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BAMBOO RESOURCES, ITS DIVERSITY AND UTILIZATION: A CASE STUDY IN KARIMGANJ DISTRICT, BARAK VALLEY

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INTRODUCTION

The survival and progress of human beings depend on recognizing and exploiting natural resources, which are very much threatened at present. Wood is widely used and it is well-known that trees have long growth cycles. Unfortunately, the excessive timber harvest has turned out to be disastrous and every country has adopted protection measures to limit the utilization of wood material obtained from the forests. With this challenge, the utilization of bamboo resources has been highlighted. Bamboo belonging to the family*Poaceae*as about 90 genera with over 1200 species. Bamboo is naturally distributed in the tropical and subtropical belt between approximately 46° north and 47° south latitude, and is commonly found in Africa, Asia and Central and South America. Dwarf bamboo species grow to only a few centimeters (cm), while medium-sized bamboo species may reach a few meters (m) and giant bamboo species grow to about 30 m, with a diameter of up to 30 cm. Bamboo stems are generally hard and vigorous, and the plant can survive and recover after severe calamities, catastrophes and damage (Global Forest Resource Assessment '2005; INBAR & FAO).

In Asia, the major bamboo producing countries are India (almost 11.4 million hectares) and China (over 5.4 million hectares), followed by Indonesia (2 million hectares) and the Lao People's Democratic Republic (1.6 million hectares). India accounts for roughly half the total area of bamboo reported for Asia, and together with China, approximately 70 percent. Over the last 15 years, the bamboo area in Asia has increased by 10 percent, primarily due to large-scale planting of bamboo in China and, to a lesser extent, in India (FRA'2005).

In India an estimated 8.96 million ha forest area of the country contains bamboo (Rai and Chauhan, 1998). According to the Forest Survey of India report, about 12.8 percent of total forest area is under bamboo cultivation, with the northeast region accounting for 66 percent of the country's bamboo resources in terms of value and 28 percent in terms of area (Indo-Asian News Service). India is very rich in bamboo diversity. There are 124 indigenous and exotic species, under 23 genera, found naturally and/or under cultivation (Naithani, 1993). Clump forming bamboo constitute over 67% of the

total growing stock and *Melocannabaccifera*, a non-clump forming bamboo, accounts for 20% of the growing stock and is found in the north-eastern states.

The North East is called the home of Bamboo and this wonder plant is intimately interwoven with the socio-cultural fabric of the population of the area. While Bamboo forests in India occupy an extent of approximately 10.03 million hectares, about 28 percent of the area is located in North Eastern Region. The region has 67 per cent of the country's growing stock, spreading over 3, 50,000 hectares in forest alone. Inextricably woven in the tradition and culture of the North Eastern people, bamboo sustains 70 per cent of rural work force in the region.

Bamboos form an important component of the rural landscape of Barak Valley in southern Assam as also in other parts of northeastern India. Home gardens and bamboo groves of Barak valley are rich in bamboo resources and *Bambusacacharensis* R. Majumder ('betua'), *B. vulgaris*Schrad. ('Jai borua'), *B. balcooa*Roxb. (Sil borua'), form important bamboos prioritized by the rural people (Nath, 2001; Nath *et al*., 2004). *B. cacharensis*is endemic to Assam (Majumder, 1983; Barooah and Borthakur, 2003) and distributed abundantly within Brahmaputra and the Barak Valley and other two species (*B. vulgaris* and *B. balcooa*) are among the 14 Indian priority bamboo species (NMBA, 2004) and 38 priority bamboo species for international action (Rao *et al*., 1998).

Bamboo has received increasing attention over the last two decades for its economic and environmental values. In Africa, Asia and Latin America, it is closely associated with indigenous culture and knowledge and is widely used for housing, forestry, agro forestry, agricultural activities and utensils. In countries undergoing economic development, traditional bamboo culture gradually disappears. However, industrial development of bamboo is offering a newopportunity to younger generations to retain and continue developing cultural traditions related to the cultivation, harvesting and use of bamboo. The physical and environmental properties of bamboo make it an exceptional economic resource for a wide range of uses and for poverty reduction. It grows quickly and can be harvested annually without depletion and deterioration of the soil.

Bamboo is utilized for various purposes depending upon its properties. It plays an important role in the daily life of people; for house construction, agricultural tools and implements, as food material and weaponry etc. Besides being a convenient source of cellulose for paper manufacture and rayon, it supports a number of traditional cottage industries. Bamboo craft is one of the oldest of traditional cottage industries in India. The origin of this rural craft is traced from the beginning of the civilization when man started cultivation of food crops thousands of years back. Now bamboo craft is spread in all rural areas of the country and it feeds millions of traditional workers. Bamboo is emerging as a major source of raw material for several processed products primarily due to its fast growth, wide spread occurrence and its multiple uses. The present study is to investigate the diversity, density, utilization and management of bamboo resources in the villages.

METHODOLOGY

The study was carried out in the villages under Patharkandi, Ramkrishna Nagar, South Karimganj and North Karimganj Blocks of Karimganj District in Barak Valley of Assam, NE India. The geographical location of Karimganj district is betweenlongitudes$92^0 15^/$and $92^0 35^/$ Eastand latitudes $24^0 15^/$and $25^0 55^/$ North.The district is bounded by River Barak &Bangladesh in the North & West, Tripura State in the South andHailakandi &Cachar districts in East. The geographical area of the district is 1809 sq.km. The district consists of plains and hilly areas and two reserve forests viz. Patharia and innerline reserve forests.

The district experiences a warm and humid climate having a mean annual rainfall of 2660 mm, most of which is received during the south-west monsoon season (May - September). The mean maximum temperature ranges from 25.4° C to 32.6° C and the mean minimum temperature ranges from 11° C to 25° C. The dry season usually corresponds to the period from December to February. The soil is acidic, heavy clay to loams except river basin and hilly tracts, where sandy to clay loams can be observed. According to 2011 census the total population of the district is 1228686. Total rural population of the district is 111,8986 (91.07%) & urban population is 109700 (8.92%) . Male-female ratio is 961 per 1000 males.

The study adopted was a descriptive survey method in which sampling was done from 30 villages, 10 homegardens in each village, which were selected randomly, under Patharkandi, Ramkrishnanagar,South Karimganj and North Karimganj blocks of Karimganj district. Information regarding the diversity, density, utilization and management of bamboo resources in the villages was gathered through field visits and interaction with bamboo growers through detailed and structured questionnaire. Species inventory and villagers' preference for bamboo species were assessed by surveying the selected home gardens and bamboo groves and enumerating the number of clumps per species. The relative importance value of a species is calculated by adding up the relative frequency and relative density of each to represent the dominant village bamboo species in the homegardens and bamboo groves.

RESULTS AND DISCUSSION

The survey revealed that there are 9 species of bamboo found to be cultivated in the villages. These are *Bambusacacharensis* R. Majumder, (Betua), *Bambusapolymorpha.* (Jama betua), *B. vulgaris,*(Jai borua), *B. balcooa,*(Sil Borua), *B. nutans,*(Bakal), *Schizostachyumdullooa,*(Dolu),*Melocannabaccifera,*Kurz (Muli), *B. assamica.* (Mirthinga) and *B. pallida.* (Ketwa). The bamboos are distributed widely throughout the region.

The villages surveyed were grouped into 3 categories based on their location - viz., riverside villages, forest side villages and other villages (which do not fall under the aforesaid categories), for comparing the frequency, density and importance of the species in such areas.

Table:1-R.I.V of bamboo species

Bamboo sp.	all villages			in river-side villages			in forest-side villages			in other villages		
	R.F	R.D	R.I.V culms	R.F	R.D	R.I.V culms	R.F	R.D	R.I.V culms	R.F	R.D	R.I.V culms
Betua	18.99	39.74	58.73	18.52	32.76	51.28	16.13	36.7	52.83	21.13	47.76	68.89
Jama betua	6.96	2.67	9.63	7.41	2.48	9.89	9.67	4.74	14.41	5.63	1.91	7.54
Sil Borua	18.35	10.37	28.72	18.52	7.79	26.31	16.13	11.91	28.04	18.31	12.08	30.39
Jai borua	18.99	25.72	44.71	18.52	36.66	55.18	16.13	12.54	28.67	19.72	21.55	41.27
Bakal	15.82	3.98	19.8	14.81	4.96	19.77	16.13	5.32	21.45	16.9	2.41	19.31
Mirthinga	13.29	15.23	28.52	14.81	13.88	28.69	12.9	26.24	39.14	12.68	11.31	23.99
Dolu	1.27	0.08	1.35	1.85	0.09	1.94	3.23	0.23	3.46	0	0	0
Ketwa	0.63	0.13	0.76	0	0	0	3.23	0.65	3.88	0	0	0
Muli	5.69	2.09	7.78	5.56	1.37	6.93	6.45	1.67	8.12	5.63	2.97	8.6

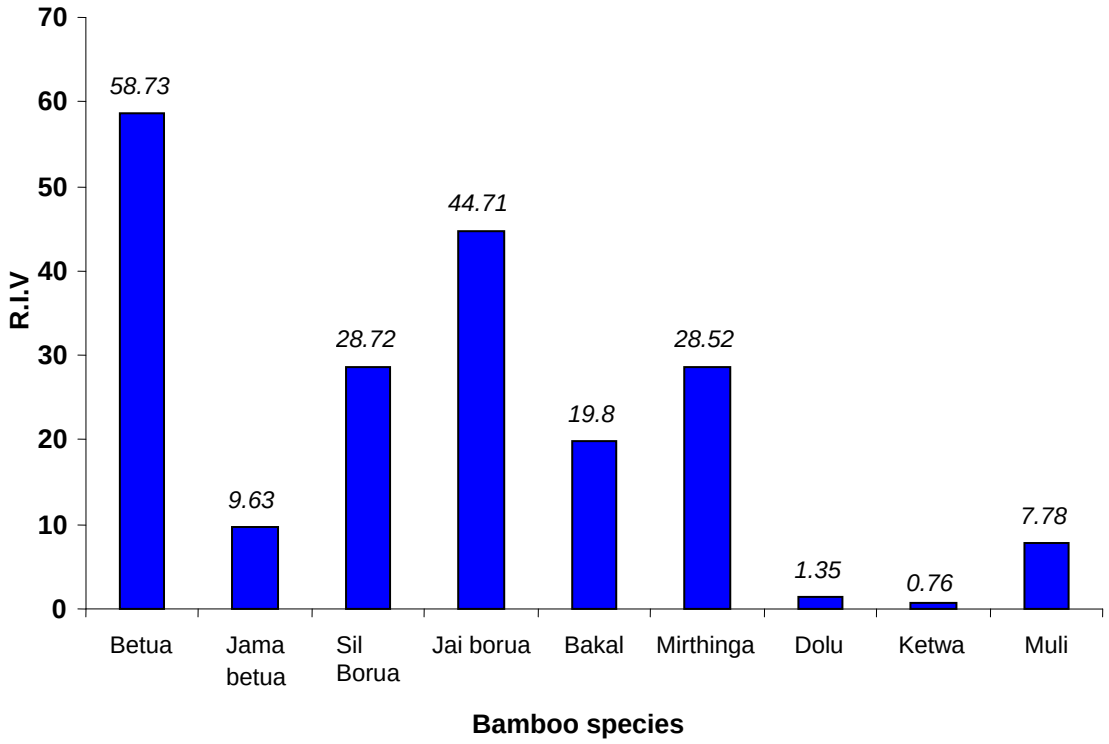


Figure:1. R.I.V of bamboo species in all villages

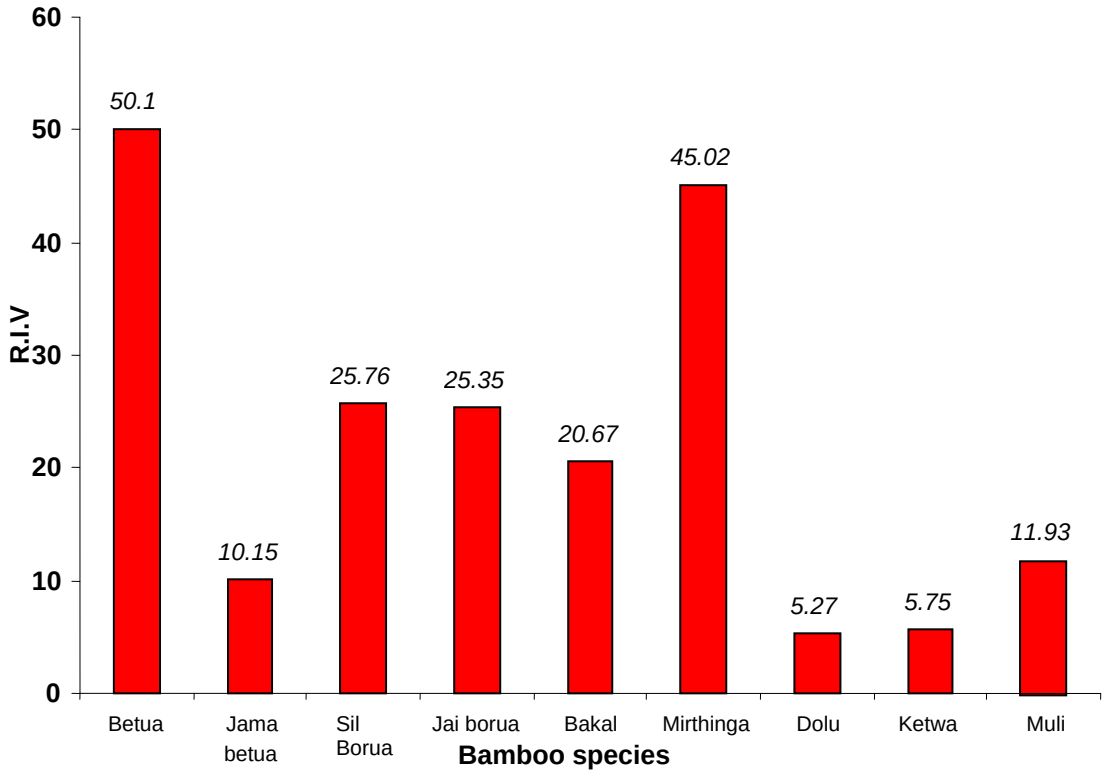
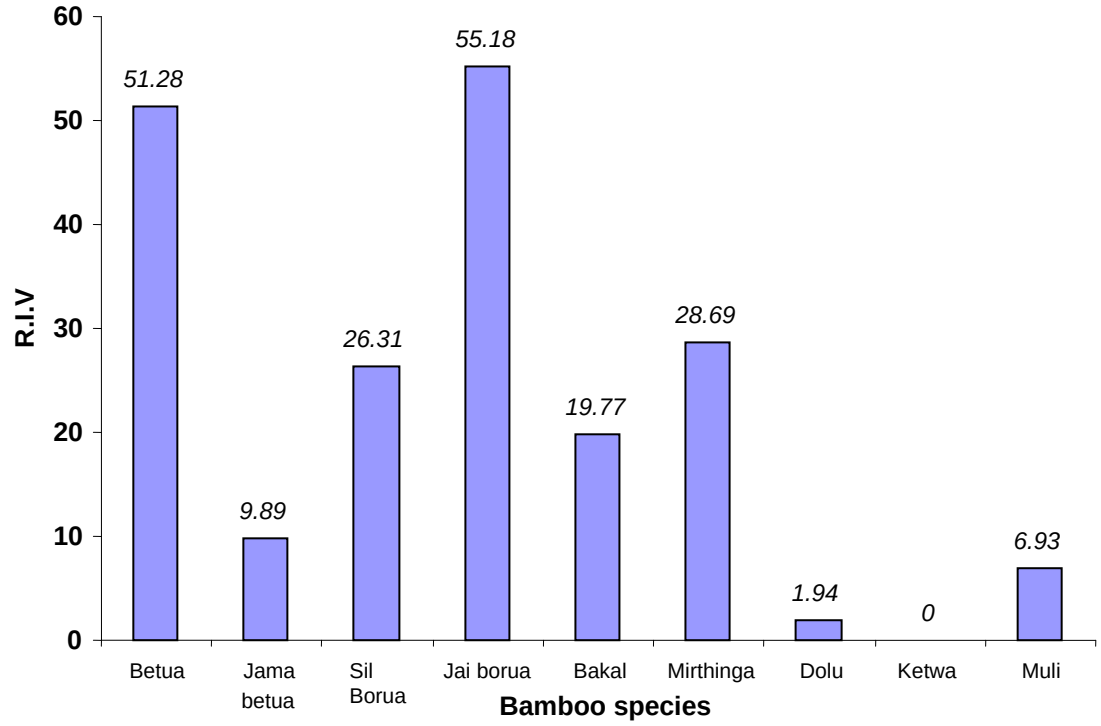


Figure:3. R.I.V of bamboo species in forestside villages



Bamboo species in riverside

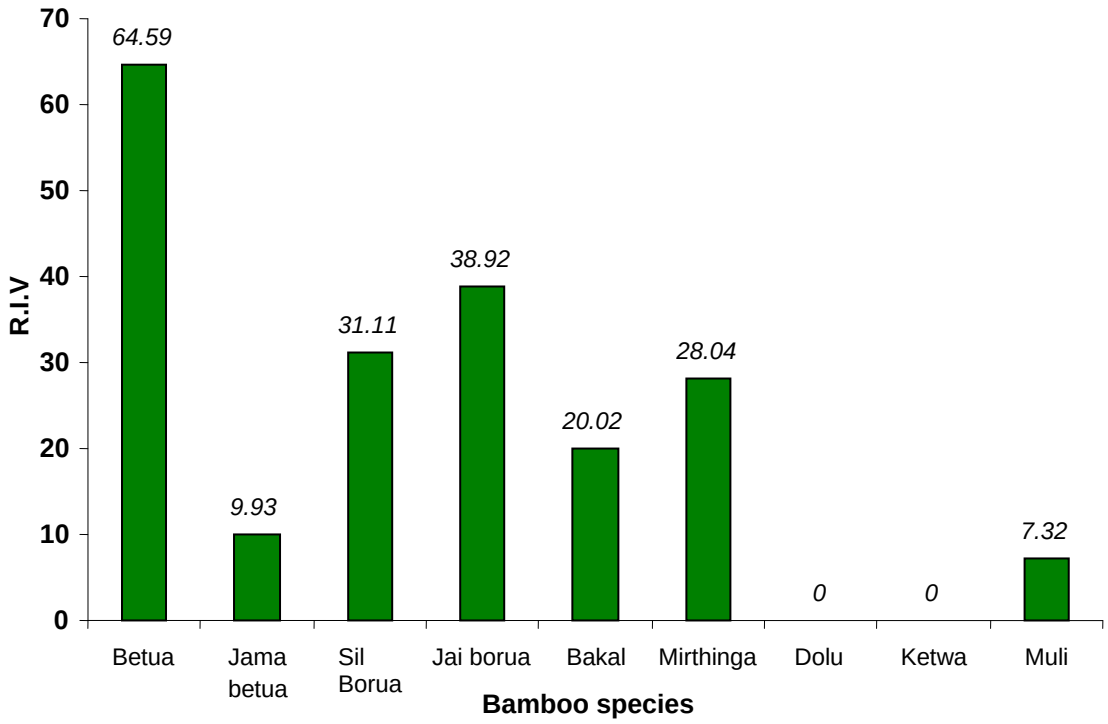


Figure: 4. R.I.V of bamboo species in other villages

Table: 2. Average number of clumps of bamboos per home garden in each village.

Sl. No	Village	Betua	Jama Betua	Sil Borua	Jai Borua	Bakal	Mirthinga	Dolu	Ketwa	Total
1	Kandigram-I	1.6	1.2	1.9	3.4	0.5	0.2	0.2	-	8.9±1.15
2	Kandigram-II	0.8	0.3	1.1	2.2	0.5	-	-	-	4.9±0.75
3	Suprkandi	1.1	0.1	0.8	0.8	0.3	-	-	-	3.1±0.41
4	Muirkimara-I	2.3	0.2	2.2	3.1	0.4	1.1	-	-	9.3±1.16
5	Deuitoli-II	2.7	1.4	0.9	0.9	0.1	1.1	-	-	7.1±0.86
6	Hizim	1.1	-	0.1	0.9	0.2	-	-	-	2.3±0.5
7	Ganshamarchak	1.9	-	1.3	2.2	0.1	1.3	-	-	6.8±0.80
8	Bashbari	2.7	-	0.8	0.7	0.1	2.3	0.2	-	7.7±1.10
9	Chandkani	1.9	0.1	0.7	1	0.1	0.1	-	-	3.9±0.72
10	Krishnapur-I	2.7	-	0.3	0.8	0.6	-	-	-	4.4±1.09
11	Krishnapur-II	1.7	0.3	1.5	2.2	1.5	1.4	-	-	8.6±0.63
12	Sonakhira	1.3	-	0.8	1.3	0.8	0.2	-	-	4.4±0.45

13	Jalalnagar	3.7	-	-	3.6	0.2	-	-	-	7.5±1.99
14	Khabol	3.2	-	0.8	1.7	0.1	-	-	-	5.8±1.34
15	Kataltoli	2.7	0.1	1.7	2.3	0.1	1.2	-	-	9±1.09
16	Anipur	3.8	0.1	0.6	1.6	-	-	-	-	6.1±1.64
17	Kalkalighat	2.6	-	0.7	1.8	0.3	0.2	-	-	5.6±1.04
18	Lakhinagar	1.6	-	1.2	0.2	0.6	-	-	-	3.6±0.62
19	Damcherra	1.2	-	1.7	0.6	-	0.2	-	-	3.7±0.66
20	Nibia	1.5	-	0.7	1.6	0.5	0.4	-	-	4.7±0.57
21	Cheragi	1.3	-	1.5	1.9	0.3	1.6	-	0.4	7±0.66
22	Eraligool	1.6	-	0.9	3.7	-	0.6	-	-	6.8±1.4
23	Ramkrishnagar	0.4	-	1.2	1.8	0.2	0.5	-	-	4.1±0.66
24	Jatrapur-I	1	-	1.1	0.4	0.2	0.7	-	-	3.4±0.38
25	Bramanshashan	1.6	-	1.6	0.8	-	0.4	-	-	4.4±0.6
26	Dhuhalia	1.9	-	1.2	1.5	0.2	0.5	-	-	5.3±0.70
27	Dhalcherra	3.6	0.8	1.3	4.4	1	1.8	-	-	12.9±1.5
28	Ratabari	1.4	-	1.2	1.6	-	0.7	-	-	4.9±0.39
29	Gulcherra	1.7	-	1	0.2	0.1	-	-	-	3±0.75
30	Dulabcherra	1.9	1.6	0.7	1.5	0.6	1.6	-	-	7.9±0.53

Considering all the villages it was found that the R.I.V of*Bambusacacharensis* R. Majumder (‘Betua’) is 58.73, which is quite high and may be due to the high dominance of the species which is again due to the high preferences of these species by the villagers and also may be due to the high productivity of these species. More over the ecological and environmental conditions of the region may be favourable for the proper growth and productivity of these species. The species *B. vulgaris*Schrad. (‘Jai borua’), and *B. balcooa*Roxb. (Sil Borua) are also having a good R.I.V in the villages. Nath, 2001; Nath *et al*., 2004, quoted that the home gardens and bamboo groves of Barak valley are rich in bamboo resources and *Bambusacacharensis* R. Majumder (‘Betua’), *B. vulgaris*Schrad. (‘Jai borua’), *B. balcooa*Roxb. (Sil Borua’), form important bamboos prioritized by the rural people. The species *B. cacharensis*is endemic to Assam (Majumder, 1983; Barooah and Borthakur, 2003) and distributed abundantly within Brahmaputra and the Barak Valley and other two species (*B. vulgaris* and *B. balcooa*) are among the 14 Indian priority bamboo species (NMBA, 2004) and 38 priority bamboo species for international action (Rao *et al*., 1998). The low R.I.V of *Schizostachyumdullooa*,(Dolu),*Bambusa pallida* (Ketwa), and *Melacannabaccifera* (Muli) may be due to less dominance and less preference of the species.

Again in the river-side villages, the R.I.V for *B. vulgaris* (Jai borua) was found to be highest (55.18), which may be due to the adaptability of the species to grow well in moist condition or in water logged condition. The species is thought to have adaptation to flooded condition and so is preferred the most in the riverside villages. In the river side villages the R.I.V of *Schizostachyumdullooa*,(Dolu) and *Melacannabaccifera* (Muli) are very low because these species are originally forest bamboos and have been planted in the villages. The ecological and environmental condition may not be favourable for their growth and productivity.

In the forest-side villages the R.I.V of*Bambusacacharensis* (Betua) is highest (50.1), but here the high R.I.V of *B. assamica* (Mirthinga) (45.02) and the presence of *Bambusa pallida*(Ketwa), *Schizostachyumdullooa*,(Dolu) and *Melocannabaccifera* (Muli)

marks the difference. The nearby forests have an impact on the diversity of the bamboos as well as in the growth and productivity of the various bamboo species. The low R.I.V of *B. vulgaris* (Jai borua) and *B. balcooa* (Sil Borua) reflects that the species have low frequency and density as because the ecological and environmental conditions are not suitable for their growth.

Again in the other villages which are in between the riverside and forest side villages, the R.I.V of *Bambusacacharensis* (Betua) was found to be highest (64.59), but here the R.I.V of *Bambusa nutans* Wall. ('Bakal') was found to be 20.02 which is comparatively higher than the R.I.V of the species in the other regions. The high R.I.V of *Bambusacacharensis* (betua) may be due to the high dominance and high preference of the species. The home gardens in all the villages reflect a good diversity of the bamboos and a diverse distribution of all the nine species through out the region. Species diversity in tropical home garden is reported to be very high due to species having different life forms, height and canopy structure (Babu *et al.* 1982; Soemarwoto& Conway (1991).

The average number of clumps of bamboos was found to be highest in Dhalcherra with about 12.9 clumps per home garden followed by Murkimara (9.3) and Katalthali (9).The lowest number of average clumps of bamboo per home garden was found in Hizim (2.3).The average no. of clumps of bamboo per home garden varies from village to village. This may be due to various topographic factors as well as climatic conditions in different areas. More over the size of the home garden, the interest of the villagers in planting bamboo and their socio-economic status may also play a great role in explaining the difference. Structure of home garden varies from place to place depending upon the socio-economic and ecological conditions (Soemarwoto 1987).

Among all the species *Bambusacacharensis* (Betua), *B. vulgaris* (Jai borua) and *B. balcooa* (silborua) are mostly preferred in the villages due to the various utility of these species and high productivity. *Bambusacacharensis* (Betua) is preferred by about 45% of the villagers as because it can be utilized in all aspects of their day to day requirements as well as for commercial purpose. The species can be used for fencing, construction purpose, making various bamboo articles like baskets, mats, fishing articles, agricultural equipments etc. Betua has good elasticity and provides quality fibre ('beth') and hence can be utilized for various purposes. Moreover the species is endemic to the region (Majumder, 1983; Barooah and Borthakur, 2003) and grows well in such climatic conditions.

The trend of preference is same in forest side villages and in other villages, but in the riverside villages *B. vulgaris* (Jai borua) is preferred the most as it can adapt to flooded conditions and has good productivity. Jai borua can also be utilized in all aspects, from subsistence need to commercial need. Due to its high productivity and quick regeneration capacity it is harvested in every 4-5 years and sold to the market or in paper mill, which is practiced in many villages. *B. vulgaris* Jai borua can also be utilized for making various agricultural equipments and rickshaw hoods and thus has a great commercial value.

In the villages, bamboos are utilized in two ways- for subsistence use and commercial use. Subsistence use refers to the uses in household, such as fencing the boundary of the house, fencing homegardens and crops for protection, construction of the houses, cattle shed, for burning in cooking, construction of barrier in water bodies, boundaries of ponds, etc. Bamboo is also used as a live fencing in the villages. Commercial

use is again of two types- Large scale production of bamboo for selling in the market or in the Paper Mill and Production of small articles of bamboo used in day to day life.

Large scale production of bamboo was found only in few villages and only in a few families, due to lack of space. Some families in the villages like Dhalcherra, Katalthali, Murkimara,Kandigram and Krishnapur-I often sell bamboos in the market or in the Paper Mill, after a gap of 5-6 years.

Production of small articles of bamboo, such as small and large baskets (Jhuri, Kholoi, Potaing, Tukri etc.), fishing articles (Dori, Chepa, Runga, Fufi etc.), agricultural implements, rickshaw hoods, etc. are produced by the villagers of- Murkimara, Gulcherra, Bashbari, Nibia, Khabol, Damcherra, Lakhinagar and Dulabcherra. These products are sold in the village market or in the nearby town.

The harvesting pattern of bamboos in the villages was found to be selective harvesting, i.e., harvesting the older or mature culms leaving behind the younger ones. But in some villages where bamboo is sold to the paper mill, clear cutting of the clumps leaving behind a few current year culms are seen.

A traditional system of bamboo management is prevalent in the region which involves yearly soiling mainly in the month of Chaitra (Mar-Apr), and burning of the litter in the month of Falgun (Feb-Mar), thus enhancing the soil quality and the vegetation cover of the region.

Bamboo cover in the villages enhances the vegetation cover of the region. The bamboo-cover also plays a great role in the process of carbon sequestration, thus lessening the impact of global warming by acting as a carbon sink. Bamboo can act as a supplement of fuel wood thus lessening the burden on the near by forests. It also plays a great role in the conservation of soil quality by restricting soil erosion. Bamboos are used in live fencing and also in regeneration of degraded lands mainly due to flood.

CONCLUSION

Considering the potential of bamboo for socio-economic development, especially in rural areas, there is an immediate need to carry out their massive plantations in forests, farms and vacant community lands. It is also necessary to boost research and development activities for genetic improvement in bamboo, development of efficient methods for mass production of superior quality planting stock, and conservation of the genetic resources. Concerned international organizations and local governments should adopt useful policies to use bamboo resources, substitute bamboo for wood, in any possible industrial use and also to strictly limit cutting of wood and deforestation. This will be a significant contribution to the improvement of natural resources and solve many ecological problems. Rational plans should be developed and carried out to make use of bamboo resources, so that the existing bamboo forests would not be destroyed, as wood forests have been. At the same time, there are advantages of using cultivated bamboo with its short rotation period. With improved management practices there should be more bamboo wood for industries

and edible shoots for human consumption. Thus there is an urgent need for the development of strategies and guidelines for the proper management of the village bamboos in Barak Valley, North East India.

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