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## **BAMBOO IN AGROFORESTRY – A STUDY FROM MADHYA PRADESH, INDIA**

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### **Abstract**

The paper discusses about the present status of the productivity of Bamboo resource on forest and non-forestlands, utilization pattern by user groups, demand supply gap and potential of Bamboo as an agroforestry species in the undivided Madhya Pradesh (MP). The paper includes the findings of the study carried out in erstwhile MP before the creation of Chhattisgarh.

### **Introduction**

Bamboo is a critical element of the economy. Bamboo and its related industries already provide income, food and housing to over 2.2 billion people worldwide. There is a 3-5 year return on investment for a new Bamboo plantation versus 8-10 years for Rattan. Governments such as India, China and Burma with 19,800,000 ha of Bamboo reserves collectively, have begun to focus attention on the economic factors of Bamboo production.

Bamboo is a renewable resource for agroforestry products. Bamboo is a high-yield renewable natural resource; ply Bamboo is now being used for wall paneling, floor tiles; Bamboo pulp, for paper making, briquettes for fuel, raw material for housing construction, and rebar for reinforced concrete beams.

### **Bamboo Resource in MP**

#### ***On Forest Land***

MP is the largest State of India having 14% of the total geographical area of the country. Out of 44.3 million ha of total geographical area, the State has 15.45 million ha area under forests. Thus about 35% of the geographical area of the State is under forests. According to the available estimates, the area under Bamboo forests is about 1.5 million ha. Normally, Bamboo grows either as understorey or with other compatible species in the forests. Area designated as Bamboo forests usually has about 200 clumps (clump is group of Bamboos) per hectare. The first and second year Bamboo culms (culm is an individual Bamboo) are not harvested. Culms, which are three years old and more are silviculturally available for harvest.

On an average, a natural sound Bamboo clump is capable of yielding about six Bamboos, each of about 5 metres in length on a four-year cycle i.e. once in four years. Thus if one hectare of Bamboo forests has 200 clumps, 1.5 million ha Bamboo forests of the State have a potential of yielding 4500 lakh Bamboos every year.

However, in the recent past, due to tremendous biotic pressure, the Bamboo forests are getting degraded at a very rapid pace. The actual production of Bamboo in the State is, therefore, hardly 900 lakhs i.e. about one fifth of the potential. These forests need an urgent attention; otherwise the Bamboo that is regarded as poor man's timber will soon go beyond the reach of a common man. Because of the variety of uses of Bamboo, it has aptly been described as poor man's timber. The Bamboo is not only a source for manufacturing paper and pulp but it is a friend of villagers, tribals and forest dwellers due to its multiple uses and fast rate of growth. In villages it is used largely in construction of houses. It plays a significant

role in the upliftment of rural economy, especially for 'Basods', who are totally dependent on Bamboo for their livelihood.

**Bamboo area and Degraded Bamboo Forests:** Table 1 gives an overview of the Bamboo area and the extent of degraded Bamboo forests in the forest divisions of the erstwhile MP (MP + Chhattishgarh).

**Table 1 - Division wise Bamboo area**

<b><i>Forest Division having bamboo area</i></b>	<b><i>Bamboo Area (in ha)</i></b>	<b><i>Degraded B. Area (in ha)</i></b>
Balaghat North	10837.413	5419
Balaghat South	142310.633	71155
Bastar Central	63576.226	31788
Bastar South	49412.000	24706
Bastar West	1047779.00	52389
Betul North	44111.600	2206
Betul South	9216.00	4608
Betul West	Data not available	
Bhanupratappur	84168.00	42084
Bhopal	No. Bamboo	(482)
Bilaspur	24355.542	12178
Bilaspur North	21614.109	10807
Burhanpur	33083.500	16542
Chhatarpur	8240.780	4120
Chhindwara East+West+South	37951.200	18976
Dewas	9624.930	4812
Durg	22494.350	11247
Guna	26902.220	13451
Harda	59402.331	29701
Hoshangabad	9991.90	4996
Jabalpur	964.874	483
Kanker	19392.00	9696
Kawardha	41687.910	20844
Khandwa	48696.216	24348
Khargone	32055.720	16028
Korba	9733.176	4867
Korea	64178.564	32090
Mandla East	Data not available	-
Mandla West	13446.500	6723
Narayanpur	47822.71	23911
Narsinghpur	7474.978	3738
Panna North	18708.340	9354
Panna South	7289.010	3645
Raipur East	6536.500	3268
Raipur North	46024.648	23012
Raisen + Obaidullaganj	37244.300	18622
Rajanadgaon	32025.020	16012
Sagar North + South	68813.616	34407
Sarguja North	48507.215	24254

Satna	44540.600	22270
Sehore	41945.752	20973
Seoni North	12427.500	6214
Seoni South	20838.896	10419
Shahdol North	87465.070	43733
Shahdol South	4118.84	2059
Sheopur	5882.900	2941
Sidhi East	34997.720	17499
Umaria	67519.110	33760
Vidisha	Data not available	(870)

### On Non Forest Land

Since there is huge demand of Bamboo, and supply from government forests is dismally low, a pressure has been generated for development of Bamboo resource outside forests also. Villagers have raised Bamboos on the bunds of their agricultural land and also in their homestead. Demand for Bamboo is partially met with from this domestic and agro forestry source. Looking to the vast expanse of the State, it was not feasible to take up detailed study regarding assessment of non-forest Bamboo resource. However, during the study an attempt has been made to assess the quantum of Bamboo contributed by the non-forest source.

### Primary Survey

Primary survey was carried out in the five selected districts, namely, Betul, Bilaspur, Mandla, Panna and Sehore, one from each stratum. The details of the selected villages are given in Table 2.

**Table 2 - Study Area**

S No	Division	Range	Village
1	Mandla	Ghori Nanipur	Guwara Dhanipur
2	Betul	Multai Multai	Sonara Khedamla
3	Panna	Kalda Piparia	Mahuadol Saleha
4	Bilaspur	Korba Balco Sehore	Patrapali, Thakruketa, Cheetapali Bela, Dondrao Sonkacchh
5	Sehore	Ashta	Bhimkhedi

Direct survey was carried out in the selected villages by contacting the villagers and collecting information from them in a redesigned questionnaire. The head of the family, number of family members, number of clumps on their private land, number of culms in each of these clumps, total number of culms, and average number of culms per clump have been recorded. The demographic data of the village, total families living in the village, number of families having Bamboo on their private land, total number of culms on their land have been computed. The district-wise and village-wise total number of families, number of families having Bamboos on their private lands, number of culms, total number of culms per family have been computed and shown in Table 3.

## Results

In 13 sample villages of the five districts, 2340 families were surveyed. Out of these, 354 families (15.13%) are having Bamboo on their fields. The total number of culms on their field is 26,041 and the average number of culms per family is 73.56.

### Production of Bamboo from private land

The State has been divided into five strata. For each stratum number of rural families is shown in Table 3. The percentage of rural families having Bamboos on their private lands has been projected from the sample data. On the basis of the number of culms per family, computation has been done to find out the total number of Bamboo culms present in each stratum. Taking average utilizable length of Bamboos as five meters, the total growing stock has been calculated by dividing the product of number of culms and five meters by 2400 (1 NT = 2400 running meter). On a four year felling cycle, 25% of the growing stock will be available as annual yield. Hence the annual available production of Bamboo from private holdings has been calculated for each stratum and shown in Table 3.

**Table 3 - Projection of Bamboo resources on private lands**

<i>Stratum</i>	<i>Sample district</i>	<i>Total no. of rural families in the stratum</i>	<i>% of families having Bamboos on their lands</i>	<i>Rural families having Bamboos on their lands</i>	<i>Per family no. of culms</i>	<i>Weight of growing stock (in NT)</i>	<i>Annual yield @ 25% of growing stock (in NT)</i>
First	Betul	14,10,151	8.46	119,299	61.12	15,191	3,798
Second	Bilaspur	19,00,506	16.14	306,742	66.30	42,369	10,592
Third	Mandla	19,78,991	3.21	63,526	218.00	28,851	7,213
Fourth	Panna	11,76,399	46.73	549,731	81.88	93,775	23,444
Fifth	Sehore	51,46,414	10.60	545,520	96.63	109,820	27,455
Total		116,12,461	15.13	1,756,965	73.56	2,69,255	67,314

According to this projection, 67,314 NT of annual production of Bamboos is available from non-forest source, which is 30% of the production from forest source

### Production potential of Bamboo

From the analysis of the data it is clear that there is a yawning gap between the requirement of Bamboos and the available supply. It is also clear from the statistics of Bamboo supply and family income of *Basods*, Nistaris and Pan Barejas that if various levels of satisfaction could be achieved then the corresponding improvement in the economic level of villagers will also be higher.

On the basis of the area estimation, Bamboo plantations in the State cover an area of 1,08,306 ha considering the plantations, under Five Year Plans by the various Department, Forest Development Corporation, and Tree Cooperative Scheme. Besides, there are other areas under private plantations and those raised by various other departments which could not be accounted for in the present study. However, annual available yield of Bamboos from the plantation area of 1,08,306 ha will be 54,153 tons, on a four year felling cycle at the rate of 2 tons per ha as estimated in the study.

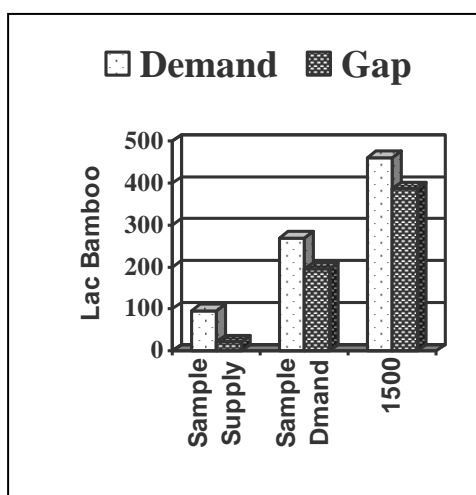
Estimation from non-forest Bamboo resource was also carried out and according to this, Bamboo resource from the farmers' field has been estimated as 67,314 tons per year, which is about 30% of the annual yield from Forest Department coupes. Thus the total available Bamboo yield on an annual basis can be summarized as under:

From government forests	2,25,384 NT
From plantations areas	54,153 NT
From non-forest land	67,314 NT
Total	3,46,851 NT

In financial terms the value of the annual yield is Rs 235.85 crore @ Rs. 6800 per NT as computed in the subsequent Para. The study also indicates that Bamboo resource available on non-forest lands is also a significant part of the total production system. This necessitates a more focused attention to regenerate and manage scientifically the Bamboo plantations in homestead and agro forestry sector by adequate technical support of the Forest Department.

### State Level Projection of Bamboo Demand Supply for *Basods*

On the basis of sample district data projection has been done for the *Basod* families of the same stratum to which the sample district belongs. At the rate of sample supply, sample demand and 1500 Bamboos per family, the quantity of Bamboo required for the entire *Basod* families of the State have been calculated. The corresponding figures are 95.56 lac, 268.92 lac, and 461.25 lac Bamboos respectively. Against this, the actual average supply of last five years is 73.82 lac Bamboos. The demand supply gap in the three scenarios has been calculated for each stratum. This shows a shortfall of 21.74 lac Bamboos, at the rate of sample supply i.e. 248 Bamboos per family, 195.10 lac Bamboos, at the rate of sample demand i.e. 908 Bamboos per family and 387.43 lac Bamboos, at the rate of 1500 Bamboos per family. The shortfall is more acute in third stratum where *Basod* families are more and in the 5th stratum where Bamboo availability is less. The demand supply gap is shown in Figure1.



**Fig. 1 *Basod* Bamboo demand supply gap**

On the basis of poverty improvement scenario for the three types of supplies, the contribution of Bamboo to the income of *Basod* families, for the whole State will be as follows -

Rs. 5.57 crore @ sample supply i.e. 248 Bamboos.

Rs. 40.21 crore @ sample demand i.e. 908 Bamboos.

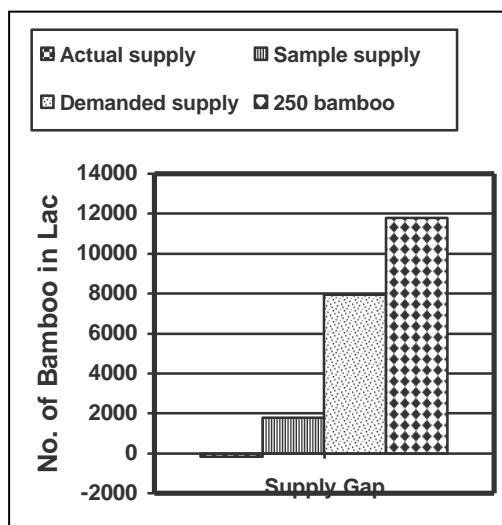
Rs. 68.22 crore @ 1500 Bamboos per family.

In the corresponding event, out of 30,750 *Basod* families 27,288, 15,832 and 7,062 families only will remain below poverty line respectively for three types of supplies. This quantifies the present and potential contribution of Bamboo for increasing economic status of *Basod* families.

### Nistar Demand and Income Projection

The demand of Bamboo for Nistar use has been projected for the whole State on the basis of the results obtained in sample districts. The number of rural families around forests, entitled for Nistar i.e. within 5 Km of the forests, is 48.77 lac. Stratum wise calculation for Bamboo requirement will be as follows –

Sample supply	- 42 Bamboos
Sample demand	- 167 Bamboos
1500	- 250 Bamboos.



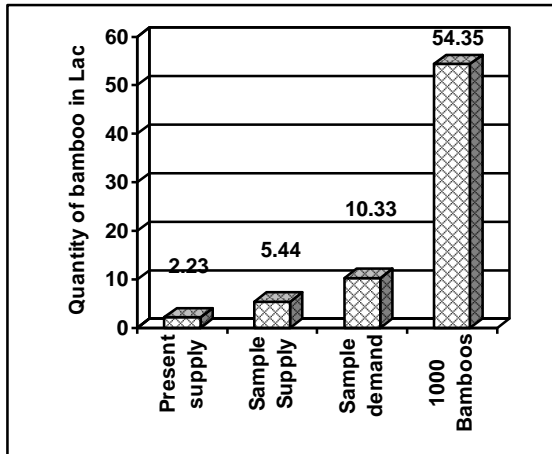
In the above scenario the requirement of Bamboo will be 21.74 crore, 83.44 crore and 121.93 crore respectively. As against this, the average production of last 5 years is only 4.66 crore. After meeting the *Basod* demand, only 3.92 crore Bamboos remains available for Nistar. This stock when put against the huge demand, the gap is 17.81 crore, 79.51 crore and 118.01 crore Bamboos respectively. As against the projection of sample data, the actual annual supply of Bamboo in the last five years has been 2.31 crore. Thus only 11% of Nistar demand, as calculated from sample data could be met with the actual supply of Bamboo. The demand supply gap is shown in Figure 2.

**Fig 2 - Nistar Bamboo demand supply gap**

Probable income supplement, if Bamboo could be provided as per three scenarios mentioned above, works out as Rs .192.84 crore, Rs. 271.34 crore, and Rs. 662.04 crore for supply of Bamboo at the rate of sample supply, actual demand and 250 Bamboos per family respectively. This explains the wide gap in demand supply of Nistar Bamboo and also highlights the quantified financial benefit that could reach villagers by concessional supply of Bamboo.

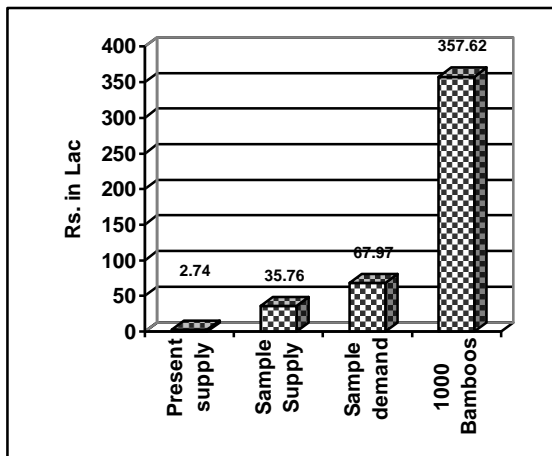
### Bamboo Demand Projection for Pan Barejas

There are 5435 Pan Bareja families in 16 districts of the State. At present they are getting a supply of 2,22,759 Bamboos. On the basis of sample district data @100 Bamboos per family, the total requirement is 5,43,500 Bamboos. On the basis of actual demand @190 Bamboos noted in the sample district, the total requirement is 10,32,650 Bamboos. According to the *Nistar* policy provision of 1000 Bamboos, total requirement works out to 54,35,000 Bamboos. The total demand projection is shown in Figure 3.



**Fig. 3 Demand projection of Bamboo for Pan Barejas**

The corresponding income supplement @Rs. 6.58 per Bamboo will be Rs. 35.76 lac, 67.97 lac and 357.62 lac respectively. Rs. 2.74 lac is however the actual income supplements in the present supply scenario. The income supplement in four scenarios above is shown in Figure 4.



**Fig. 4 Income supplement to Pan Barejas**

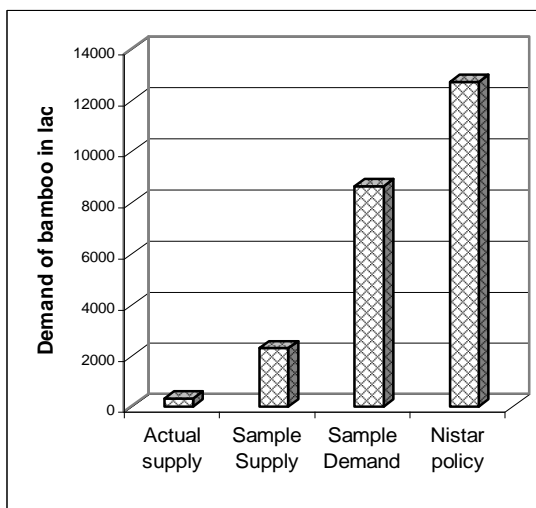
### Combined Demand of Commercial Bamboo

The requirement of Bamboo for the three important categories of consumers in the State, namely *Basod*, *Nistari* and *Panbareja* have been quantified in the study under four different scenario (1) at the rate of actual supply (2) at the rate of supply as per sample data, (3) at the rate of Bamboo demanded by the consumer, (4) at the rate of Bamboo promised by *Nistar* policy of the government subject to availability (Table 4).

**Table 4: Commercial Bamboo combined demand (No. in lac)**

<b>Consumer</b>	<b>Actual supply</b>	<b>Supply as per sample data</b>	<b>Supply as per consumer demand</b>	<b>As per nistar policy</b>
<i>Basod</i>	73.82	95.56	268.92	461.25
<i>Nistar</i>	231	2174	8344	12193
<i>Panbareja</i>	2.23	5.43	10.33	54.35
<b>Total</b>	<b>307.05</b>	<b>2274.99</b>	<b>8623.25</b>	<b>12708.60</b>

This shows that at present 307 lac Bamboos is being supplied to the consumers of three different categories while the actual departmental production is 466.24 lac Bamboos. Thus almost 70% of commercial Bamboo production is supplied to the three categories of consumers under Nistar supply, thereby leaving only 30% for other consumers and open market disposal. If the data of actual supply to the sample families are projected for the total rural families around forests who are eligible for Nistar supply, the total requirement works out to be 2275 lac Bamboos which is seven times higher than the actual supply. Thus for every person benefited from Nistar supply, there are six others who are deprived. The deficiency is mainly in Nistar supply. The requirement of Bamboo to meet the actual demand of the *Basod* and also the target of Nistar policy is astronomically higher, as is clear from the demand projection in the last two scenarios. The graphical representation of the combined demand scenario is in Figure 5.



**Fig. 5 Combined demand of Bamboo in three different scenarios**

#### Industrial Bamboo Demand

The State presently is producing industrial Bamboo to the extent 131970 NT per year. The demand of paper mills in M.P. for utilizing the current installed capacity of 2,63,550 tons is 6.85 lac tons of raw material. Even if the present production is committed entirely for the Paper Mills within the State still a gap of 5.53 lac tons of industrial Bamboo demand will remain unsatisfied. Production of Bamboo from non-forest areas needs to be activated to meet this gap in raw material supply.

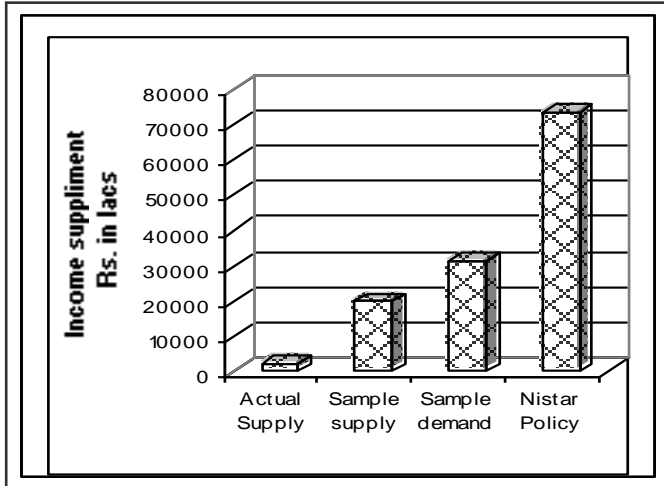
#### Combined Income Supplement

The study has quantified the contribution of Bamboo in the economy of *Basod*, *Nistari* and *Panbarejas*. The addition to their family income under four different scenarios can be summarized as in Table 5. This is diagrammatically explained in Figure 6.

**Table 5: Combined income supplement (in lac Rs.)**

<b>Consumer</b>	<b>Actual supply</b>	<b>Supply as per sample data</b>	<b>Supply as per consumer demand</b>	<b>As per Nistar policy</b>
<i>Basod</i>	108.00	557.00	4020.00	6822.00
Nistar	2014.00	19284.00	27137.00	66204.00
Panbareja	2.74	35.76	67.97	357.62
<b>Total</b>	<b>2124.74</b>	<b>19876.76</b>	<b>31224.97</b>	<b>73383.62</b>





**Fig 6 Combined income supplement in three different scenarios**

Thus in MP even at the present rate of Bamboo supply which is a small fraction of their requirement a huge amount of Rs. 21.24 crore is flowing to the beneficiaries as income supplement. If Bamboo could be provided to the consumers of three categories mentioned above at the same rate as have been provided to the consumers in the sample districts the income supplement could have gone up to Rs. 198.77 crore. This could have increased to a very high figure of Rs. 312.25 crore and Rs. 733.83 crore if it would have been possible to supply Bamboo to the consumers as per their actual demand and as per Nistar policy commitment respectively.

The Combined demand supply (DIS) and income supplement has been summarised in the following diagram -

		Actual Supply	Sample Supply	Demand Supply	Supply as per policy
<b>Basods</b>	Requirement in lac Bamboo	73.82	95.56	268.92	461.25
	D/S-gap in lac Bamboo		21.74	195.10	387.43
	Income Supplement (Rs. In Lac)	108.00	557.00	4021.00	6822.00
<b>+</b>					
<b>Nistar</b>	Requirement in lac Bamboo	231.47	2174	8344	12193
	D/S-gap in lac Bamboo	-161	1781	7951	11801
	Income Supplement in Crore	2014.00	19284.0	27137.0	66204.0
<b>+</b>					
<b>Panbareia</b>	Requirement in lac Bamboo	2.23	5.43	10.33	54.35
	D/S-gap in lac Bamboo		3.20	8.10	52.12
	Income Supplement in Crore.	2.74	35.76	67.79	357.62
<b>↓</b>					
<b>Combined</b>	Requirement in lac Bamboo	307.05	2274.99	8623.35	12708.6
	D/S-gap in lac Bamboo	-161	1805.94	8154.20	12240.5
	Income Supplement in Crore	2124.74	19876.7	31224.9	73383.8

This amply proves the tremendous contribution of Bamboo for poverty alleviation of rural forest dependent families and its potential to achieve a much higher limit in case the Bamboo resource augmentation becomes possible.

### Plantation Economics

One of the most important ways to increase Bamboo resource is to take up large-scale plantations. Bamboo with diverse utility in the field of domestic and industrial consumption gives better return than most favoured species e.g. Teak, Eucalyptus, etc. Many Forest Development Corporations and Forest Departments selected Teak for raising commercial

plantations. It is realized that Bamboo has not got its due place in the country's afforestation and reforestation programmes. Even in social forestry plantation programme, Bamboo is not given the place, which it deserves. Bamboo is more economical than Teak, which is considered by and large the most valuable commercial forest species. Comparative economic parameters of Teak and Bamboo plantations are shown in Table 6.

**Table 6 : Results of economic analysis**

(Source: Anon, 1981)

<b>MODEL</b>	<b>IRR %</b>	<b>NPV at 12% in Rs./ha</b>	<b>B.C. RATIO at 12 %</b>
<b>TEAK</b>			
1. Model 1 (II site quality)	16.5	+2100	1.733
2. Model II (III site quality)	11.5	-23	0.980
3. Model III (IV site quality)	8.5	-1257	0.560
<b>BAMBOO</b>			
Model I (good site quality)	20.7	+3294	2.621
Model II (Medium site quality)	16.7	+1456	1.717
Model III (Poor site quality)	11.0	-193	0.905

Above analysis amply proves that Bamboo (*Dendrocalamus strictus*) plantation is more profitable and economically more viable than Teak plantations. Economic returns from Teak plantations are greatly influenced by the value of thinned material and specially from earlier thinning. The marketability of thinning material from first and second thinning are generally low in remote areas and areas which are agriculturally and industrially less developed. Bamboo on the other hand is always in demand in areas, which are less developed and remote. The other species of Bamboo viz., *Bambusa bambos*, *B. vulgaris*, *B. nutans*, *B. tulda*, etc. which are frequently grown by villagers, are believed to give more yield as compared to *Dendrocalamus strictus*. Therefore, if these species are planted in suitable localities, yield will be much higher than estimated for *Dendrocalamus strictus*.

State Government has already initiated a massive tree plantation programme under various schemes. It is necessary that Bamboo should be planted in admixture with other species. The following factors would fully justify its large share-

- Bamboo is easy to grow and manage. Villagers are well versed with plantation and management techniques.
- Bamboo starts yielding from 8 to 10 years of age. Repeated yield is obtained on short cycles of 3 to 4 years up to a period of 30 to 40 years, till it flowers.
- It has diverse utility both in domestic consumption and industrial use. Bamboo yields basic raw material for a number of cottage industries. It is principal raw material for paper and pulp manufacture in India. With the increasing demand for paper, it is imperative that Bamboo plantation is taken up on a large scale.
- Bamboo species are not very exacting in nature and can be grown in a variety of agro-climatic conditions.
- Bamboo plantations are economically more paying than most commercial tree species.
- Bamboo easily grows as under crop with many tree species. It can be grown with Teak and other tree species on the same site and thus augment the resource generating potential of the forests.

## Suggestions

To mitigate the acute shortage of Bamboo resource and also to improve the socio economic condition of the rural people particularly those dependent on Bamboo the following measures are suggested -

- Looking to the economics of raising Bamboo plantation, those high market price of Bamboo, the decreasing annual production of Bamboo from areas within forests, agro forestry system and community plantations can fetch encouraging price. The local people within the villages can utilize the commercial Bamboo at remunerative price, while the industrial Bamboo can be supplied to the paper mills who are looking for such supply sources these days, after expiry of the industrial lease agreement.
- It is also suggested to popularize *Bambusa vulgaris* and *Bambusa bambos* among farmers, as Bamboosa is known to establish fast, recruitment rate of new culm is relatively more and is easy to work. Although the species is common in eastern MP, it can be grown throughout the State. Productivity of these two Bamboos on field bunds and in village wastelands is believed to be more than *Dendrocalamus strictus*.
- Genetic improvement of existing Bamboo resources is an important step. Bamboos are highly cross pollinated and selection of superior seedling after gregarious flowering as a result of crossing followed by genetic recombination, should be easier. Early vigour and growth habit may be criteria for seedling selection. Superior clones based on phenotypic characters like number of culms / clump, height, thickness, girth of culms, length of internodes, fibre length, resistance to disease and pests can be selected from the adult wild populations and plantations (Balasubramanyam *et al.*, 1992).
- It is necessary to encourage tree planting on non-forest land and attract private investment for wasteland afforestation. The increase in Bamboo production from farmers' field can in a very big way augment the supply situation. Removal of the hurdles from private plantation will go a long way in improving the supply situation along with socio economic development of rural people.
- Suitable tax exemption on income from Bamboo plantation should be considered to encourage private entrepreneurs for growing Bamboo.
- Bamboo based Cottage industry should be encouraged so that the advantage of value addition goes to the local craftsmen. This will improve their economic condition. Training in Bamboo handicraft should be imparted to rural artisan in general and *Basod* community in particular.
- Marketing support to derive the best benefit from Bamboo articles should be organized, may be in the cooperative sector, in the pattern of Kerala Bamboo Corporation Ltd. The corporation takes care of the marketing of Bamboo and cane articles, manufactured by their members. Sericulture Department requires large quantity of Bamboo for manufacturing "chandrika" and "chhabra" which are used for silk worm rearing. Supply of these commodities could be tagged with *Basod* societies (which could be formed) for their benefit.

With these efforts, Bamboo is likely to play a more important role in the life of rural population in general and Bamboo dependent communities in particular.

## References

- Anon. 1981. Prosperity through Bamboo planting, Forest Survey Organisation, MP. Bhopal. April, 1981.
- Anon. 1993. Project for Rehabilitation of Degraded Bamboo Forests in MP. MP Rajya Van Vikas Nigam Ltd., Bhopal.
- Anon. 1994b. De-notifying Bamboo nationalization, Government of MP, Gazette Notification No. F30-46-93-X-3 dated 11<sup>th</sup> Feb. 1994.
- Anon. 1994c. Constraints to production of Bamboo and Rattan, INBAR technical report No. 5, report of a consultation held 9-13 May 1994 Bangalore, India.
- Balasubrahmanyam V R and Kumar N, 1992. Problems and Prospects of Bamboo Cultivation in India. International Symposium of industrial use of Bamboo
- Bhargava Alka, Kumbhare V, Shrivastava A., Sahay, Amit. and Bisen, S. S., 1995. Bamboo - an additional source of nutrition. Tropical Forests Research Institute. Jabalpur.
- Biswas, SAS, 1988. Studies on Bamboo Distribution in North East Region of India. Indian Forester, 114 (9), 514-531.
- Chakraborty A K, 1998. "Economics of Bamboo plantation" Thesis for Ph.D. submitted to FRI, Deemed University.
- Date G P, 1989. Prospect for Bamboo plantation on farmers land in MP. State Forest Research Institute MP, Jabalpur.
- Datta J J and Tomar M S, 1964. Bamboo forests of MP. Bulletin no. 8, Government of MP Forest Department.
- FAO, 1978. Bamboo. Forest News for Asia and the Pacific. Volume 2, No. 4. November 1978.
- FAO, 1989. FAO Year book of forest products, 1966-89.
- Grosser Dietger and Liese Walter, 1971. The anatomy of Asian Bamboos, with special reference to their vascular bundles. Wood Science and Technology Volume 5. Springer – Verlag, Hamburg.
- Khare S N, 1976. Nationalization of Bamboo and *Salai* in MP. Souvenir of MP Forest Department published by Chief Conservator of Forests, Bhopal, MP.
- Kigomo B N, 1988. The distribution, cultivation, and research status of Bamboo in East Africa. International Bamboo Workshop, Cochin, India.
- Lakshmana A C, 1990. A new approach to the management of Bamboo stands, Bamboo current research, proceedings of international Bamboo workshop. Nov 1988, Cochin pp 128-132.

- Liese W, 1986. Bamboos – Biology, Silvics, Properties and Utilization. Schriftenreihe de GTZ, No. 180. 132 p.
- Liese W, 1980. Anatomy of Bamboo (In: Bamboo Research in Asia). Proc. Workshop. Singapore May 28-30, 1980. Ed. Gilles Lesserd and Amy Chouinard. IDRC Canada.
- Mishra D N and Susaeta, E, 1973. Formulation and economic evaluation of a Bamboo afforestation project in South East Uttar Pradesh.
- Masani N J, Dhamani B C and Singh B, 1977. Studies on Bamboo – concrete composite construction, Forest Research Institute, Dehradun.
- Mishra H N, 1988. Structural use of Bamboo in rural housing. Indian Forester 114 (10). P. 622-634
- McClure F A, 1966. The Bamboo: A fresh Perspective. Harvard University Press, Cambridge, Massachusetts. 347 p.
- Namdeo R K, 1988. Status of Bamboo in India. Institute of Deciduous Forest. Jabalpur, M.P.
- Parameswaran N and Liese W, 1976. One of the fine structures of Bamboo fibres. Wood Science and Technology Volume 10 (1976): p 231-246.
- Pathak P S, 1989. Bamboo resources in the world. Paper presented in Seminar on Silviculture and management of Bamboos, Jabalpur, India. Institute of Deciduous Forests, Jabalpur.
- Qiu F G, 1992. The recent development of Bamboo food. International Symposium of industrial use of Bamboo, Beijing, China, 7 to 11 Dec 1992, International Tropical Timber Organization, Chinese Academy of Forestry.
- Rai S N and Chauhan K V S, 1998. Distribution and growing stock of Bamboos in India. "Indian Forester" volume 124 No. 2.
- Ram Prasad, 1985. Effect of grazing closure on the rehabilitation of flowered Bamboo areas in Mandla forests of MP. Journal of Tropical Forestry April - June 1985 Vol. 1 (2).
- Ram Prasad, 1986. Bamboo Plantation. Technical Bulletin No. 22. State Forest Research Institute Jabalpur.
- Ram Prasad,. 1988. Retrieval of Bamboo forests in MP. Indian Forester, 114(9): p 496-504.
- Ram Prasad, 1990. Gregarious flowering pattern in Bamboo (*Dendrocalamus strictus*) in MP, Journal of Tropical Forestry, Jan. - March 1990. Volume 6 (1).
- Seth V K, 1976. Review of State Trading in Bamboo. MP Forest Department publication.
- Shankhwar H O, 1999. Report on Bamboo rates in Balaghat market, 15.2.1999.

- Shen Z R, 1992. On development of Bamboo industry in continental China. International Symposium of industrial use of Bamboo Beijing, China. 7 to 11 Dec, 1992 International Tropical Timber Organization, Chinese Academy of Forestry.
- Shi Q T and Yang X S, 1992. Study and relationship between nutrient in Bamboo shoots and human health. International Symposium of industrial use of Bamboo Beijing, China. 7 to 11 Dec 1992, International Tropical Timber Organization, Chinese Academy of Forestry.
- Singhal R M and Gangopadhyay P B, 1999. Bamboo in India and database. I.C.F.R.E. Dehradun.
- Tewari D N, 1994. A Monograph on Bamboo. International Book Distributors, Dehradun.
- Thammincha S, 1988. Some aspects of Bamboo production and marketing. International Bamboo Workshop, Cochin India (in print).
- Thammincha S, 1989. Proceedings of the workshop on design and manufacture of Bamboo and Rattan furniture. Asia Pacific Region, Jakarta, Indonesia. pp. 3-10
- Uchimura E, 1978. Ecological studies on cultivation of tropical Bamboo forest in the Philippines. Bulletin of the Forestry and Forest Products Research Institute, Ibaraki, Japan. No. 301: 79-118.
- Varmah J C and Bahadur K N, 1980. Country report and status of research on Bamboo in India. Indian forest record (New Series) 6(1): pp 28.
- Waheed Khan M A, 1974. Management of Bamboo forests, problems and solutions "*Vanshree Bans Visheshank*".