOI (1990)	:	Survey Report of Manipur Forests, FSI, Dehra Dun.
6	GOI(2009)	:	Statistical Booklet of Manipur Forest, Forest Dept. of Manipur.
7	Singh, M.I. (1989)	:	Report of Management of Forest Resources of Manipur, Economics Dept., University, Canchipur, Imphal.
8	Singh, A.S. (1999)	:	Forest Economy of Manipur: Perspectives for Scientific Management, an unpublished Thesis submitted to Manipur University, Canchipur, Imphal.
9.	Negi, S.S. (1984)	:	Scientific Management of Forests, Bishen Singh Mahendra Pal Singh, Dehra Dun.