



Status and strategies for conservation of bamboo resources of Meghalaya

B. K. Tiwari*, M.B. Lynser and B. Nongbri

Center for Environmental Studies, North-Eastern Hill University, Shillong- 793002, Meghalaya, India

Abstract: This paper reviews the status of knowledge about bamboo resources of Meghalaya and suggests ways to enhance the benefits to the rural poor engaged in production and trade of bamboo in the State. Thirty three species of bamboo belonging to 11 genera are found in Meghalaya. Bamboo forests cover 1,464.68 km². While most of pure patches of bamboo are found in Garo Hills, in other parts of the State it grows mixed with other trees and in plantations near human habitations. Activities like mat and basket making, extraction of bamboo for sale to paper mills, sale and processing of bamboo shoots, production and sale of bamboo handicrafts provide livelihood to a large number of people of the State. About 442 t of fresh bamboo shoots and 39.2 t of fermented bamboo shoots are sold in the State. Bamboo worth Rs. 50 million is sold to the paper mills. Bamboo contributes significantly to the State Government and District Councils by way of royalty. The study reveals that bamboo plays a pivotal role in the socio-economic and cultural life of the people of the State. While in remote places it provides employment to local people through crafts and production of artifacts; in places connected by motorable roads it is produced for sale as raw material.

Key words: Bamboo resources, bamboo trade, livelihood, bamboo crafts, Meghalaya.

INTRODUCTION

A-PDF Merger DEMO : Purchase from www.A-PDF.com to remove the watermark

Bamboo has emerged as one of the most important forestry species that contributes in a major way to the rural economy in India. Meghalaya is richly endowed with bamboo forests. Its abundance and multiple uses have led to a pivotal role in the socio-economic and cultural life of the tribal people of the State. It finds varied uses as construction material, in making of diverse implements for agriculture, fishing, cattle rearing and simple household items like utensils, small furniture, *etc.* Livelihood of a significant population in the State is dependent on the handicrafts made of bamboo. This paper reviews the status of knowledge about bamboo resources of Meghalaya and suggests strategies for their conservation and to enhance the benefits to the rural poor engaged in production and trade of bamboo in the State.

*To whom correspondence should be addressed; E-mail: bktiwarinchu@gmail.com

STUDY AREA AND METHODOLOGY

Meghalaya occupies an area of 22,429 km² in the North Eastern Region of India. The population of Meghalaya is predominantly tribal (90.4%). A case study was conducted in Tangmang village situated in the southern part of Meghalaya at a distance of 75 km from Shillong. This area is popularly known as War area located at 25° 12' 17.1" N latitude and 91° 52' 13.0" E longitude. The inhabitants of this area are predominantly of the Khasi tribe. Tangmang village with a population of about 1600 is under the Pynursla Community Development Block, Pynursla is the main township and market center of the region. The area experiences very high rainfall which ranges from 6000 mm to 10,000 mm. The temperature is also comparatively high with a minimum of 15°C to a maximum of 32°C. The collection of the data was done as per the questionnaire and guidelines provided by the PEN Technical Guidelines (PEN, 2007). Questionnaires of two levels viz., village level and the household level were used. The village level questionnaire comprised of questions regarding demography, infrastructure, landuse, forest cover and was used for forest resources. Systematic filling of the village level questionnaire was carried out with a group of knowledgeable persons of the village including the headman of the village during the meeting and discussion in the village. This was followed by the household level survey conducted with the help of household questionnaire. Ten per cent of the total households or a minimum of 30 households were randomly selected for household survey in each of the four study villages. The questionnaires were filled in through interview with the members of the household at a time suitable to the householder. The field work was conducted between 12 March-15 April 2007. Data pertaining to production and trade of bamboo in the State were collected from the records of the Forest Department and the three autonomous District Councils of the State.

RESULTS

Distribution

According to the Forest Resource Survey of Meghalaya (2002-2004), the total area under bamboo in 1986-'88 (pure bamboo area and overlapping/mixed bamboo area) was 3,102.72 km². It was highest in the Khasi Hills followed by Garo Hills and least

Table I. Distribution of bamboo bearing areas in Meghalaya (km²)

Forest Divisions	Geographical Area	Bamboo bearing area	
		1986-88 (FSI)	2002-04 (State Forest Resource Survey)
Khasi Hills	10,443	1,729.52	1,250.83
Jaintia Hills	3,819	140.18	60.312
Garo Hills	8,167	1,233.02	153.55
Total	22,429	3,102.72	1,464.68

Source: FSI (1990) and State Forest Resource Survey (2002-2004)

in Jaintia Hills (Table 1). The area under bamboo in 2002- '04 was reported to be 1,464.68 km². Under the mixed bamboo area, the bamboo species occurred with forest trees and the common bamboo species were *Dendrocalamus strictus*, *D. hamiltonii* and *Bambusa tulda*. Under the bamboo brakes/pure bamboo areas, the main species were *Melocanna baccifera*, *Sinarundinaria* spp. and *Chimonobambusa griffithiana*. Pure bamboo brakes comprised 664.72 km², whereas 2,438 km² was under bamboo mixed with forest trees (FSI, 1990).

Distribution of the different species of bamboo was not uniform. Species like *B. tulda*, *B. bambos*, *D. hookeri*, *D. hamiltonii* were mostly found in the Garo Hills, whereas *M. baccifera*, *M. bambusoides*, *Sinarundinaria* spp. and *B. pallida* were more predominant in the Khasi Hills. *C. griffithiana* occurred both in the Khasi and Garo Hills (Table 2). Larger bamboo species such as *B. balcooa*, *B. bambos*, *B. pallida*, *B. tulda*, *B. nutans*, *D. hamiltonii*, *D. hookeri* and *D. sikkimensis* were distributed mainly in the lower elevations (<500 m a.s.l.). Small diameter bamboo species such as *Phyllostachys assamica*, *Arundinaria hirsuta*, *A. suberecta*, *C. callosa* were mostly found in the higher elevations (>800 m a.s.l.). Although there was a reduction in size of bamboo with the increase in elevation, it was observed that all the seven districts of Meghalaya supported good growth and high yield of bamboo (Bhatt *et al.*, 2004).

Inventory

The bamboo forests were mainly confined to areas subjected to extensive *jhumming* (shifting cultivation) in the past. The State has 33 species of bamboo belonging to 11 genera. Some important genera of bamboo found in Meghalaya were: *Arundinaria*, *Bambusa*, *Chimonobambusa*, *Dendrocalamus*, *Dinochloa*, *Gigantochloa*, *Melocanna*, *Phyllostachys*, *Schizostachyum* and *Thamnocalamus* (Rawat and Khanduli, 1999). Of these, *A. hirsuta*, *A. mannii*, *B. jaintiana*, *B. pseudopallida*, *P. mannii*, *S. griffithii*, *S. mannii*, *S. pallidum* and *T. prainii* are endemic to Meghalaya. The endemic species belong to the threatened category. Bamboo forests in the State have diverse species base, which include sympodial as well as monopodial types. The important sympodial species include *D. strictus*, *D. hamiltonii*, *B. bambos*, *B. pallida*, *B. tulda*, whereas *M. bambusoides* is the important monopodial species.

The number of culms of monopodial bamboo species was assessed at 350.34 million corresponding to an area of 472.54 km² with the total number of equivalent sound culms at 210.67 million (60.13%). In respect of the 2630.18 km² area bearing sympodial bamboos, 2,385.17 km² fell under non-hacked category and the total number of clumps in this area was assessed at 16.3 million with an average of 68 clumps per ha. The total number of equivalent sound culms was assessed at 260.39 million (62.46%). Over the entire region the total stock of bamboo was assessed at 471 million equivalent sound culms having a gross dry weight of 2,644 t (FSI, 1990).

Extraction and utilization

Bamboos are put to varied uses in the State. Most important use is in the manufacture of paper and newsprint. The report of the Pre-investment Survey of Forest Resources emphasizes that there is great possibility for exploiting the naturally growing bamboo for paper pulp manufacturing. Bamboo is also used as building material in the rural areas. *D. hamiltonii*, *B. tulda* and *M. bambusoides* are used for building houses, and for mats and basket making. Bamboo shoots are used as food item in the form of pickles and fermented slices in almost all parts of the State. Bamboo extraction for local consumption, making of handicrafts and their marketing provide livelihood to a large number of people of the State. Articles made from bamboo include mats (*Shylliah*), baskets (*Shang*), Khasi umbrella (*Knup*), and winnowing tray (*Prah*), which are commonly used by the tribals. Other handicraft products like decorative items and mats are produced and sold in the market for cash income.

Bamboo as raw material for pulping

Although there is no paper mill in the State, a huge quantity of bamboo from the Khasi, Jaintia and Garo Hills finds its way to the paper mills in the neighboring State of Assam. Unpublished literature reveals that there is an annual demand of 50,000 t of bamboo from the State as raw material to Nagaon Paper Mill, Jagiroad. The largest quantity of bamboo supplied to this paper mill is met by *D. hamiltonii* from Ri Bhoi District and *M. baccifera* from Garo Hills District. In another paper mill, the Cachar Paper Mill located at Hailakandi District of Southern Assam, the demand and supply of bamboo from Meghalaya was estimated to be 20,000 t till the year 2004. This demand was actually being met from the bamboo forests of Jaintia Hills. This suggests that there is a potential of supplying atleast 20,000 t of bamboo from Jaintia Hills of Meghalaya.

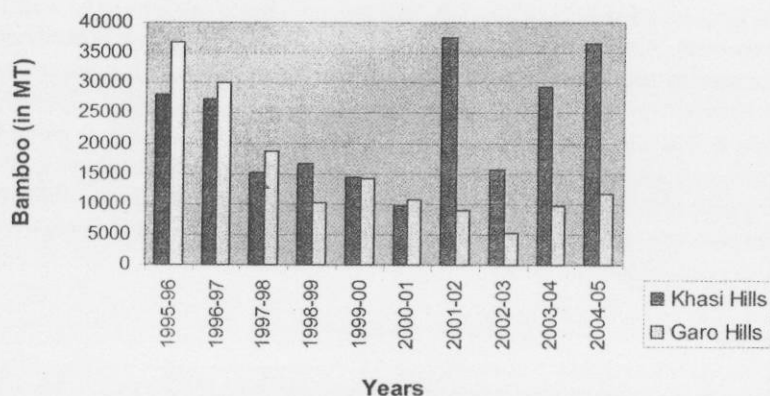


Figure 1. Annual sale of bamboo from Khasi Hills and Garo Hills

The supply of bamboo from the State is generally made through local contractors/*mahaldars*. They purchase the bamboo from the State Forest Department and Autonomous District Council based on certain terms and conditions for a limited period of time. Bamboo is also extracted from the private and community forests, and purchased directly from the owners and local contractors. Extraction of bamboo by the contractors is carried out through the inhabitants/laborers of the locality. They are either paid as man days or per truck loads depending on the convenience of the contractor. A truckload can accommodate approximately six tonnes of fresh bamboos. Contractors sell this bamboo to the paper mills at the rate of Rs. 1000/t or Rs 6000/truckload. Hence, there is a total outturn of Rs. 50 million from bamboo sector by exporting about 50,000 t of bamboo to paper mills (Fig. 1).

Handicrafts

Cane and bamboo crafts are a very important component of handicraft sector of Meghalaya. These range from furniture, basketwares, mats, bows and arrows and other artistic and carved items, which have over the years adorned every modest home of the Khasi, Jaintia and Garo tribes of the State. Basket work dominates in variety over other range of cane and bamboo products. Bamboo handicrafts are mostly produced in rural areas of Meghalaya. These handicraft items are an important part of tourist attraction, and are also exported to other parts of the country and abroad. Meghalaya Khadi and Gram Silpa sell such handicraft items to the tune of Rs. 50,000/year. The rural artisans in the State are generally not aware of the market potential of their products. They do not know the tastes and preferences of the ultimate buyer/user outside the State. There would be four or five intermediaries before the product actually reaches the end user. Our recent survey revealed that most of the handicraft artisans are facing the problem of marketing their finished products at reasonable prices. Most Garo craftsmen usually produce wares to meet the demand of their villagers and so dispose off their products in the village itself either for cash or kind. Some Garo cane and bamboo workers nowadays bring mats, baskets and winnowing fans to be sold in the weekly markets. Artistic baskets known as *meghum khoks* are made in the Garo Hills and are used by tribals to store valuable items including clothes. It is important to note that mats are often purchased by the outside traders from the Garo cane and bamboo workers. The trade of handicrafts from Meghalaya to different places is through the middlemen and agents. These two avenues of marketing constitute about 62.04 and 23.41 per cent respectively. The handicrafts are also sold directly in the markets and these constitute around 11.39 per cent while through the Government agencies it is only 3.61 per cent (Khaund, 1984).

Edible shoots

Bamboo shoots have a high market demand in Meghalaya. A seasonal (May – August) sale of fresh bamboo shoots was reported from Meghalaya to the tune of 11.2 t (Bhatt

Table 2. Distribution of pure bamboo forests (km²)

Bamboo species Scientific name	Local name	Districts							Total area
		*EKH	WKH	JH	RB	EGH	WGH	SGH	
<i>B. tulda</i>	Rangai (K)	-	-	-		8.63	12.19	0.57	21.39
	Wago (G)				-				
<i>M. baccifera</i>	Tyriaw (K)	-	-	0.68	0.42	-	-	-	1.1
<i>B. pallida</i>	Skhen (K)	9.37	20.42	0.36	4.58	-	-	-	34.72
<i>C. griffithiana</i>	Sparheh (K)	5.84	-	0.76		-	-	-	6.60
<i>Sinarundinaria</i>	Tyra (K)	-	1.88	0.64		-	-	-	2.52
<i>M. bambusoides</i>	Muri (K) /	18.52	64.32		16.32	25.31	24.3	148.77	
	Wathrae (G)			-	-				
<i>D. hamiltonii</i>	Siejbah (K)/		-	-		22.04	14.14	10.91	47.09
	Wanok (G)								
<i>B. bambos</i>	Wakynta (G)	-	-	-	-	-		14.5	14.5
<i>D. hookerii</i>	Wadro (G)	-	-	-	-	-	5.2	-	5.2

Source: Forest Resource Survey, Meghalaya (2002-2004).

*EKH = East Khasi Hills; WKH = West Khasi Hills; JH = Jaintia Hills; RB = Ri Bhoi; EGH = East Garo Hills; WGH = West Garo Hills; SGH = South Garo Hills; K = Khasi; G = Garo.

et al., 2004). Among various districts, Khasi Hills exhibited highest sale followed by West Garo Hill District. Bamboo shoots are sold in the markets for a period of 40-70 days per year in all the districts. In addition, bamboo shoot pickles and fermented slices are also sold in the markets throughout the year. A total of 39.2 t of fermented shoots are sold in Meghalaya (Bhatt *et al.*, 2005).

Species-wise sale of bamboo shoots showed that *D. hamiltonii* contributed to 82 per cent of the total consumption, followed by *B. balcooa* (9.22%) and *M. baccifera* (8.75%), respectively. Often the distance traveled for bamboo shoot collection depends on the availability of the resources and distance of the market places from the bamboo forest. The average market rate of tender shoots of *D. hamiltonii* was highest (Rs. 5.16/kg), whereas shoots of *B. balcooa* were sold at lowest rate (Rs 4.82/kg). The total gross income from fresh bamboo shoots was estimated to be Rs 2.26 million per year, whereas annual net income of Rs. 1.14 million was recorded (after deduction of financial investment and wages for man days). A total of about 39.2 t fermented bamboo shoot products are sold in the market places of Meghalaya (Bhatt *et al.*, 2005). A total of Rs. 1.18 million (gross income) could be generated from the fermented bamboo shoot products with a net annual income of Rs 0.59 million (Bhatt *et al.*, 2005). Pickles made of bamboo shoots sold in a single market place of Ri Bhoi District could fetch a gross income of Rs 0.4 million per year with a net income of Rs 0.199 million per year.

Market and economics

Quantity of extraction from the forests of Meghalaya varies from year to year. Records

Table 3. Annual sale of bamboo (t) from forests of Meghalaya

Year	SFD	KHADC	GHADC	Total
1995-96	NA	28168.34	36666.67	64835.01
1996-97	NA	27327.66	30000	57327.66
1997-98	NA	15244.11	18566.67	33810.78
1998-99	NA	16759.57	10066.67	26826.24
1999-00	27.66	14314.91	14266.67	28609.24
2000-01	NA	9787.66	10066.67	19854.33
2001-02	974.04	37433.83	9000	47407.87
2002-03	12625.6	15744.34	5250	33619.94
2003-04	NA	29239.53	9666.67	38906.2
2004-05	NA	36438.64	11666.67	48105.31
Total	13627.3	230458.59	155216.69	399302.6

SFD= State Forest Department, KHADC= Khasi Hills Autonomous District Council, GHADC= Garo Hills Autonomous District Council. Source: State Forest Department, Shillong; KHADC, Shillong and GHADC, Tura.

from the State Forest Department as well as the respective District Councils show low extraction of bamboo in the State (Table 3). This does not take into account the local consumption and those which go through the informal route of trade. However, data collected from the paper mills alone suggest that more than 50,000 t of bamboos are sold to them every year. Data on production of commercial bamboo in the Jaintia Hills are not available. Highest production was seen in the Khasi Hills with an average of 23,045.85 t annually. In the Garo Hills, official figure records a very low production of bamboo for commercial purpose. Highest production of bamboo (64,835.01 t) in the State was recorded in the year 1995-96.

A large quantity of bamboo is sold to the paper mills in the neighboring State of Assam. As on 28 March, 2006 annually about 50,000 t of bamboo was sold to the Nagaon Paper Mill, Jagiroad. Another 20,000 t was sold to the Cachar Paper Mill, Hailakandi District of Assam during the previous years. As reported, there is a total outturn of Rs. 50 million only from the bamboo sector by selling bamboo in raw form. The remaining quantity of bamboo produced is used in the State itself for meeting the needs of the local people mainly for food, construction purposes, handicrafts and also for the manufacture of plywood. A market survey has revealed that the price of bamboo varies from district to district. In Garo Hills, the market rate of bamboo is Rs. 225/t; in Jaintia Hills the rate of bamboo is Rs 1500/t and in Khasi Hills the rate is Rs. 2100/t.

Cost-benefit analysis of edible shoots has shown that the total gross income (excluding physical efforts made for collection and selling, but including the transportation charges and various miscellaneous expenditures incurred during harvesting to selling) of Rs. 1.96 million/year, for Meghalaya. The net income (calculated after deducting the cost of man-days and various expenditures) was Rs. 1.14 million/year.

Table 4. Rate of royalty (Rs.) for 100 numbers collected by the KHADC and GHADC

Bamboos	Khasi Hills	Garro Hills
<i>D. hamiltonii</i>	60.00	125.00
<i>B. tulda</i>	48.00	250.00
<i>B. pallida</i>	60.00	100.00
<i>B. vulgaris</i>	100.00	
<i>B. balcooa</i>	100.00	250.00
<i>M. bambusoides</i>	24.00	100.00
<i>S. dullooa</i>	20.00	68.00
Other bamboos > 5cm dia	20.00	40.00
Other bamboos of < 2.5-5cm in dia	10.00	15.00
Other bamboos less than 2.5cm in dia	8.00	

Note: GHADC and State Forest Department have the same rate of royalty

Source: Working Scheme for Selected Private/ Community Owned Forests in Khasi Hills, Shillong: State Forest Department, Forest Resources Survey, Shillong

Contribution of bamboo to state exchequer

In Meghalaya, royalty is levied on the forest produce, which come from the forests falling under the management and control of the Khasi Hills Autonomous District Council (KHADC). However, even forest produce extracted from private forests are subjected to pay royalty collected by the KHADC. Such forest produce are subject to the Khasi Hills Autonomous District (Management and Control of Forest Revised Rates of Royalty) Rules, 2005, which became effective from April, 2005. The revised rates of royalty levied on bamboo as per Schedule of Rates of Royalty varies from species to species. The royalty collected by the KHADC and GHADC differ from species to species as shown in Table 4. In Khasi Hills, the royalty rate for *B. pallida* and *D. hamiltonii* are Rs. 60/100 numbers and *B. vulgaris* and *B. balcooa* Rs. 100/100 numbers. For *B. tulda* the rate is Rs. 48/100 numbers, for *M. bambusoides* Rs. 24/100 numbers and for *S. dullooa* Rs.20/100 numbers. In Garo Hills also the rates of royalty for bamboo differ from one species to another. For *B. tulda* and *B. balcooa* the rate is fixed at Rs. 250 per hundred numbers. For *D. hamiltonii* the rate of royalty is fixed to Rs. 125 and for *M. bambusoides* and *B. pallida* rate of royalty is Rs. 100/100 (Source: GHADC, Tura). In Jaintia Hills, the royalty of bamboo is Rs. 60/100 numbers. (Source: JHADC, Jowai). For other bamboos species of 5 cm and above in diameter, the rates of royalty as per the KHADC and GHADC are Rs. 20 and Rs. 68 respectively. For bamboo species which are of 2.5 - 5 cm diameter, the royalty in Garo and Khasi Hills is Rs. 10 and Rs. 40 respectively. For bamboos which are less than 2.5 cm diameter, the royalty rate in Khasi Hills is Rs. 80 and in Garo Hills Rs. 15. State government collects royalty on the bamboos extracted from the forests falling under their control. The State government royalty rates are: *B. tulda* Rs. 250/100 numbers, *D. hamiltonii* Rs.150/100 numbers and for other species above 5 cm diameter, the rate is Rs. 66/100 numbers.

Management of bamboo in Tangmang village: a case study

People of Tangmang village, situated in the Southern part of Meghalaya, under the Pynursla Community Development Block follow a traditional system of bamboo management. In these areas, before planting bamboo, the area is cleared by burning the undergrowth. Burning of forest is carried out once in a year between March and April, in the area where bamboo plantation is to be taken up. Most of the bamboo found in the village are planted, although they also grow in wild. The most important bamboo species used in the village are: *B. pallida* (*Shken*) and *Bambusa* sp. (*Rngai*).

Production of planting stock, planting and aftercare

There are two methods of propagation. The most common method is through rhizomes with culmstock and roots. If the culm is young, it is maintained intact and if it is large, the upper part is removed and branches are trimmed. After cutting, the rhizome is transported and transplanted in 20-30 cm deep soil and 30 cm apart.

Another method of propagation is by rooting culm cuttings. Segments of one or two nodes are selected from the lower to basal part of one-year-old culms. The upper part and the lateral branches of the culm are discarded. Immediately after cutting, the segments are transported and transplanted. The culm segment is planted in 20-30 cm deep soil and 20-30 cm apart leaving the upper segment (about 10-15 cm) without soil cover. The propagules are transplanted in the month of April. After one year the transplanted rhizomes start growing. However, growth through culm cuttings takes a longer period and has smaller diameter culms than that of rhizomes in the first year of growth. Within 5-6 months after emergence, the culm attains its full height. These culms are then allowed to grow and multiply for 5 years. Thinning is done once in a year during rainy season (May-August). Both male and female labourers are engaged in cleaning and weeding. The branches of dense bamboo clumps are trimmed and dead culms and branches are removed to give space for new culms to grow.

Harvesting

Extraction of bamboos from village forest is not allowed. However, dead culms and branches can be collected for fuel wood. Harvesting of bamboos is carried out during winter (December-February). Males are usually involved in harvesting and carrying of bamboo poles from forest to their residences. Bamboo is harvested for different purposes such as local house construction, fencing, flooring, animal cages, making mats, baskets, trays, caskets and other household items. A large knife or *wait* is used to cut bamboo poles from clumps. The poles are cut at a point about 0.6 m above the ground. Straight, well formed poles are preferred, with an average age of 3 years. However, for mat making, 1-year-old bamboo is most commonly harvested. The number of poles harvested per person depends upon the distance from the assembly

point, the size of bamboo poles cut and the means of transport available to the collection team, among other factors. In general, bamboo is transported from the forest to collection sites on foot by collection teams usually comprising 3 to 5 members.

The sprouting period of bamboo is during May-July. Harvest of bamboo shoots is done during summer season (May-July). Only young shoots of *Bambusa* sp. (*Rngai*) is preferred for edible purposes. The villagers do not harvest young shoots of *B. pallida* (*Shken*) for edible purpose. *B. pallida* is one of the most important bamboo species of the village and the region. Although this species is available in natural forest, it is also cultivated by the villagers mainly for construction purposes, mat-weaving, baskets, caskets and other items.

Mat/basket weaving

B. pallida is mainly used for weaving mats. Mat making is one of the main occupations in the village. During the household survey, it was found that it contributes Rs. 0.1 million to the annual income of the villagers which is around 5.77 per cent of their total income from all sources. The processing work is mainly done by the female members of the family, and 90 per cent of the surveyed households are involved in mat-making. It was observed that the mat-making was seasonal and prevalent only during the rainy season (May-September) and during periods when there was shortage of work in the field. Thus, it can be said that this activity helps them to get employment during the lean seasons to sustain their family.

The processing (splitting, slicing and weaving) works for mat-making was mainly done manually by the female members of the family and there is no use of machine. The bamboo cut from the forest are left there for some time before further processing. The cutting and slicing of the bamboo was usually done from December to April and the strips are then bundled and stored for mat-weaving during rainy season. Only the outer rind of bamboo was used for mat making, the rest was used as firewood or discarded. The sale of the mats was through the local traders or the middlemen. The middlemen were the only agents through whom the villagers sold their finished products. The villagers' dependence on the middlemen was mainly due to the lack of proper trading channels and transport.

Strategies for conservation and sustainable utilization

The following strategies are suggested to address the constraints faced by the bamboo sector of Meghalaya.

Market information

The existing policies often do not take into account the specific problems faced by the

producers in marketing the bamboo products. For instance, the main hurdle to marketing bamboo products is lack of necessary market information, transparency and equal opportunity. The rural poor do not have access to market information like price, peak season, major markets and the consumer's needs and preferences. Thus, to facilitate marketing of products and help the producers, necessary market information should be made available to the rural producers at an appropriate time. The National Informatics Centre of the Government can set up a Market Information Center or market information kiosk, in main market places, villages, blocks or headquarters of the districts, about the demand of the product, the price of the product at national as well as international level. This will ensure that all stakeholders have equal access to basic market information.

Minimum support price

For most of the bamboo products, the pricing is done by the middlemen or regional traders and in most cases it is seen that they are the ones who are benefited. Most often, the items are under-priced and the growers are always at the receiving end. Hence, to remove this discrepancy/inconsistency, regulation of prices is to be effected out by a government authority.

Transport

In most interior villages where basic infrastructure like road and means of transport are lacking, the producers face a huge problem in transporting their goods from the site of production to the roadside or main markets. Cost of the transport of bamboo makes it economically less viable, hence they remain under-utilized.

Collection center

A collection center can be set up to facilitate marketing of forest goods. While the producers can be free from hassles of transport to long distances, the traders find the produce in good quantity at one point. These centers can be linked with the warehouses and information centers as stated above.

Rationalization of royalty and taxes

Taxation policies are not favorable for bamboo production and trade. Rates of royalty levied on bamboo are too high compared to the cost involved in the collection and processing of the same. It reduces the income of the growers.

Value addition and processing

Bulk of bamboo is sold in raw form and value addition is done outside the State

Another problem faced by the people involved in bamboo collection and trade is their ignorance of the value added processing such as bamboo chips, bamboo ply, *etc.* There is almost total absence of technologies for processing of bamboo to convert them into high value products. Bamboo shoots can be efficiently dried and pickled since bamboo shoot pickle has a huge demand in international market. But the local producers and even market players are not trained to produce the value added products for such markets, hence less benefits. Value addition at the village level will also provides employment opportunities besides assuring a higher income to the producers.

Technology upgradation

In the case of bamboo handicraft and furniture-making, there is a need to upgrade technology so as to enhance the productivity and quality of the finished materials; also to cater to the needs of high end consumers. If appropriate and modern technologies are introduced, the bamboo products of Meghalaya can suitably cater to the consumer's needs and can also successfully compete with other manufacturing units present in the national and international scenario.

Skill improvement and capacity building

The producers have the basic necessary skill required in many areas like furniture and handicrafts making and processing of edible items. However, to cater to the needs of the diverse consumers, skill upgradation and capacity building is essential. Training and exposure trips from time to time can improve their expertise in these areas. Such skill formation and upgradation according to the changing need of the market is essential to remain a key player in the highly competitive market of a globalized economy.

Research input

There are research gaps that need to be filled up. There is no quantitative information on the size of the market for various products of bamboo and their trade. There is also a need to study the dependency of the rural poor on bamboo. Researchers should examine the conditions under which commercialization of bamboo-based products contributes optimally to the livelihood of the growers and the impact of commercialization of bamboo on the rural poor, livelihoods, natural resources and access and benefit sharing from these resources.

Cultivation of bamboo

Cultivation of bamboo is picking up in areas where it has become a commercial product. However, this needs to be encouraged and policy and legal impediments in the process need to be removed. This will fetch a better income to the growers; at the

same time, it will also meet the market demands and serve the consumers.

Local industries

More emphasis should be given for the setting up industries for processing bamboo shoots, so as to cater to the demand not only at the national level but also at the international level. There has been a flourishing market for bamboo plywood in the world; an initiative in this direction is also desirable.

ACKNOWLEDGEMENT

The authors are thankful to the Centre for International Forestry Research, Bogor, Indonesia for providing financial support for this study. We are also thankful to L.B. Singha for helping in collection of data.

REFERENCES

- Bhatt, B.P. Singha, L.B., Sachan, M.S. and Singh, K. 2004. Commercial edible bamboo species of the North Eastern Region, India. Part I: Young shoots sale. *J. Bamboo and Rattan* 3: 337-364.
- Bhatt, B.P., Singha, L.B., Sachan, M.S. and Singh, K. 2005. Commercial edible bamboo species of the North Eastern Region, India. Part II: fermented, roasted and boiled bamboo shoots sale. *J. Bamboo and Rattan* 4: 13-31.
- Forest Resource Survey, 2002-2004. Department of Forest, Government of Meghalaya, Shillong.
- FSI 1990. Forest Resource Survey of Meghalaya State Inventory Results. Forest Survey of India, Dehra Dun.
- Khaund, P.K. 1984. Marketing and handicrafts. In: J.B.Ganguli (Ed.). Marketing in North East India. Omsons Publications, Guwahati, India: 87-91.
- Poverty and Environment Network (PEN), 2007. PEN Technical Guidelines. Version 3, Centre for International Forestry Research, Bogor Indonesia. www.cgiar.org/cifor.
- Rawat, J.K. and Khanduli, D.C. 1999. The Status of Bamboo and Rattan in India. Forest Research Institute, Ministry of Environment and Forests, Government of India, New Delhi.