

2017



Bamboo

**Conservation, Management
and Utilisation in India**

Supplement to the Status Report



**Indian Council of Forestry Research and Education
Dehradun**



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and Utilisation in India**

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ICFRE, October 2017

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Foreword



India has vast bamboo resources, which can offset the raw material requirement of forest-based small and large industries, both in organized and unorganized sectors. Bamboo is climate friendly and has enormous potential for solving many problems of social and environmental sectors. The traditional bamboo industry has created plenty low-cost employment and livelihood opportunities. However, even after having second largest bamboo resource in the world, the full potential of bamboo has not been realized.

Promotion of bamboo sector has many opportunities and perspectives for supporting livelihoods of rural people. Government of India has realized this in the past and two specific centrally-sponsored missions were launched for the growth of bamboo sector. The National Bamboo Mission (NBM), later renamed as National Agroforestry and Bamboo Mission (NABM) was set up under Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmers Welfare, Government of India in 2007 to promote holistic growth of bamboo sector by adopting area-based, regionally-differentiated strategy and to increase the area under bamboo in potential areas with improved varieties for enhancing yield.

Subsequently, a National Mission for Bamboo Application (NMBA) was setup under Department of Science and Technology and was structured as a Technology Mission. NMBA was to create the basis for enlarging the bamboo sector by augmenting economic opportunity, income and employment through multi-disciplinary approach focused on value addition and commercialization; develop, test and disseminates technologies; support for entrepreneurial projects. The major thrust by NMBA was given to wood substitutes and composites, machinery and processing technologies, propagation and cultivation, bamboo for energy, industrial products and product applications.

ICFRE, under the World Bank supported Forest Research, Extension and Education Project (1994-2002), initiated a bamboo selection programme in respect of selected species from their natural populations and established rhizome banks with the selected germplasm across the country. In 2014, ICFRE took another step towards second stage selection of promising clumps from the established rhizome banks with financial support from the erstwhile National Bamboo Mission for species like *Bambusa vulgaris*, *B. tulda*, *B. nutans*, *B. balcooa*, *B. bambos*, *Dendrocalamus brandisii*, *D. hamiltonii*, *D. strictus*, *D. somdevai*, and *D. stocksii*. In addition to this, work has also been carried out through self-funded projects of ICFRE. IWST and IPIRTI at Bengaluru and FRI, Dehradun also developed technologies for utilization of bamboo as timber and composite material.

Besides efforts of ICFRE Institutes, some organizations and universities are also carrying out research on bamboo. However, bamboo sector is yet to attain its full potential. This report is an endeavour on the part of ICFRE to identify the issues related to extension of forest and non-forest areas under bamboo cultivation, improvement in productivity, availability of raw material to artisans and bamboo-based industries, improved utilization, market linkages and policy changes.

Scientists and officers of ICFRE have put their whole-hearted efforts in collecting and synthesizing the information from various sectors and organizations. I acknowledge the entire team for its effort and hope that this report will help the Government formalize suitable strategies for growth of bamboo sector in India.

- Dr. S.C. Gairola



Preface

Systematic forest research in modern times, started in India with the creation of Indian Forest Department in 1864 and took firm roots with the establishment of a dedicated Imperial Forest Research Institute at Dehradun in 1906. With the expansion of forestry research, Indian Council of Forestry Research and Education (ICFRE) was set up in 1988 as an autonomous organization in 1990. Since its inception, ICFRE has been effectively planning, steering and monitoring forestry research in the country through its nine institutes and has been continuously adjusting its research programmes to the national needs.

Bamboo is an important sector where ICFRE has been working on different aspects for past several years either through its own funds or through the projects supported by different funding agencies. During 2007-08, Bamboo Technical Support Groups (BTSG) was also established at ICFRE through financial assistance from the erstwhile National Bamboo Mission (NBM). BTSG-ICFRE with fund support from NBM/NABM has been continuously carrying out development activities through its nine Institutes. The main focus of BTSG-ICFRE has been on training, research and development for producing quality planting material, propagation protocols, wood substitutes from bamboo, creation of common facility centre (CFCs), developing audio-visual programmes, exposure visits to artisans, and conducting theme-based seminar/workshops on bamboo.

It is an apt decision to entrust the work of preparing 'Status Report on Bamboo' to ICFRE. The experience of past research work has helped considerably in preparation of this report. Organizations outside ICFRE, including research bodies, industries and growers were also consulted to provide the information which has been duly incorporated in various chapters of the report. Basic work of the compilation and synthesis of the information was done by teams of scientists and officers of domain areas at ICFRE Institutes. The information was then synthesized, edited and augmented into chapters by the Drafting Team at ICFRE Headquarters. Executive Committee members provided their inputs in the draft version of the report, which was then incorporated by the Drafting Team. The invaluable logistic support of ICFRE during preparation of the report is duly acknowledged.

This volume supplements the main report providing information for those who might need more technical details on specific aspects of bamboo.

We take this opportunity to thank all the team members and others who have contributed in compiling the report. Contribution of Drafting Team, who worked tirelessly with Dr. S.P.S. Kushwaha, Anchor for preparation of the report, is commendable. Cooperation of the Directorate of Research team in coordinating all the activities is also acknowledged. We sincerely hope that this report will be very useful in framing and developing new strategies for the growth of the bamboo sector in the country.

- Executive Committee



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VI-G:	International Conference on Improvement of Bamboo Productivity and Marketing for Sustainable Livelihood, NBM, Ministry of Agriculture, GoI, New Delhi, 15-17 April 2008.	71-72
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VI-O:	National Seminar on Role of Technology in Enhancing Bamboo Use, FRI, Dehradun, 4 November 2014	85-86
VI-P:	National Workshop on Exploring the Best Practices in Bamboo Management: Investing in Green Gold, Madhya Pradesh State Forest Department and NBM, 24-25 January 2015	87-88
VI-Q:	Regional Seminar on Livelihood Opportunities with Bamboo and Rattan in the North-East India, ARCBR, Mizoram, 14 March 2015	89
VI-R:	Seminar on Bamboo Resource Management and Advances in Utilization Options, IWST, Bengaluru, 23-25 February 2016	90





SECTION-I
Species for Promotion





I-A: List of Important Species Identified by Bamboo Technical Support Group (BTSG)-ICFRE for Promotion

S. No.	Species Name
1.	<i>Arundinaria falcata</i> (syn. <i>Sinarundinaria falcata</i>)
2.	<i>Arundinaria falconeri</i> (syn. <i>Thamnocalamus falconeri</i>)
3.	<i>Bambusa affinis</i>
4.	<i>Bambusa assamica</i>
5.	<i>Bambusa balcooa</i>
6.	<i>Bambusa bambos</i> (syn. <i>B. arundinacea</i>)
7.	<i>Bambusa cacharensis</i>
8.	<i>Bambusa jaintiana</i>
9.	<i>Bambusa mizorameana</i>
10.	<i>Bambusa nutans</i>
11.	<i>Bambusa pallida</i>
12.	<i>Bambusa polymorpha</i>
13.	<i>Bambusa striata</i>
14.	<i>Bambusa teres</i>
15.	<i>Bambusa tulda</i>
16.	<i>Bambusa vulgaris</i> (green)
17.	<i>Chimonobambusa callosa</i>
18.	<i>Chimonobambusa griffithiana</i> (syn. <i>Chimonocalamus griffithianus</i>)
19.	<i>Dendrocalamus asper</i>
20.	<i>Dendrocalamus brandisii</i>
21.	<i>Dendrocalamus giganteus</i>
22.	<i>Dendrocalamus hamiltonii</i>
23.	<i>Dendrocalamus hookeri</i>
24.	<i>Dendrocalamus latiflorus</i>
25.	<i>Dendrocalamus longispathus</i>
26.	<i>Dendrocalamus manipureanus</i>
27.	<i>Dendrocalamus membranaceus</i>
28.	<i>Dendrocalamus sikkimensis</i>
29.	<i>Dendrocalamus stocksii</i> (syn. <i>Pseudoxytenanthera stocksii</i>)
30.	<i>Dendrocalamus strictus</i>
31.	<i>Dinochloa maclellandii</i>
32.	<i>Gigantochloa andamanica</i>

Sr. No	Species Name
33.	<i>Gigantochloa rostrata</i>
34.	<i>Melocalamus compactiflorus</i>
35.	<i>Melocanna baccifera</i>
36.	<i>Neohouzeaua dullooa</i> (syn. <i>Teinostachyum dullooa</i> , syn <i>Schizostachyum dullooa</i>)
37.	<i>Ochlandra travancorica</i>
38.	<i>Oxytenanthera nigrociliata</i>
39.	<i>Oxytenanthera parviflora</i>
40.	<i>Phyllostachys bambusoides</i>
41.	<i>Phyllostachys edulis</i>
42.	<i>Phyllostachys mannii</i>
43.	<i>Schizostachyum pergracile</i>
44.	<i>Sinarundinaria hookeriana</i>
45.	<i>Sinarundinaria maling</i>
46.	<i>Teinostachyum dullooa</i> (syn. <i>Neohouzeaua dullooa</i> , <i>Schizostachyum dullooa</i>)
47.	<i>Thyrsostachys oliveri</i>

Further details available at BTSG-ICFRE



SECTION-II
Protocols for Vegetative Propagation





II-A: Some Published Protocols of Bamboo Micro-propagation

S. No.	Species	Source	Induction	Multiplication	Rooting	References
1.	<i>B. bambos</i>	Seeds	MS+ 2 mg/l BAP	MS medium + 3.0 mg /l BAP + 0.5 mg/l Kn	½ MS medium + 2.0 mg/l IBA +0.5 mg/l Kn	Kalaiarasi <i>et al.</i> (2014)
		Nodal explants	4.4 µM BAP	4.4 µM Benzyl aminopurine (BAP) and 1.16 µM Kn	9.80 µM of IBA	Anand and Brar (2013)
2.	<i>B. balcooa</i>	Nodal explants	4 mg/l BAP		MS+ 1 mg/l IBA	Gantait <i>et al.</i> (2016)
		Nodal explants	liquid and solid media MS + 0.01% myo-inositol, 3% sugar, 25 mg/l citrate 50 mg/l ascorbate, and 3.5 mg/l BAP	3 mg/l BAP and 0.5 mg/l NAA	½ MS+ 4 mg/l NAA	Patel <i>et al.</i> (2015)
3.	<i>D. asper</i>	Nodal explants	MS+15 µM BAP	MS+ 20µM BAP	spontaneous rhizogenesis after five subcultures	Ornellas <i>et al.</i> (2017)
		Nodal explants	MS+15 µM BAP	MS+ 10 µM BAP and 75 µM Adenine sulfate	½ MS+ 5 µM each of IBA and NAA	
4.	<i>B. nutans</i>	Nodal explants	MS+ 3 mg/l BAP +0.1 mg/l NAA, MS+ 5 mg/l BAP +0.1 mg/l NAA	MS+ 3 mg/l BAP+0.1 mg/l NAA	½ MS+2.0 mg/l IBA	Choudhary <i>et al.</i> (2016)
		Nodal explants	MS+ 1.0 mg/l BAP	MS+ BAP (0.5 mg/l) and 0.1 mg/l α-NAA	MS+ 2.0 mg/l NAA	Mudoi <i>et al.</i> (2014)
5.	<i>B.tulda</i>	Nodal explants	MS+ 3 mg/l BAP	MS+ 2 mg/l Kn + 3 mg/l of BAP	½ MS+ 3 mg/l (IBA), 10 mg/l coumarin	Waikhom, and Louis, (2014)
		Nodal explants	MS+ 1 mg/l BAP	MS+ 1 mg/l BAP	½ MS+ 5 mg/l NAA	Sharma and Sharma (2013)

6.	<i>D. hamiltonii</i>	Nodal explants	MS + 1 mg/l BAP + 2,4-D.+ 0.5 mg /l GA3	½ liquid MS	0.5-1.0 mg IBA/litre	Sood <i>et al.</i> (1994)
		Nodal explants	White media + (0.50 mg/l, 1.0 mg/l) BAP	White media + 2.00 mg/l BA	NAA, IBA, IAA	Jha <i>et al.</i> (2013)
7.	<i>D. strictus</i>	Nodal explants	MS+ 4 mg/l BAP	MS +4 mg/l BAP	MS+ 3 mg/l NAA	Kumar <i>et al.</i> (2015)
		Nodal explants	MS+ 0.5 mg/l BAP	MS+ 0.5 mg/l BAP + 15 mg/l ADS	½ MS + 2.0 mg/l IBA	Chowdhury <i>et al.</i> (2004)
8.	<i>D. giganteus</i>	Nodal explants	MS + 20 µM BAP	MS+ BAP (10 µ M) + kinetin (10 µ M)	MS +25 µ M IBA + 0.05 µ M BAP	Arya <i>et al.</i> (2006)
		Seeds	Liquid MS+0.5 mg/l GA3	MS + 10 mg/l BAP	½ MS+ 5 mg/l IBA	Devi <i>et al.</i> (2012)
9.	<i>M. baccifera</i>	Nodal explants	MS+ 3 mg/l BAP	MS+ 2 mg/l Kn +3 mg/l BAP	½ MS+ 3 mg/l (IBA), 10 mg/l coumarin	Waikhom, and Louis (2014)

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II-B: Micro-propagation Protocols Optimized by ICFRE Institutes

Sr.No.	Species/explants	Bud Induction	Multiplication	Rooting
1.	<i>Bambusa bambos</i> Nodal explants	MS+BAP (5.0 mg /l)	MS+BAP (5.0 mg /l)	½ MS+NAA (3.0 mg /l)
2.	<i>B. nutans</i> Nodal segments	MS+BAP (0.5 mg /l)	MS +BAP (5.0 mg /l)	½ MS+IBA (10.0 mg /l) + Glucose
3.	<i>B. vulgaris</i> Nodal explants)	MS+BAP (5.0 mg /l)	MS+BAP (5.0 mg /l)	½ MS + NAA (4.0 mg /l)
4.	<i>Dendrocalamus asper</i> Nodal segments	MS+ BAP (1.0-10.0 mg /l)	BAP (3.0 mg /l)	½ MS + IBA(10.0 mg /l); NAA (3.0 mg / l)
5.	<i>D. giganteus</i> Nodal explants	MS+ BAP(2.0-5.0 mg /l)	MS+ Kin (2.5 mg /l) + BAP (2.25 mg /l)	MS+ IBA (5.0 mg /l) + BAP (0.05 mg /l)
6.	<i>D. membranaceus</i> Nodal explants	MS+ BAP(1.0-5.0 mg /l) + NAA (0.5 mg /l)	MS+ BAP(1.0-5.0 mg /l) + NAA (0.5 mg /l)	MS+ NAA (3.0 mg / l + IBA (10.0 mg /l)
7.	<i>B. tulda</i> Nodal explants		MS liquid medium + 14.0 mg /l glutamine, 0.01 mg /l, IAA, 2.7 mg /l BAP)	MS liquid medium + 5.80 mg /l coumarin
8.	<i>B. balcoa</i> Nodal explant	BAP (1.0 mg /l) TDZ (1.0 mg /l)	BAP (3.0 mg /l)	½ MS + NAA (4.0 mg/l) followed by 15 days incubation on ½ MS.
9.	<i>B. nutans</i> Zygotic embryo	MS +BAP (0.5 mg /l)	MS +BAP (0.5 mg /l)	IBA (0.5 mg /l) - ½ MS Mass propagation
10.	<i>D. asper</i> Zygotic embryo	MS • BAP (1.0-10.0 mg /l)	BAP (3.0 mg /l)	½ MS + IBA(10.0 mg /l); NAA (3.0 mg /l)
11.	<i>D. membranaceus</i> Zygotic embryo	MS +BAP (0.5 mg /l)	MS +BAP (0.5 mg /l)	½ MS +IBA (0.5 mg /l) - ½ MS Mass propagation
12.	<i>D. stocksii</i> Nodal explants	MS liquid medium supplemented with (NAA; 0.5 mg /l) and (BA; 1.0 mg /l)	NAA (0.5 mg /l), BA (0.5 mg /l) & additives: ascorbic acid (50 mg /l), citric acid (2.2 mg /l), cysteine (1.2 mg /l), and glutamine (49 mg /l)	½ MS + IBA (1.0 mg /l), BA (0.1 mg /l)

Abbreviations used:

- ADS: Adenine sulphate
- IAA: Indole-3- acetic acid
- IBA: Indole-3- butyric acid
- Kn: Kinetin (6-Furfurylaminopurine)
- NAA: α-Napthalene acetic acid
- mg/l: Milligram per litre
- BAP: Benzyl amino purine
- TDZ: Thidiazuron



II-C: Macro-propagation Methods

Sl. No.	Technique	Brief Method	References
1.	Propagation through cuttings	Rooting can be induced in culm, branch and nodal cuttings. <ul style="list-style-type: none"> • Two nodal cuttings should be planted in the suitable media and conditions exposing one node outside and another inside the media. • Upper portion of cutting should be covered by Parafilm to avoid fungal attack etc. • In addition to the effect of growth regulators, method of treatment, time of collection of cuttings and part of the culm (like base, middle and top) play a crucial role in different species 	Ray and Ali (2017), Diad <i>et al.</i> (2003), Banik (1995), Kumar (1991)
2.	Multiplication of bamboo plants through rhizome splitting/ macro-proliferation	<ul style="list-style-type: none"> • Young seedlings are allowed to grow for six months to one year before carrying at macro-proliferation. • To promote growth, NPK fertilizer is given at an interval of one month from the day of planting. • In this method, rhizomes are separated from the seedlings using a secateur. • The separated rhizomes are planted in fresh polybags for further growth. 	Banik (1995), Seethalakshmi (2016), Kumar (1991)
3.	Macro-propagation through rhizomes and offsets	<ul style="list-style-type: none"> • Preferably one- to two-year-old culms from the peripheral portion of a clump are selected. • The identified culms are cut in a slanting manner in such a way that two to three nodes are left at the base. Cutting can also be done right above the node without damaging the basal portion of the branches. • While collecting the offsets and rhizomes, the attached rhizome and roots should not be damaged and the buds should remain intact. • Offsets can be planted along with the pre-monsoon showers or just before rainy season. 	Kumar, (1991), Banik (1995), Seethalakshmi (2016)

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SECTION-III
Standards and Practices for Utilisation





III-A: BIS Standards Relevant to Utilisation of Bamboo and Bamboo Composite Material in Structural Application

1.	IS 1902:1993	Code of Practice for preservation of bamboo and cane for non-structural purposes
2.	IS 6874:2008	Methods of test for bamboos
3.	IS7344:1974	Specification for bamboo tent bamboos
4.	IS 8242:1976	Methods of tests for split bamboos
5.	IS 8295 (Part 1): 1976	Specification for bamboo chicks: Part 1 Fine
6.	IS 8295 (Part 2): 1976	Specification for bamboo chicks: Part 2 Coarse
7.	IS 9096: 1979	Code of practice for preservation of bamboo for structural purposes.
8.	IS 10145:1982	Specification for bamboo supports for camouflaging Equipment.
9.	IS 13958: 1994	Specification for bamboo mat board for general purposes
10.	IS 14588: 1999	Specification for bamboo mat veneer composites for general purposes
11.	IS-15476: 2004	Bamboo mat corrugated sheets
12.	IS 5913:	Durability including water absorption, impermeability, load bearing capacity, density, frost cracking etc.
13.	IS 4908: 1968	Random sampling.
14.	IS 459: 1992/	Standard for accelerated aging. ASTM-D1037
15.	UV Resistance test	Lamp UV-B Cycle: 4 hours exposure at 60°C followed by 4 hrs humidity exposure at 50°C.
16.	IS 4990: 1993	Ply wood for concrete shuttering.
17.	ISO 22156: 2004	Bamboo structural design
18.	ISO 22157: 2004	Bamboo physical and mech properties.
19.	IS 2752: 1995	Activated carbon specification (granular)
	IS 8366: 1989	Activated carbon specification (Powder)
	IS 877: 1989	Sampling and test of activated carbon.
20.	IS 833	Design of wood based load bearing structures
21.	IS 5990	Fire retardant parameters for ply wood

Details available at <http://www.bis.org.in/>

III-B: Recommended Practices and Preservatives for Bamboo Preservation

(a) Summary of recommended treatment practices

Applications	Preservatives	Concentration (%)	Retention (kg/m ³)	Method
Structures exposed to weather and in ground contact (posts, fences/split for walls etc.)				
All purposes except handicrafts and interior use	Creosote	Ready to use	50-100	Hot & Cold
Dry bamboo Diffusion	CCA/CCB	10	8-12	Pressure
Green bamboo	CCB/ZiBOC/CCA	8-10	10-15	Pressure/Boucherie
Structures exposed to weather but not in contact with ground (bridges, ladders, scaffolding, huts etc.)				
All purposes except handicrafts and interior use	Creosote	Ready to use	50-80	Hot & Cold
Dry bamboo Pressure	CCA/ZiBOC/CCB	6	8	Pressure
Green bamboo Soaking	CCA/CCB	6-8	8	Soaking/Diffusion
Structures under cover - rafters, walls, doors				
Dry bamboo	CCB/CCA	5-6	4-6	Pressure
Green bamboo	CCB/ZiBOC	6-8	4-6	Soaking/Diffusion
Outdoor furniture				
Dry bamboo	CCA/CCB	4-6	8	Pressure
Green bamboo	CCA/ZiBOC	6-8	8	Soaking/ Boucherie
Indoor furniture				
Dry bamboo	Boric acid/ borax	2-4	4	Pressure
Green bamboo	CCB/ZiBOC	3-5	4	Soaking
Handicraft items				
Green/dry bamboo	CCB/ZiBOC	6-8	8	Soaking/Dipping/ Boucherie

(b) Preservative treatments and their retention for bamboo preservation

IS 875	Design loads for building and structures
Parts 1: 1987	Unit weights of building material and stored materials (Second Revision)
Parts 2: 1987	Imposed loads (Second revision)
Parts 3: 1987	Wind loads (Second Revision)
Parts 4: 1987	Snow loads (Second Revision)
Parts 5: 1987	Special loads and load combinations (second revision)
IS 883:1994	Design of structural timber in building – Code of practice (fourth revision)
IS 1902:2006	Preservation of bamboo and cane for non-structural purposes (second revision)
IS 6874:2008	Method of test for round bamboo (first revision)
IS 8242:1976	Method of test for split bamboo
IS 9096:2006	Code of practice for preservation of bamboo for structural purposes (first revision)
IS 13958:1994	Bamboo mat board for general purposes – Specification
IS 9096-2006	Preservation of bamboo for structural purposes
IS 1902: 2006	Preservation of bamboo and cane for non-structural purposes



SECTION-IV
State Bamboo Policies





IV-A: Nagaland Bamboo Policy

(Source: <https://www.nagaland.gov.in//Nagaland/UsefulLinks/Nagaland%20Bamboo%20Policy.pdf>)

Vision Statement

The Naga people have survived through the centuries with the diverse and varied uses of bamboo and its products. From the cutting of the umbilical cord to the mats that have wrapped the dead for burial, Bamboo has been integral to the life of the Nagas. It continues to play a predominant role in the life of the people even today in every walk of life that ranges from agricultural tools and implements to shelter, food, and livelihood.

Bamboo, the fastest growing and highest yielding renewable natural resource, and found extensively all over the State, constitute one of the most important resources of Nagaland which has to be put to use in the present day context for the benefit, growth and development of the people.

Denudation of forest cover, degradation of environment and fast deteriorating ecology threatens the very existence of man and animal. The development of the natural bamboo resources of Nagaland will greatly add to the environment and the ecological balance of the land consequently having great impact on the quality of life of the people.

A planned, scientific and holistic approach to the cultivation and management of bamboos on a sustained basis can be an inexhaustible source of goods and services and can play a significant role in the development of the State.

With increasing demand of timber and wood, which is becoming a scare commodity in the world, bamboos can serve as an alternative to many of the forest products. Its wide range of uses and its great versatility qualifies it to be a multiple use alternative to timber which will add greatly to the rural agricultural economy in general and act as poverty alleviator for the rural poor in particular. Through the processing of such bamboo goods and products and incorporating many other economic uses, bamboos can boost the economy of the State and facilitate the entry of Nagaland into the world economy.

The Nagaland Bamboo Policy is thus adopted to attain such goals:

1. Rationale

Bamboo has been the basic natural resource that has helped mankind to survive and progress since primitive days. Tribal people, particularly the Nagas, continue to depend on bamboo for their existence and sustenance. Bamboo qualifies to be a multiple use alternative to timber in the rural agricultural economy in general. Its use has grown over the centuries and the study of bamboo has currently identified over 1500 use of bamboo.

- 1.2 Denudation of forest cover, degradation of environment and fast deteriorating ecology threatens the very existence of man and animal because of its adverse impact on climate and ground water resources. Accelerated overuse and mismanagement of our natural forest resources and galloping rise in human and livestock population is leading to fast dwindling of our natural resources with adverse consequences leading to impoverishment of watershed, disruption of ecological balance and consequently having an adverse impact on the quality of life of the rural people who constitute 80% of the population of the State.
- 1.3 Bamboo is one of the fastest growing plants on the planet. Apart from its critical role in maintaining the fragile environment in the forms maintaining the balance of oxygen and carbon dioxide in the atmosphere, it is the fastest growing canopy for greening of degraded areas and capable of generating more oxygen than equivalent stand of other tree species. It lowers light intensity, protects against ultraviolet rays, and is an atmosphere and soil purifier.
- 1.4 Bamboo is a hardy and versatile species, which is adaptable to a wide range of soil and climate. It responds well to high inputs like irrigation and fertilizers for higher productivity.
- 1.5 Bamboo is a viable alternative of wood as timber. Technology inputs to the qualities of versatility and resilience has given it a totally wider scope of uses in the form of pulping, boards, ply furniture, handicrafts and many other use including energy alternatives in the form of bamboo charcoal and biomass electric generating resource.

- 1.7 Bamboos are the fastest growing and highest yielding renewable natural resource. If managed on sustained basis, bamboos can be an inexhaustible source of goods and services and can play a significant role in the restoration and rejuvenation of rural economy.
- 1.8 Bamboo is therefore, one of the most important forest resources in Nagaland. Its wide range of uses and its great versatility qualities it to be a multiple use alternative to timber, food in the rural agricultural economy in general and as poverty alleviator for the rural poor and tribal in particular.
- 1.9 Mass propagation of bamboo by active involvement of the people for plantation on private and public jhumlands is feasible as the plantation, management and harvesting technique of bamboo is well known to the rural people.
- 1.10 A planned and scientific approach to the cultivation and management of bamboos in the state will greatly contribute to the economic development of the state.

2. The Bamboo Resource of Nagaland

2.1 Bamboo is found extensively all over Nagaland. It occurs as a predominant plant in portions of the districts of Dimapur, Peren, Mon and Mokokchung; while, it is readily found mixed with other forest species in all other districts of the state. The growing stock of bamboo been estimated to the around 8.96 million hectares in the country, out of which about 5 per cent of the growing stock is assessed to be available in Nagaland which work out to be about 0.448 million Ha or 4,48,000 Ha.

2.2 The predominant species of bamboo found in Nagaland are Kakoo (*Dendrocalamus hamitonii*), Daloo (*Teinostachyum dulloa*) and Jati (*Bambusa tulda*). They occur almost all along the lower belts in continuous strips of some length descending down to plains along the border with Assam. While Kakoo and Daloo clumps are characterized in moist localities along the nalas and streams, Jati occupies better- drained sites. In more accessible localities along the roads, bamboos have been over cut while, in other areas they have been left untouched for many years.

2.3 There has not been any detailed study made on bamboos in Nagaland, but currently around 22 species have been identified which are spread all over Nagaland.

- a. *Sinarundinaria griffithiana* (Munro) Chao & Renv. (*Arundinaria griffithiana* Munro) Saramti region
- b. *Sinarundinaria elegans* (Kurz) Chao & Renv. (*Arundinaria legans* Kurz) Puliebadze, near Kohima.
- c. *Sinarundinaria rolloana* (Gamble) Chao & Renv. (*Arundinaria rolloana* Gamble) Japfu Range, Kohima.
- d. *Sinarundinaria nagalandiana* Naithani Niriyo Peak, Wokha.
- e. *Chimonobambusa callosa* (Munro) (*Arundinaria callosa* (Munro) Puliebadze above Kohima and Mao.
- f. *Neomicrocalamus prainii* (Gamble) Keng f. (*Arundinaria prainii* Gamble) Puliebadze, Japfu Range.
- g. *Bambusa balcooa* Roxb. Wokha
- h. *Bambusa tulda* Roxb. Kohima, Jalukie region
- i. *Bambusa palliada* Munro Wokha, Kohima and Peren region
- j. *Dendrocalamus hookeri* Munro Kohima, Wokha
- k. *Dendrocalamus hamitonii* Nees et Arn ex Munro Dimapur-Kohima Road, and Wokha.
- l. *Dendrocalamus gigantues* Munro Kohima, Mao.
- m. *Dendrocalamus calostachys* (Kurz) Kurz Phekerkrima, Dimapur and Kohima.
- n. *Schizostachyum polymorphum* (Munro) Majumdar (*Pseudostachyum polymorphum* Munro) Longsachu near Wokha
- o. *Schizostachyum dullooa* (Gamble) Majumdar (*Teinostachyum dullooa* Gamble) Yikum near Wokha
- p. *Schizostachyum fuchsianum* (Gamble) Majumdar (*Cephalostachyum fuchsianum* Gamble) Kohima, Zulha mi – Kilomi area
- q. *Melocanna baccifera* (Roxb.) Kurz. (*M. bambusoides* Trin.) Jalukie



3. Aims and Objectives

Keeping in view, the ecological significance and vast economic potential of bamboos in the state, the Nagaland Bamboo Policy is envisaged to achieve the following Aims and Objectives:

- 3.1 Protection & conservation of rich bio-diversity associated with bamboo forests and bamboo growth areas in the state.
- 3.2 Sustainable development and utilization of bamboo resources through scientific management.
- 3.3 Promotion of bamboo plantation (by Government, Individuals and communities) as they key thrust area for future economy of the state.
- 3.4 Promotion of bamboo based industries for utilizing the available resources for generating income.
- 3.5 Revitalization and promotion of local traditional bamboo craft & art with improved technology & design and value addition for export through industrialized mode of production.
- 3.6 Promotion of bamboo as an essential wood substitute by increasing bamboo production and promotion of bamboo based enterprise in the state in order to reduce pressure on forests.
- 3.7 Promotion of awareness and understanding of bamboo as “Green Gold” among farmers, traders, industry, and the people in the state with a view to utilizing its full potential and to galvanize the rural and industrial economy in the state.
- 3.8 Effective exploitation of existing mature bamboos before the impending gregarious flowering.

4. The Strategy

The Development of Bamboo in Nagaland will be approached in a Mission mode, which shall have two approaches namely:

- **Development of Bamboo as a Resource**
- **Development of Bamboo as an Enterprise**

5. Development of Bamboo as a Resource

Strategy for cultivation and management of bamboo resources in the state shall be evolved with special focus to the following activities;

- a) Inventorization of the bamboo resources, including identification, documentation, demarcation, assessing the extent of various types.
- b) Assess scope and potential of bamboo growth and regeneration, both in Government land and in private/community land.
- c) Evolve scientific management practices for naturally occurring bamboos and plantation bamboos to improve productivity and harvesting.
- d) Create massive and consistent awareness of the value of bamboo among the people, especially among major stakeholders.
- e) Evolve suitable policies to deal with gregarious flowering of Bamboo.
- f) Set up appropriate Institutes for research and development of bamboos, both for regeneration and industrial processing & value addition.
- g) Evolve suitable techniques of multiplication and develop infrastructure for mass production of planting materials for commercial cultivation.
- h) Introduce desirable species of commercial importance for cultivation in the state.
- i) Establish infrastructure and mechanism for dissemination of bamboo production technologies to the common man.
- j) Establish network of bamboo setum for different agro-climatic zones for ex-situ preservation of bamboo germ plasm.
- k) Identify preservation natural bamboo occurring areas within and outside Government land for in-situ preservation.
- l) Development of communication network for development of Bamboo as in industry in Nagaland.

5.1. Action Plan for Development of Bamboo Resources

(a) Development of Natural Bamboo Forest:

Large tracts of land are covered by clump forming bamboos in the state, Most of which could not be utilized due to absence of extraction road and the difficulty in extraction. Proper management techniques supported by communication network can greatly accelerate the utilization of these already available bamboo resources in the state.

- i. Identify, demarcate and quantify the extent of natural bamboo area
- ii. Evolve management practice and harvesting techniques for natural bamboos
- iii. Increase area of natural bamboos through aided natural regeneration in the immediate vicinities of the bamboo forests
- iv. Improve communication network to access the existing bamboos for harvesting and transportation.
- iv. Afford protection to bamboo forests and re-growth areas in critical mountain slopes and around village habitations to ensure environmental security. It shall also include such activities that will act as protection of river catchments, regulation of water flow, recharge of water table, conservation of flora and fauna etc. and protection of developmental infrastructure like roads, bridges, hydel projects, habitation area, etc.
- vi. All varieties of native bamboo species, ecotypes shall be protected and germplasm preserved through the mechanism of bamboo setum, in-situ and ex-situ preservation.
- vii. Bamboo resource assessment including mapping and inventorization of bamboos shall be accorded high priority in co-ordination with the institutes such as State Forest Research Institute, Itanagar, Forest Survey of India, National Institute of Bamboo & Rattans, National Remote Sensing Agency (NRSA), Nagaland University, State Remote Sensing Application Center, Nagaland, Department of Forest & Environment, Nagaland, etc.
- viii. Areas with potential for commercial cultivation of bamboo, both within and outside Government land will be identified for development of bamboo plantation on sustained basis.
- ix. All natural bamboos within notified forests/Government acquired lands shall be managed as per approved management plan keeping in view sustainable forest management principles.

(b) Bamboo Plantation Development:

Nagaland with 89% of its total geographical area under the ownership of private individuals and communities offers a unique scope for raising bamboo plantation. Plantations will be promoted on individual landholdings as well as community lands. The concept of Joint Forest Management, currently promoted by Government of India for all forestry programmes funded by Central Government will also be promoted as listed below.

- i. Promotion of bamboo cultivation by individuals and communities on private and community lands which forms 89 per cent of the total area of the state through the active participation of the village Councils, VDBs and VFCs.
- ii. Introduction of bamboos having commercial superior and desirable attributes for large-scale cultivation to augment the existing local varieties of bamboos in the state.
- iii. Development of bamboo nurseries and distribution networks in both the Government and the private sector to ensure adequate and timely supply of high quality planting materials.
- iv. Encouraging the participation of private sector wherever Government, private and community land can be made available by way of land lease.
- v. Development of research infrastructures for introduction and adoption of technological innovations.
- vi. Development of mechanism for technology transfer, extension and awareness education.
- vii. Streamlining of finance and credit facilities for bamboo plantation, management and harvesting.
- viii. Promotion of Co-operatives Self-Help-Groups and CBOs for the plantation and management of Bamboo.
- ix. Bamboo cultivation to synchronize with existing farming practices, such as jhuming, ect to maximize interim benefits.
- x. Structural changes within the Government machinery to provide people oriented bamboo development programme.



6. Regulation of Bamboo Harvest

At present, transplantation of unprocessed bamboo requires transit pass through the payment of forest royalty. Production and transportation of bamboo and its products should be hassle-free and least cumbersome, if mass cultivation and production is to take place. It will be the endeavor to do away with the present systems of transit pass etc. for transportation of bamboo through appropriate administrative decision and alternate means of realizing forest royalty evolved.

7. Protection from Forest Fire

Protection from forest fires can greatly reduce economic loss. Both preventive and control measures need to be resorted to. Advantage will be taken of the existing institutions such as VDBs, JFM, VCs, etc. for awareness and enforcement of preventive measures at the local level. Control measures are possible with the active participation of the government, since financial implications are involved. Adequate financial provision will be required to sustain the efforts of these institutions for their multi-functional roles in overall economic development of the village as well as promoting preventive measures.

8. Bamboo Flowering and Strategy to Utilize Surplus Bamboo

- 8.1 Fullest possible utilization of bamboo before flowering shall be encouraged and promoted. Scientific harvesting of bamboo inside and outside the Government forests, Jhum lands shall be encouraged.
- 8.2 Construction of extraction road/path network to reduce extraction cost. These networks will facilitate replenishment of the depleted bamboo areas.
- 8.3 Increase the use of improved products from bamboo for infrastructure development works like construction, road laying, retaining walls, jhum terracing, water harvesting structures and gabions. Improved design and technology shall be obtained from National and International Institute to support and maintain such initiatives.
- 8.4 Conversion of Bamboo to other mass scale uses such as Bamboo Charcoal and Biomass energy plants for generation of power shall be promoted.
- 8.5 Replenishment of depleted bamboo growing stock through artificial regeneration using modern scientific technology of micro-propagation protocols developed for important bamboo species.

9. Bamboo Trade

- 9.1 With the policy reform in regard to management, harvesting, utilization of natural bamboo resources in the State and promoting bamboo plantation development, it is expected that bamboo trade shall receive a fillip. With increased bamboo harvesting before the flowering and establishment to bamboo industries and with support incentive framework, trade in bamboo and bamboo products within and outside the State shall grow. It shall be the endeavor of the State to promote trade in bamboo and bamboo products among the people. The bamboo traders shall be organized into trade associations with linkages with bamboo growers and the bamboo processing industries and bamboo exporters to rationalize the bamboo trade practices.
- 9.2 A study to organize the marketing structure of the Bamboo Industry that may evolve in the State is a priority need. Such studies will incorporate issues such as movement of the products from the primary producing point or the cultivation areas to the Industrial location. The various dynamics and the location of activities such as collecting points, wholesale marketing points, auction points etc have to be worked out meticulously. It will ascertain the cost of the raw material, taking into account the difficult terrain and from where the Bamboo is to be extracted, the shortage of manpower in the labor. Such a study will be undertaken with the aim to contain the cost of raw material required for promoting the Bamboo Industry. This exercise will be directed to ensure that the Bamboo products of Nagaland become commercially viable with competitive pricing including comparison with wood-based products as also Bamboo products from other parts of the world.

10. Infrastructure for Development of Bamboo Trade and Commerce

The development of Bamboo as an Economy shall entail substantial infrastructure requirements especially relating to road, communication and power to cut down cost of extraction and maximize profit. A very good network of extraction roads is required which need to be tie-up with schemes such as agri-link roads and rural connectivity programmes under PMGSY. In-built component for development of roads also need to be introduced in bamboo development programmes for areas not covered by the above schemes. It shall endeavor to initiate special infrastructure programmes for Bamboo roads and strengthening the Rural Power programmes to provide special infrastructure for the development of bamboo as an industry in Nagaland.

11. Development of Bamboo as an Enterprise

Development of "Bamboo as enterprise" shall evolve policies and action plans that will focus on the following aspects:

Promote Bamboo based Industries:

- a) Food products
- b) Medicinal, chemical products and alcohol beverages
- c) Craft, handicraft and art Products
- d) Value added products and wood substitutes such as ply, flooring tiles, shuttering, etc.
- e) Create awareness of the uses and value of bamboo by imparting training, seminar, workshop, etc.
- f) Promote and develop traditional usage of bamboo

11.1 The Bamboo Policy framework shall encourage and promote establishment of bamboo enterprises and industries in cottage, small and medium industries sectors linked to the need of bamboo produce/products within and outside the State.

11.2 Initially the industries shall be established based on the bamboo resource of the State suitable for manufacturing of either semi-finished products or simple bamboo products such as mat board, chopsticks, bamboo shoots, aggarbatti sticks and other handicraft products.

11.3 While simple technologies and manufacturing process can be adapted by cottage and handicrafts sectors, import of technology shall also be encouraged and adopted in small and medium sectors industries to produce quality products for sale within and outside the State and for export purposes.

11.4 The following will be the broad areas identified for promoting various Bamboo based industries:

- a. Finished bamboo products in the form of bamboo ply, Bamboo timber, flooring tiles, shuttering, curtain making, etc.
- b. Intermediary Bamboo industries and semi finished products for production of chopsticks, toothpicks, skewers, incense sticks, etc.
- c. Bamboo craft, handicraft and art.
- d. Bamboo charcoal and bamboo charcoal products in the form of active bamboo charcoal filter products.
- e. Bamboo food products in the form of:
 - i. Raw bamboo shoot food products
 - ii. Finished bamboo shoot food products
- f. Bamboo medicine and chemical products/alcohol beverages
- g. Bamboo related ancillary activities such as tourism, etc.



- 11.5 Bamboo mat boards and bamboo ply boards can be promoted as wood substitute for the growing construction needs within and outside the State. This will not only result in a value addition to bamboo products but will also be a wood substitute reducing use of timber within the State.
- 11.6 Use of bamboo and bamboo products shall be emphasized in Government constructions where such uses are feasible. Standard housing designs for various constructional purposes shall be evolved taking help of national and international expertise available.
- 11.7 High value products will necessitate affective and appropriate manufacturing process and market and export linkages. This policy shall encourage joint ventures with entrepreneurs outside the State including foreign enterprises with technology, finance and export linkages. This arrangement will channel the resources through local traders and manufacturing industries into domestic and international markets earning revenues for the State. Present export policy in agro industry encourages such arrangements. This approach shall also be adopted and encouraged for bamboo sector development in the State.
- 11.8 The State Industrial Policy-2000 will be reviewed to include a framework of incentives and subsidy to encourage establishment of such Bamboo industries and enterprises.
- 11.9 The State Industries department will act as the Nodal Department for the promotion of such Bamboo based industries whose role would also cover to promote training, quality control, standardization, assistance, scientific and technical support, market support, publicity, education, incentives and patronizing in bamboo related activities as indicated below:
 - a. Training to facilitate entrepreneurs by way of arranging short term as well as intensive enterprise oriented training programmes, Turnkey Entrepreneurship Development Programmes, etc.
 - b. Collaborate with other institutions/organizations/engaged in bamboo related activities. Create awareness, encourage, assist and undertake bamboo based trade or business or profession.
 - c. Undertake and encourage research, development and application work in bamboo sector Industrial development.
 - d. Provide Technical Assistance and Undertake comparative study of available technology both indigenous as well imported, *vis-à-vis* its suitability, cost involvement, ease of operation and adaptability, etc as also undertake identification of machinery, manufacturers and assistance in import and installation.
 - e. Undertake Techno-economic feasibility studies and provide assistance for Preparation of project profiles of feasible and viable projects of the various bamboo based industries which could be taken up in the State.
 - f. Undertake intensive market study of the marketing prospects of Bamboo products that are produced from the region including engaging consultancy firms to undertake such surveys and study to identify potential buyers with their basket of purchase items as also tie-up buy back arrangements.
 - g. Provide assistance in export of exportable Bamboo products.
 - h. Financial assistance: The Department shall act to explore and obtain fund, assistance, grant, contributions and loans towards development of bamboo and bamboo utilization. A separate and exclusive fund could be created for promotion and development of Bamboo Industries in the state.
 - i. Identify and promote bamboo usage in both the organized and the un-organized sectors.

11.10 Usage of existing infrastructure & facilities:

- a. The mini tool room, which is expected to be operationalised soon, will be geared up to manufacture/fabricate some of the machinery, tools and implements required.
- b. Utilize existing platforms like the IITF, etc for showcasing end products.
- c. Semi-finished products could be produced in clusters or as community projects. Thereafter projects for the finished products or high-end and export oriented bamboo products could be set up at the Industrial Growth Center (IGC) and the Export Promotion Industrial Park (EPIP) where all necessary basic infrastructures shall be made available. The proposed IIDCs could also be made available for setting up bamboo-oriented projects.

12. Human Resource and Entrepreneurial Development

12.1 Adequate pool of trained manpower needs to be created for bamboo resource development, propagation and supply of high yielding planting material to farmers, harvesting, management, industrial production, infrastructure uses, marketing and Export. Due emphasis would be given to training of personnel within the State, Central Institutions and outside the country.

12.2 The State Bamboo Policy will given focus on the following areas for entrepreneur development in the State for development of the Bamboo as a resource and as an industry.

- a. Propagation of the modern uses of Bamboo among the general people of the State.
- b. Inclusion of bamboo in the school syllabus and also as specialized subjects in college and university studies.
- c. One of the it is in the State will be especially structured to impart training and skill on bamboo related activities.
- d. Identification and capacity building of entrepreneurs in Bamboo technology with the training programmes confined to the specialized area of usage.
- e. Appropriate policy to promote transfer of technology and transplanting it in the region.
- f. Infrastructure for marketing, transportation and the necessary infrastructure including roads and communication linkages both for extraction of Bamboo and its processing and ultimate marketing will require to be given special attention.
- g. An aggressive marketing policy to propagate and promote the Bamboo products and use of Bamboo as eco friendly timber will have to be evolved for which substantial expertise and funds have to be made available.
- h. In the realm of bamboo craft, handicraft and art the following activities will be promoted:
 - (I) Capacity building of existing craftsmen
 - (ii) Promotion of new manpower
 - (iii) Specialization
 - (iv) Diversification
 - (v) Design intervention
 - (vi) Technology inputs such as treatment, bleaching, colouring, etc. techniques.
- i. Consultants shall be hired wherever their inputs are required specially pertaining to survey, assessment of product cost as also aggressive marketing advertisement and promotion of the Bamboo products of Nagaland.
- j. The Government will have to initially play a pro-active role by provision of necessary funds in all the critical areas where the new private entrepreneur are not able to meeting the requirements.
- k. Training programme outside the State and the country shall be promoted in specific and selected field involving policy makers, entrepreneurs and people in the handicraft field.
- l. Entrepreneurship will be promoted through organized and volunteered participation of people. The Government shall facilitate the growth of entrepreneurship skills through several means such as education and training, promoting group formation, providing supports such as funding, credit, leases, tenurial security and consultation with people's groups and involving them in management committees.



13. Research and Development

- 13.1 Research support for bamboo sector to improve quality, enhance productivity and value of products, sustainable management, conservation of germ-plasm and diversified products would be promoted through interactive involvement with the National Institute of Bamboo and Rattan Development.
- 13.2 An interface with research wing of the Forest Department and technical institutes outside the State would be established for problem specific and site specific research regarding bamboo growing, bamboo, plantation development, management of natural bamboo stands, etc.
- 13.3 Appropriate technology and technology transfer would be facilitated through establishment of Technology part to facilitate effective lab to land transfer.
- 13.4 dissemination of technology shall also be through campaigns involving media, exhibitions, demonstration centers, etc.
- 13.5 it is proposed to establish a Bamboo & Rattan development institute in the State with support funding by Government of India. The Bamboo Institute will cater to the research and development requirement of bamboo development in the State including design intervention in collaboration with existing Institutes such as NID, NIFT, BCDIIPRTI, etc.
- 13.6 The various species of bamboo of Nagaland need to be put under intensive industrial testing to ascertain the industrial use of the various species. This exercise has been partially undertaken by the CBT/UNIDO, Guwahati. It should be further continued for the bamboo of Nagaland. Only after identifying the species, which can be put into commercial use, can we embark on the activity of commercial scale plantations. An Institute will need to be identified or set up to undertake such continuing research works. Linkages with Nagaland University will be explored in this regard.
- 13.7 For Bamboo medicine a specific research institute will require to be set up which will not only research on innovative medicinal use of bamboo but also build up on the traditional and inherent knowledge amongst the various tribes of the North-East.
- 13.8 Bamboo food products will be another new area of activity requiring active promotion and development by the Government. A part from tying up the production based of Bamboo shoots, various activities involving preservation and processing will have to be given direction through research and development center. This center will also study the traditional methods of preservation and uses of bamboo shoot as food for promoting commercial production. Side by side, specially food products from Bamboo shoot identified with the North-East will also be promoted.

14. Institutional Arrangement

- 14.1 The implementation of bamboo policy and bamboo development programmes in the State shall need to be undertaken in a Mission mode. Since it shall be implemented by a number of development departments. Hence it is necessary to coordinate implementation strategy through an apex body under the Chairmanship of Chief Minister, Nagaland under whom a state level bamboo agency shall be constituted with the Ministers, Commissioners, Secretaries and Head of Department of line departments as representatives from Entrepreneurs, Trade, Commerce, Industries, Banks, NGOs and farmers with the primary function to review and coordinate implementation of bamboo development programmes in the State.
- 14.2 The Bamboo Agency shall be assisted in its function by two Task forces for:
 - a. Task force for development of bamboo as resource and
 - b. Task force for development of bamboo as an enterpriseIt shall comprise of the Departments as may be designated and set up by the Government of Nagaland from time to time.
- 14.3 While the sectoral actions shall be implementation by various development departments, to facilitate the task of co-ordination among the various agencies that will work to promote the uses of Bamboo in the State, the Bamboo Agency it shall be assisted by a Nagaland Bamboo Agency Office.
- 14.4 Permanent Bamboo Development Wing will be set up in the Departments of Environment & Forest and the Industries & Commerce in the State while every other related Departments shall constitute Bamboo Cells in their respective

Departments. The primary function of the Wings and the Cells would be resource development, providing technical expertise for conservation and management of bamboos plantation within Notified Forests private & community plantations and developing bamboo based Industries with appropriate Action Plans.

- 14.5 The existing District level bodies such as the District Forest Committee and the District Agri-Allied Committees which function under the District Planning Boards shall assist the Bamboo Agency at the District level. At a later stage, after the Bamboo Task forces set up their working teams appropriate District Support Unit shall be set up at the District/Sub Divisional Level to coordinate the activities of the Bamboo Agency.

15. Funding of the Bamboo Policy

- 15.1 The Bamboo Agency will maintain a Bamboo fund to achieve the goals as set out in the Nagaland Bamboo Policy. This shall consist of the funds received from the National Bamboo Mission, allocations from the State plan and any other sources as the Agency may so obtain. It may also raise loans from the State Government, the Central Government or from any other sources as may be approved by the State Government of Nagaland for the development of Bamboo as an industrial activity in the State.
- 15.2 Funding support to implement the various policy initiatives enunciated shall be provided from the programme funds of the various development departments. While bamboo resource development within the Notified Forest area shall be supported by bamboo development project under CSS, development of bamboo plantation in agro forestry sectors shall be supported from respective programme funds of Agriculture, Horticulture and Rural Development Department. Special programme to finance bamboo plantation in farmer sector shall be prepared for support institutional finance by NABARD and NEDFI. Establishment of craft centers, training of artisans and craftsman and establishment of cottage and small and medium sector industries can be supported by government subsidies and institutional finance from industrial financing agencies and industrial investors and exporters.
- 15.3 While the State shall provide for the activities of the Bamboo Agency from within its Plan and also endeavor to obtain funds out of the National Bamboo Mission, funding in the form of Grants and/or Credit will be explored through the various Financial SIDBI, NEDFI, CBTC, Banks and State level institutions like NIDC and NSCB.
- 15.4 There shall be a Nagaland Bamboo Fund comprising of the following components:
- a. Bamboo as resource fund
 - b. Bamboo as enterprise fund
 - c. Village bamboo fund (To be used as micro credit)
 - d. Corpus fund for the bamboo agency office.

16. Acts and Rules

All the acts and rules promulgated in the State and Center shall be applicable for Bamboo development sector in Nagaland.

17. Action Plan

The policy shall be implemented through appropriate action plan packages and the implementation of programmes shall be monitored from time to time so that policy objectives are achieved.

18. Policy Review

The policy shall be reviewed periodically so that essential policy directives and imperatives are evolved from time to time.



19. Sharing of Benefits

The State Government will levy the royalty Sale tax Excise and any other taxes as enforced from time to time on the bamboo harvest and the Bamboo Products produced in the State.

The Nagaland Bamboo Development Agency/Board

As outlined in the Nagaland Bamboo Policy the Nagaland Bamboo Development Agency will be set up to achieve the aims and objectives outlined in the Vision and the Policy statement of the Nagaland Bamboo Policy working in close conjunction with the National Bamboo Mission.

The apex body shall be named the Governing Body of the Nagaland Bamboo Agency and shall be constituted as follows:

1. Chief Minister - (Chairman)
2. Minister Forest
3. Minister Agriculture
4. Minister Horticulture
5. Minister Industry & Commerce
6. Minister RD
7. Minister REPA
8. Chief Secretary
9. Development Commissioner
10. Financial Commissioner
11. Pr. Secy. Agriculture
12. Secretary Industry
13. Representative Jt. Secretary or above of the concerned Ministry in GOI
14. Representative of DONOR
15. Representative of the NEC
16. Representative of CBTC/UNIDO
17. Representative of TIFAC
18. DGM SBI (Lead Bank)
29. Representative of NABARD
20. Agriculture Production Commissioner (Member-Secretary)

Members from the following Institutions shall be co-opted into the Bamboo Board:

- a. Nagaland University
- b. SASARD
- c. SARS
- d. ICAR
- e. RFRI, Jorhat
- f. RRL, Jorhat

The Agency shall sit at least four times in a year to deliberate and draw up the action plans to implement the policies outlined in the Bamboo Policy.

It shall set the guidelines for the various Task Forces set up for the purposes of the Bamboo Mission as also review its activities from time to time.

It shall draw up the Annual Budget of the Mission as also explore the possibilities of funding the various projects identified by the Task Forces.

It shall review the various incentive programmes for the development and promotion of Bamboo as Resource and Enterprise in the State.

Task Force on Bamboo as Resource

The task force for development of Bamboo as resource shall consists of the following:

1. Principal Secy. (Forest) - Chairman
2. PCCF - Member- Secretary
3. Director (Agri.)
4. Director (Wasteland)
5. Director (Soil &Water Conservation)
6. Director (Horticulture)
7. Director (RD)
8. Director (Industries & Commerce)
9. NEPED

The task force shall have as its mandate and agenda to implement the various policies for development of "Bamboo as Resource" as outlined in the Policy Statement of the Nagaland Bamboo Policy.

Task Force on Bamboo as Enterprise

The task force on bamboo as enterprise shall consist of the following:

1. Secretary Industry - Chairman
2. Director (I & C) - Member-Secretary
3. PCCF
4. CE, Power
5. CE, R&B
6. MD, NKVIB
7. MD, NHHDC
8. MD, NIDC
9. DGM, SBI
10. Representative of CBTC

The Task force shall have as its mandate and agenda to implement the various policies for development of "Bamboo as Enterprise" as outlined in the Policy Statement of the Nagaland Bamboo Policy.

Bamboo Agency Office

The Nagaland Bamboo Development Agency shall be assisted by an Agency Office comprising of a dedicated team of officers drawn from the various fields.

The new Team will be named the Nagaland Bamboo Team and shall work in the form of NEPED, which shall be focused on the development of Bamboo as an industry in Nagaland. The Office shall initially work in conjunction with the NEPED Office.

People from the private sector as entrepreneurs, NGOs and consultants shall be co-opted, as members in the working team as and when deemed necessary.



IV-B: Tripura Bamboo Policy

(Source: http://farmersportal.tripura.gov.in/PDF/Policy/Forest/State_Bamboo_Policy.pdf)

1. Preamble

Bamboo is one of the most important non-wood forest resources used extensively by tribals and rural poor in Tripura. While it plays an important role in the economy of the State and in subsistence activities, employment generation and household income, the economic potential is significantly greater. At present only 1-2% of the total extracted bamboo is used for value addition and this is a matter of concern, keeping in view that bamboo handicraft, with superior design, craftsmanship and fineness has been a traditional activity in the State. It is estimated that around 6.1 million man days per annum of employment is generated on account of management and extraction of bamboo. Around 1.49 lakh artisans are engaged in value addition in bamboo, producing an estimated annual craft sale value of Rs.35.34 crores. Efforts to date have not been taken a focused approach and as such the drafting of this policy is a step to achieving the same.

The entire area of the State lies in one of the highest CVP (Climate, Vegetation, and Precipitation) Index zones (a measure of potential productivity) of the country. State is endowed with rich and diverse bamboo resources (annexure-I), The endeavor has been to cover all areas of the bamboo forests of the State under scientific management by way of working plan prescriptions as formulated by the Forest Department. Despite this effort, the resource survey in the past has shown that there has not only been a decrease in the areas supporting bamboo forests but such areas have also witnessed severe decline in productivity. One of the reasons for such resource degradation has been excessive biotic pressure. The other major factors responsible for hastening the process of degradation include over exploitation and damage from fire and grazing, and the occurrence of gregarious flowering. To add to this situation is the fact that a large number of bamboos are illegally felled and transported to Bangladesh using the rivers and also overland. In the absence of a planned usage program that directly involves and benefits the people, bamboo is an easy temptation to those who can lay their hands on the forests.

With this background, the 'State Bamboo Policy' envisages to develop bamboo sector in the State through a market-led community-based utilization, development and conservation of the resource in forest and farm areas. It would:

- Provide a fillip to conservation;
- Develop the resource, both in forest and farm areas through scientific means such as tissue culture, planned cultivation and proved management using community based initiatives amongst other practices;
- Improve the utilization of bamboo establishing small and large enterprises in the processes; and,
- Develop effective marketing for the bamboo-based products.

The 'State Bamboo Policy is based on the following sound economic and social principles and reasons:

1. Market-led community based development in the bamboo sector is based on the principle that development can only be truly sustainable if markets are viewed as the primary driving force behind the utilization, processing and supply of raw materials. It is a demand-driven solution based upon cash realization of the end product at the market. The price paid at the market strongly influences the supply chain, thereby acting as a powerful controlling and cost effectiveness-inducing force, in comparison to other more traditional supply-driven solutions.
2. By taking the markets as paramount, the identification of development options aimed at increasing income-generation and employment are given a clearly defined focus at the outset.
3. Bamboo is not a staple commodity like rice or sugar, nor does it have a guaranteed market like electricity. This means that changes in market demand can greatly affect processors and suppliers, and cause undue pressure on natural resources, resulting in unsustainable harvesting. This is one of reasons for the degradation of the bamboo resource. Both higher and lower prices for bamboo products may lead to increased harvesting in the short term with subsequent depletion of the resource in the future. Higher prices increase harvesting because people want to capitalise on the increased prices but is tempered by the quality that the market demands, and lower prices increase harvesting because people need to make up for loss of income.

4. Effective steps for developing local manufacturing are therefore important for encouraging local demand and increasing prices for raw materials and helping stabilise the demand for them. Emphasis on supply-driven solutions such as establishing plantations would not have any effect until this is addressed.
5. Market-led community based development is driven by the desires of the people involved to better their lives. Removal of full State control from aspects such as resource management and their transfer to the community, but on a sustainable management basis, is vital in order to maximize their incentives. Sustainable resource management will occur when the people understand that proper management of the resources will bring the maximum benefits to themselves.

The community is best capable to tend to a resource like bamboo, which actually needs management on an annual basis like an agricultural crop, unlike a typical forest resource like trees. The people do not participate in natural resource management since the benefits of investment do not directly accrue to them. Sense of participation and ownership of the resource by the community through Joint Forest Management (JFM), is therefore key for effective resource management. A change from the present system will have tremendous benefits in terms of increase of bamboo resources, reduced degradation, better quality, reduced smuggling, and overall growth of tax revenues to the State. There will also be benefits in terms of increased income and poverty alleviation, and building up of rural assets.

6. The development of communities involves proactively integrating them into the market mechanism, and empowering them against shocks, rather than just protecting them. In order to achieve this resilience, the share and role of the community in the economic process must be increased by direct means through the establishment of community based cooperatives, companies or similar commercially oriented manufacturing structures owned by members of the community and that benefit all members of the community.

Improving the markets (and products) should be done in a way that benefits the consumers and the producers alike so the prosperity of all members of the production to consumption system increases.

2. Vision of the Policy

To realize the economic, social and environmental potential of the bamboo resource of Tripura, develop it into one of major economic sectors of the State, and provide employment and income generating activities for the tribals and rural poor. This vision will be implemented on a sustainable economic development basis so that market and ownership systems not only halt the process of further degradation of bamboo resources, but lead to an increase in the quantity and quality of bamboo resources, to meet the present and prospective requirements of bamboo users including the environmental needs of the State.

3. Goals and Objectives

3.1 The main goals of the policy which stem from the vision are:

- Development and implementation of a sustainable community based production model with concomitant benefits for forest conservation
- Development and implementation of an economic development program using bamboo for spurring industrial development
- Enhancing employment and income generating opportunities for tribals and rural poor using bamboo as the prime resource.

3.2 The basic targeted objectives that would govern the State Bamboo Policy are the following:

- Scientific assessment of the plantation inventory by species to assess the effort involved.
- Conserving the bio-diversity of resource base.



- Enhancing the productivity and production base of the resource to meet the expected increase in demand up to a 10% annual increase of the sustainable yield from the year 2001 level.
- Enabling training, tools and other mechanical productivity enhancers, consolidation, distribution and marketing channels.
- Developing value addition in handicrafts through improved processing, product diversification, design development and enhanced shelf life, to produce quality products at par with international standards and to increase the trade in home and export market by 100% in next 5 (five) years.
- Establishing bamboo industrial products as an economic and successful new industrial sub-sector. This includes developing Small Scale Industries (SSIs) and also medium-scale operations based on bamboo such as Bamboo Mat Boards (BMBs), Bamboo laminates, Bamboo ply, Bamboo flooring and Bamboo shoot processing, among others, to be identified by the INBAR-Tripura Bamboo Mission. Smaller industries for production of chopsticks, agarbattis and baskets would be promoted at the community level.
- Developing the necessary market mechanism with support towards promotion and marketing of finished products.
- Popularizing bamboo as a cost effective and earthquake resistant building material for housing in the State, which lies in one of the high seismic zones of the country.
- Arranging financial resources as may be necessary to achieve the above objectives.
- Setting up of monitoring facilities and systems for fine tuning the devised plans and ensuring their effectiveness.

4. Approach

The approach of the policy in achieving the above mentioned objectives would be based on the following :

- Community and private sector participation in bamboo development
- Support to activities focused on conservation of bamboo resource
- Plant propagation
- Enhancement of the production base
- Management Information System (MIS), inventory and database development
- Promotion of handicrafts
- Industrial utilisation and entrepreneurship development
- Bamboo utilisation in building material and low cost housing
- Development of marketing and trading plan and systems

5. Facilitation Process

The role of the government in achieving the above objectives would be that of a facilitator and promoter of activities in each of the areas outlined in the approach. The strategic direction and thrust would be provided by the government while the community and the private sector would be the implementers of the strategy. To this end the government has already initiated the process of setting up of institutional mechanisms, detailed later.

6. Strategy

6.1 Community participation

- a) Bamboo provides subsistence and livelihood security to tribals and it fits in to socio-economic milieu of tribal culture in the State. The knowledge and skill required for resource development and value addition are part of their tradition. These communities with scientific assistance and training support would be involved in development of the sector to

revive their traditional knowledge and supporting and integrating it with modern techniques to ensure economic upliftment.

- b) Community based development approach for the sector would be adopted through active participation and involvement of local communities under Joint Forest Management (JFM), under cluster co-operatives of artisans, and other mechanisms to ensure sustainable return to these communities. This will help achieve goals as a sense of participation and ownership will improve productivity. This has found success in various parts of the world where the productivity has shown marked improvement and the communities contribute to the larger cause of economic development and the environment in the process.
- c) Institutions of local self governance in ADC and non-ADC areas would be involved in promotion and development of bamboo at grass root level, and to ensure participation of masses in sectoral development programmes.

6.2 Conservation of the resource

- a) Claim of bamboo dependent local communities would be honoured and their access to the resource ensured through implementation of suitably designed arrangements. The lack of sense of participation and ownership, and also the poverty of these communities is an important factor in causing their indifference towards resource degradation. Enhanced income generation of these communities through cultivation/extraction/value addition of bamboo, would be considered as an activity aimed at conservation and would be promoted. Where the need is felt, an additional income source/arrangement would be considered to tide over the phase of gestation before plantations come to maturity.
- b) Existing management practices related to end-use would be updated and down-streamed to the community by infusing appropriate scientific inputs.
- c) To ensure ex-situ conservation of the bamboo resource, gene banks of different cohorts of species would be developed within next two years, which may also be used for propagation, multiplication and cultivation needs in future.
- d) A bambusetum, which would contain a live collection of different bamboo species, would also be established within next two years, to enable local artisans, bamboo growers and farmers to get first hand information about morphological features, aesthetic properties and growth characteristics of these plants. Information systems would be put into place for all to be aware of this facility and encourage usage.
- e) Immediate corrective steps would be taken to tackle ongoing bamboo flowering of Muli (*Melocanna baccifera*) and other species in different areas. These steps would include: covering maximum area under plantation programme, preferably with superior species having wider uses; protection against fire and grazing to ensure establishment of profuse regeneration which follows such flowering; harvesting/removal of flowered culms up to 70 per cent to reduce fire hazards; documentation and cohort mapping including ex-situ conservation of different cohorts; and rodent pest management in affected areas.

6.3 Plant propagation

The shortage of bamboo planting material, a major constraint for large-scale bamboo plantation, would be addressed.

- a) Existing use of rhizome as planting material is not only costly but in most of the clump forming bamboos, it leads to relocation rather than development of the resource. In view of this, and where alternatives are available, the use of rhizome for field planting would be phased out in next five years.
- b) Facilities would be developed during 2001-2003, for raising the required planting stock of identified species of bamboo through suitable macro-proliferation (if seed/seedlings are available) or a combination of rooting of culm/branch cutting and macro-proliferation techniques.
- c) Plant tissue culture technique for mass clonal propagation viz, micro-propagation of bamboo, has certain advantages



in terms of very high multiplication rates, plant production throughout the year, possibilities to induce early culm formation/improved yield, and easy handling and transportation of plantlets. Accordingly micro-propagation facility for identified bamboo species would be developed over the next three years in collaboration with appropriate technical agencies.

6.4 Development of the resource

- a) To meet the prospective requirements of non-clump forming bamboos, productivity of existing Muli (*Melocanna baccifera*) bamboo forests would be enhanced through cost effective method of Aided Natural Regeneration (ANR), which includes protection from fire, grazing and substitute sowing of seeds on steep slopes following gregarious /sporadic flowering. An area of 50,000ha would be covered under ANR in next five years through community based and managed afforestation programs with government support.
- b) To meet requirements of other clump/non-clump forming bamboos, production base would be enhanced by taking up artificial regeneration over 10,000 ha of degraded forests and 5,000 ha of un-arable tillage land in private holdings, in five years. The species targeted for artificial regeneration are Barak (*Bambusa balcooa*), Bari (*Bambusa polymorpha*), Mritinga (*Bambusa tulda*), Muli (*Melocanna baccifera*), Poara (*Bambusa teres*), Dolu (*Sehizostaehyum dullooa*), Makal (*Bamboo pallida*), Kanak Kaich (*Bambusa affinis*), Lanthi bans (*Dendrocalamus strictus*), which are primarily being used in value addition and creation of income generation activities in the State. *Guadua angustifolia* would also be introduced from South America. To encourage bamboo plantation in private holdings, the favourable economic return of bamboo plantation vis-a-vis other crops would be publicized and appropriate technical and financial support would be provided to the cultivators.
- c) To ensure achievement of targets as mentioned above, the responsibility for bamboo resource development would be taken up by different departments with technical and material support of Forest Department (Annex2).

6.5 Inventory and data collection

- a) Detailed inventory of bamboo resource inside forests and outside forest areas would be carried out by Forest Department every 5 (five) years, by involving an appropriate technical organization having skill and manpower.
- b) Regular survey of private handicraft sector at two years interval would be carried out by Directorate of Handloom Handicrafts and Sericulture to update the database relating to details of artisans, product range, technology adopted, raw material requirement and capacity of production.

6.6 Handicrafts

- a) The handicrafts sector requirements would be linked in a coordinated manner to the community plantation and usage plan. Existing requirement of semi-processed and treated raw material of handicrafts sector is presently being met through manual processing of whole bamboo members by artisans. In the process, productivity and quality of products are adversely affected. Integrated linkages will be provided to bring technical and technological solutions, and facilities to the producers doorstep. Micro-Common Facility Centers (CFCs) set up on a modified Build-Operate-Transfer basis, with the government providing funding for setting up these units by cooperatives or corporate units, would be promoted to enhance quality and durability of handicrafts items and also to facilitate reduction of wastes, drudgery and physical risks.
- b) Facilities for bamboo quality verification and testing would be developed at all such CFCs along with appropriate processing and treatment facilities for value addition. A system of certification would be put in place to promote sustained improved quality that meets buyer needs.
- c) Local talent for product design, development and diversification would be promoted by providing regular technical inputs from market and design institutes such as National Institute of Design (NID), Ahmedabad, the Cane and

Bamboo Technology Center (CBTC), Guwahati, as well as agencies and designers abroad. An extension/exchange based program would be structured for ongoing inputs into the design process involving artisans. This would be channeled through an agency which would then train the trainers and link them to production outputs.

- d) A focused category (product family) specific strategy and business plan would be developed for each cluster which would be supported with required training, raw material and specific jigs, fixtures and tools. Channels would be set up to reach the technologies and designs developed externally to the artisan communities. This role may be performed by an external agency which has to work to getting new designs and techniques to survive as repetition of content will dilute its offering.
- e) Market research which is targeted towards working backwards from the needs of the markets would be initiated. Assistance from Export Promotion Council for Handicrafts (EPCH) and other organizations would be taken in this regard.
- f) Industrial Training Institutes (ITIs) of the State would be included as part of a program to provide technical manpower required for the sector. Specialist courses would be offered addressing the needs emerging from use of bamboo material and tools for various industrial and mechanical handicraft processes.
- g) Interactive workshops, buyer-seller meets, preparation/updation of catalogues and showcasing of products and capabilities would be promoted and supported. Support from organizations such as National Informatics Center (NIC) would be sought whose Community Information Centre programs will help increase the reach of learning material through the web. Doordarshan would be leveraged to provide online video based training content on a scheduled basis. Content could be sourced from organizations such as INBAR and local translations carried out.

6.7 Industrial use

- a) Small and Medium-Scale Industries in emerging areas of bamboo mat boards (BMBs), bamboo laminates, bamboo ply, bamboo tiles, bamboo furniture and bamboo shoot processing, etc., would be promoted through entrepreneurship development and by providing appropriate incentives and linkages with appropriate agencies such as the Indian Plywood Industries Research and Training Institute (IPIRTI), Bangalore, Building Material and Technology Promotion Council (BMTPC), New Delhi, and the Central Food Technology Research Institute (CFTRI), Mysore. TIFAC, an organization of the Department of Science & Technology, Govt. of India, would be involved in setting up of some ventures providing soft funding for technology implementation. Assistance from TIFAC would also be taken for a Bamboo Technology Park to be established in Agartala.
- b) Project profiles would be prepared based on extensive market study to enable support in setting up enterprises. The information from the ongoing INBAR market and investment analysis survey will be useful in this context. Where required, global technology and machinery sourcing would be planned for, through the assistance of an organization such as INBAR.
- c) Appropriate funding mechanisms would be established under the aegis of North East Development and Financial Institution (NEDFI), which has a mandate to perform this task in the North East. If the terms of the offer are not suited to an entrepreneur, additional support plans would be drawn up which should work on performance basis rather than on grant basis.
- d) Conducive industrial climate needs to be established to give the new industries being set up, an even chance to survive. Initially the Government may provide some commitments from its side to enable them to hold their end of the effort.
- e) Partnerships on an inter-state or even international basis need to be considered for mutual benefit. Opening of borders with Bangladesh in a limited way would be one of the steps to start with.
- f) Given the advantage of natural gas availability, adequate steps would be taken to ensure availability of the same and to an extent possible the same would be considered the prime fuel for industrial usage.



- g) Bamboo utilization in bulk sectoral uses of Agarbatti sticks, fishing rods and umbrella handles, and hitherto unexplored applications, would be promoted through market linkages and appropriate incentives. Mechanisation processes would be introduced and movement up the value chain would be taken up on a priority basis.

6.8 Building material

- a) The present use of bamboo as building material in rural housing is beset with problems of low durability, low fire resistance, poor design and lack of technical details and skill. Use of bamboo in rural housing would be promoted through appropriate standardization of species grouping and preservation techniques! processes for different structural elements to make it a fire resistant, durable and tough building material under local conditions.
- b) International Network of Bamboo and Rattan (INBAR) has been commissioned by the Govt. of India (Min. of SSI) through UNDP for a project on low-cost bamboo based housing, and Tripura has been chosen as the pilot location for the North East. An autonomous professionally run institution would be set up under the joint auspices of Tripura, INBAR and UNIDO-CBTC, dedicated to the study of this sector, as Tripura stands to gain from the use of bamboo on an ongoing basis for purposes of housing. Support in this regard would also be sought from the Ministry of Small Scale Industries.
- c) Improved designs would be developed along with technical specifications and skills in collaboration with Indian Plywood Industries Research and Training Institute (IPIRTI), Bangalore, Building Material and Technology Promotion Council (BMTPC), the Housing and Urban Development Corporation (HUDCO), and International Network of Bamboo and Rattan (INBAR).
- d) Cost estimates and schedule of rates would be developed and bamboo housing would be promoted through District Rural Development Agencies (DRDAs), Rural Development (RD) Department and Local Nirmiti Kendras. Various schemes, Indira Awas Yojana (IAY) for one, sponsored by the Government of India (GOI) would be borne in mind while planning for objectives under this sector. If aggressive targets need to be set beyond those outlined under the scheme by the GOI, the State Government would arrange for additional resources for the same.
- e) A scheme for renovation would be drawn up as the IAY has been running for a long term and soon a requirement for renovation would come up. Bamboo offering cheaper options will get maximization of value for this effort, if included by the Government under its plans.
- f) The Government would actively consider the use of bamboo for its own requirements and programs. This will not only set a good example to the people but will also build confidence in the minds of the people as to bamboo's potential and efficacy.

6.9 Marketing

- a) Existing regulations relating to trade and movement of bamboo would be reviewed to ensure income generation to growers and extractors to stimulate bamboo growing as an economic activity in the State.
- b) The issue of illegal movement of bamboo across the border would be addressed and a long-term plan would be drawn up to build up utilization within the State. This will help keep the prices of bamboo at realistic levels rather than building inflationary pressures on it. Controlled and regulated trade of bamboo with Bangladesh would be started to ensure appropriate benefits to cultivators and extractors.
- c) Export oriented units of bamboo products would be promoted by providing appropriate marketing linkage, information and support.
- d) Chains of distribution would be collapsed to ensure fairer returns to the producers.

6.10 Funding and institutional strengthening

- a) Based on the projected development of bamboo sector in the State in next five years, it is estimated that an amount of Rs. 200.00 crores would be required for the same. An integrated project on holistic perspective would be prepared through the International Network for Bamboo and Rattan (INBAR) and necessary funding would be arranged from external donor agencies, Government of India and from internal resources of the State.
- b) A medium-term arrangement would be entered into with INBAR to provide necessary technical backstopping, institutional and managerial support, to implement the integrated project. Mechanisms to source and deploy the funds on a task basis rather than on a budget-expenditure basis will be put into place. Detailed monitoring with guidelines and systems will be put into place in a manner that at any point of time, progress on all fronts can be monitored effectively.
- c) An autonomous institution would be set up to build up the capacity of the State to carry forward the development of the sector over the long-term with the assistance of International Network for Bamboo and Rattan (INBAR)

6.11 Monitoring and regulation

A State level Advisory Committee of the Bamboo Sector has been formed under the Chairmanship of the Chief Secretary. The committee would monitor the development of the sector and, would regulate and ensure accountability as well as proper functioning of agencies involved in development of the sector. The committee would meet at least twice in a year to review the status of development of bamboo sector in the State.

Resource base

- i) Species of bamboo found in Tripura:
Barak (*Bambusa balcooa*), Bari (*Bambusa polymorpha*), Mritinga (*Bambusa tulda*), Muli (*Melocanna baccifera*), Kali (*Bambusa nutans*), Poara (*Bambusa teres*), Rupai (*Dendrocalamus longispatus*), Dolu (*Sehizostaehyum dullooa*), Makal (*Bamboo pallida*), Pecha (*Dendrocalamus hamiltonii*), Kailiyai (*Gigantochloa rostrata*), Kanak Kaich (*Bambusa affinis*), Lanthibans (*Dendrocalamus strictus*), Tetua (*Bambusa* sp.), Ish (*Bambusa* sp.), Jai (*Bambusa* sp.), Bombash (*Bambusa* sp.), Sairil/Wadu bamboo (*Melocalamus compactiflorus*), Bosai (*Bambusa* sp.).
- ii) Area under bamboo resource:
Taking Bamboo, Bamboo with Miscellaneous and Shifting Cultivation stratum, the bamboo resource base extends over 2397 km² of forests (as per State Forestry Action Plan) and 109 km² in small holdings of farmers outside the forests.
- iii) Productivity of the resource:
The average productivity of the resource for forests and farm areas is estimated to be 0.73 MT/ha/annum, which is higher than all India average of 0.51 MT/ha/annum but compares very poorly with productivity level of 3.79 MT/ha/annum in China.
- iv) Yield and utilization:
The present level of extraction of 184.26 million numbers/annum is much beyond sustainable yield of 142.60 million numbers/annum, meaning thereby that forced supply to cater the existing demand, is being maintained either by reducing the rotation of the crop or by extending the degradation to non-degraded areas by way of over-exploitation of the crop, thereby resulting in further degradation of the resource. The present utilization of aforesaid extracted bamboo million culms is as mentioned below: .

Housing	134.69.
Supply to paper mill	16.51
Handicrafts	3.20
Agricultural implements	1.47
Other use	28.39
Total	184.26



The department-wise target for next five years would be as mentioned below:

(Area in ha)

Department	ANR inside forests	Artificial degraded forests	Regeneration in mixed with teak	Artificial regeneration in private holdings	Total
Forest	50,000	5,000	5,000	500	60,500
R.D.				1,500	1,500
A.D.C.				500	500
Panchayat/PRLs				2,500	2,500
Total	50,000			5,000	65,000

IV-C: Assam Bamboo and Rattan Policy-2003 (Draft)

(Source: http://103.8.249.31/assamforest/downloads/doc/bamboo_policy.pdf)

1. Preamble

- 1.1 Bamboo and Rattan represent untapped major resource of Assam State whose full ecological and economic potential needs to be recognized, developed and promoted in a manner ensuring ecological security for all round sustainable development of the State and also the livelihood security to its people.
- 1.2 Although as per a recent study, the bamboo has over 1500 documented uses, in India, it is primarily meant for making paper pulp (35 per cent), apart from uses like housing (20 per cent), non-residential uses (5 per cent), rural uses (20 per cent), fuel (8.5 per cent), packing, including baskets (5 per cent), transport (1.5 per cent), furniture (1 per cent), other wood industries (1 per cent), other (3 per cent). In Assam 3 paper mills have been set up based on bamboo, as the basis raw material and all bamboo bearing forest areas have been leased out to the paper mills at concessional rates. The main bamboo growing areas of Assam are the districts of Cachar, Karbi Anglong, North Cachar Hills, Nagaon and Lakhimpur. Bamboo is a raw material of great versatility and forms an integral part of the culture, life style of the people and the economy of Assam since time immemorial. There is mention in history about the rattan and bamboo products of Assam during the time of Bhaskara Varman (early part of the 7th century A.D.), the king of Assam. In the 21st century also the rattan and bamboo products of the State are made mainly at cottage industry level, as no value addition or diversification in a major way has taken place.
- 1.3 Bamboo and Rattans are an essential component of forest eco- system, which is a dominant feature of State's landscape. Traditional living and lifestyle of Assamese society, to a large extent, is dependent on bamboos and rattans for its variety of uses and these species have much to offer by way of contributing to socio-economic advancement of modern Assamese society. The eco-friendly bamboo and rattan crop has immense potential in improving rural economy, industrial development and a sound economic base for the state on sustained basis.
- 1.4 Bamboo and Rattan sector development is a high priority thrust area of the State Govt. and Govt. of India. Thus there is a need to promote bamboo and Rattan development for the benefit of rural sector.
- 1.5 The change over from traditional use to a modern use, tracking a high potential growth path in an eco-friendly manner needs a clear vision, an appropriate policy framework and a blueprint. Hence the necessity of drafting a Bamboo and Rattan Policy.

2. Role of Bamboo in Socio-Economic Development

- 2.1 Bamboo has been an integral part of the cultural, social and economic traditions of Assam. Many people still depend on it for their livelihood, and for household and functional uses. In return communities have nurtured and protected bamboo and are repositories of vast knowledge and skills related to the propagation, processing and usage of bamboo. There is a social context too – bamboo in Assam finds a place in ritual and recreation, in culture and ceremony – needs to find a mention. Most importantly there is a traditional familiarity with the material, and a legacy of skill that can be built upon for newly emerging applications and products. All of this means - along with the fact of abundant bamboo - that Assam has a competitive and comparative advantage.
- 2.2 Bamboo offers promise and potential for value addition and incremental income and employment. The employment intensity of many products and processes is very high - and can lead to enhanced employment in the formal and informal sectors at different stages – cultivation, harvesting, processing, product conversion and marketing. Bamboo can be an important vehicle for sustainable and widespread development, augmenting economic opportunity, income and employment.
- 2.3 Bamboo is an eco-friendly alternative to many currently used materials. It is a material that lends itself easily to simple processing technologies. At the same time it is capable of high end and high value products and applications.
- 2.4 Bamboo contributes to the soil and environment, giving back as much as it takes. It is a pivotal element in the balance of



oxygen and carbon dioxide in the atmosphere; bamboo produces 30% of its volume in biomass. Its unique root and rhizome structures act as binders, controlling erosion and rejuvenation soil. Bamboo, in plantations or on the periphery of homesteads, acts as a windbreaker, a noise & climate buffer. As a consequence, bamboo based household plantation and agro-forestry can enhance food security, assist in soil conservation, watershed development and the reclamation of wasteland. In Assam, bamboo plantation can therefore be used to control river bank erosion, to arrest soil degradation, and to stabilize embankments.

2.5 The development of bamboo applications would promote eco-friendly products and processes. It would have environmentally beneficial impact. Through substitution and conservation of timber resources, and enhancement of green cover. Bamboo have many new uses too, developed through the application of science and technology. It can substitute technologically and commercially not only could, but also plastics, steel and cement and composite materials in structural and product applications through improvement in processing technologies, product innovations and the application of scientific and engineering skills.

2.6 Use of Bamboo

Bamboo and rattan products generally used for various domestic purposes and made in cottage industry are named below:-

- a. Chalani (sieve) of different sizes
- b. Kula (winnowing fan)
- c. Khorahi (small basket)
- d. Dukula/Tukuri (big basket)
- e. Dala (bamboo tray)
- f. Duli (Assamese)/Tali (Bengali)-big basket for storing paddy/ rice
- g. Doon (Assamese)/ Kathi (Bengali) – for measuring paddy/rice
- h. Dhol (big measure)
- i. Bamboo mats known as Dhari, Dhara, Jharia or Darma. These mats are used for various purposes like construction of temporary walls and sheds, big pandals, roofing of country boats, dwelling houses, other domestic uses and also for spreading and drying of paddy/rice

3. Resource Scenario

Rattan and bamboo handicraft is the traditional industry of Assam. The State has the greatest concentration of rattan and bamboo in the country. Total bamboo area in Assam is about 2.23 million hectares as against Indian's total area of about 11 million hectares under bamboo. Out of the 130 bamboo species available in India, 34 species available in Assam. The raw stock of bamboo is valued at about Rs.4,000 crores. Unfortunately uses of bamboo and rattan have largely been local and traditional with very little value addition. With value additions of even two times about Rs.8000 crores can easily be generated in Assam from rattan and bamboo on an annual basis.

A. Bamboo

- A.3.1 Forest types occurring in the state are Tropical Wet Evergreen, Tropical Semi-Evergreen, Tropical Moist Deciduous, Sub Tropical Broad Leaved Hill, Sub tropical Pine and Littoral and Swamp forests.
- A.3.2 There are 34 species of bamboos occurring in the State. The following species are extensively found : *Dendrocalamus hamiltonii* (Kako), *Neohouzeaua dulooa* syn. *Teinostachyum dulooa* (Dolu), *Melocana baccifera* syn. *Melocana bambusides* (Muli), *Oxytenanthera parviflora* (Hill Jati), *Dendrocalamus longispathus* (Khang), *Oxytenanthera albociliata* (Kala sundi), *Oxytenanthera nigrociliata* (Kaligoda), *Bamboosa pallida* (Hill Jati), *Bambusa balcooa*

(Bhaluka). All the bamboo species are clump forming except Muli (*Melocanna baccifera*), *Bambusa tulda* (Jati), *Bambusa vulgaris*, *Bambusa balcooa* (Bhaluka), *Bambusa teres* (Bhaluki Mokhal), *Bambusa nutans*, *Bambusa polymorpha*, *Bambusa gigantia*, *Bambusa arundinacea* (Kata Bamboo), *Bamboosa pallida* (Bajal) are mostly grown in homesteads. A list of Bamboo found in Assam is given below:

Bamboos found in Assam along with their locality and vernacular names

S.No.	Scientific Name	Vernacular name	Locality
1.	<i>Bambusa auriculata</i>	Kalia bans	Karimganj
2.	<i>Bambusa balcooa</i>	Bhaluka	Throughout the State
3.	<i>Bambusa bambos</i>	Kotoha, Kotabanh	Throughout the State
4.	<i>Bambusa cacharensis</i>	-	Lakimpur, Sultani-Cherra Village
5.	<i>Bambusa jaintiana</i>	-	N.C. Hills
6.	<i>Bambusa mastersii</i>	Beti banh	Lakhimpur, Dibrugarh
7.	<i>Bambusa nutans</i>	Deobanh, Jotia makal.	Throughout the State
8.	<i>Bambusa pallida</i>	Bijuli, Jowa, Makal.	Throughout the State
9.	<i>Bambusa polymorpha</i>	Betua, Jama.	Cachar, Dholai, Kakicherra, Silchar
10.	<i>Bambusa pseudopallida</i>	-	-
11.	<i>Bambusa sp.</i>	Nangal banh	Kamrup, Gohpur
12.	<i>Bambusa teres</i>	Bhaluki makal, paura	Chariduar, Darrag, Kamrup, Sibsagar
13.	<i>Bambusa tulda</i>	Jati, Nal banh.	Throughout the State
14.	<i>Bambusa vulgaris</i>	Tansti banh, Ketura	Karimganj
15.	<i>Dendrocalamus giganteus</i>	Worra	N.Lakhimpur, Upper Dihing
16.	<i>Dendrocalamus hamiltonii</i>	Kakoa, Kakeo banh	N.C. Hill., K.Anglong, Nagaon Cachar etc
17.	<i>Dendrocalamus longispatus</i>	Karail, Jati, Rupahi banh	N.C. Hills, Kamrup, Dholai block, Hovaithung
18.	<i>Dendrocalamus strictus</i>	Karail, Jati	Deopani river bank
19.	<i>Dinochloa compactiflora</i>	-	Cachar
20.	<i>Dinochloa gracilis</i>	-	N.C. Hills
21.	<i>Dinochloa indica</i> .	-	Bhuban Hills.
22.	<i>Dinochloa mclellandii</i> .	Lota	Karimganj N.C. Hills
23.	<i>Gigantochloa sp.</i>	Kalisundi	Karimganj.
24.	<i>Gigantochloa macrostachys</i>	-	Hathikhali, Kamrup, Kulsi
25.	<i>Melocanna baccifera</i> = <i>M. bambusoides</i>	Tarai banh, Nah banh, Muli banh	Common in hilly areas -
26.	<i>Phyllostachys assamica</i>	-	Common in hilly areas and in
27.	<i>Schizostachyum dullooa</i>	Dalu banh	upper Assam
28.	<i>Schizostachyum griffithii</i>	Behti banh	Sibsagar, Dibrugarh
29.	<i>Schizostachyum pergracile</i>	Madang	Dibrugarh, N.C. Hills
30.	<i>Schizostachyum polymorphum</i>	Bajal banh, bajah banh	Barduar, Batasipur, Darrang R. F. Garampani, Makum forest of Narduar,

(Source: State Forest Research Institute, Itanagar-Survey of Bamboo in North-East India.)



- A.3.3 Amongst the edible bamboos *Melocanna baccifera* is most favoured followed by *Bambusa tulda*, *Dedrocalamus hamiltonii*, and *D. longispathus*.
- A.3.4. The study of availability of bamboo grown in forest areas was carried out by different agencies since 1953. In 1953, reports for M/S Srraw Products showed annual yield in Upper Assam, Central Assam, Lower Assam, Cachar and Mizo hills was 3,69,100 tons. In 1955, Mr. I. Vinton Burn, F A O Expert reported annual yield of Upper Assam, Lower Assam, Central Assam and Cachar as 2,22,700 tons. In 1957 Report for Assam Pulp Co. Limited showed annual yield of N.C. Hills as 1,11,559 tons. In 1961, Mr. R.C. Dutta Purkayastha calculated annual yield of Upper Assam as 45,000 tons, Cachar 2,75,000 tons. Mizo hills 8,19,100 tons, Central Assam 1,29,800 tons, Lower Assam 54,000 tons. Mr. A.H. Choudhury (1969) estimated the total yield of Cachar as 19 Lakhs ton, Mr. L.C. Das calculated total yield of South Kamrup as 1,81,019.70 tons and prescribed 54,448 tons as annual cut. Mr. H.K. Choudhury revised the yield in 1974 as 1,11,940 tons Mr. L.C. Das calculated the annual yield of Goalpara as 15,526 tons from Reserved Forests and Proposed Reserved Forests and 20,000 tons from homestead. A report for International Paper Consltants (1973) mentioned annual yield of the whole N.C. Hills to 3,00,000 tons.
- A.3.4.1 Considering all these reports, the annual availability of bamboos from the forests areas of this region may be estimated as below:

S. No.	District	Quantity (tonne)
1.	Upper Assam (Lakhimpur, Sibsagar, etc.).	1,05,100
2.	Central Assam(Nagaon,Diung Valley)	1,54,000
3.	Lower Assam (Kamrup, Khasi Hills, Garo Hills)	80,000
4.	Goalpara	15,525
5.	Cachar	2,75,000
6.	N.C. Hills (R.F areas)	61,392
7.	N.C. Hills (U.S.F. areas)	1,40,00
Total		7,25,000

- a) The yield mentioned above may not be the true picture at present as there had been considerable destruction of bamboo forests by shifting and unscientific exploitation of accessible bamboo forests areas. In addition to this, the annual availability of bamboo yield will not be available due to reorganization of the States. Thus, the actual yield available as resource on a sustainable basis may be much less as indicated above. The inventory carried out by the Forests Survey of India during 1989-90 indicates that the total growing stock of bamboo for the State of Assam is 10.04 million tons having area of 8213 sq. km.
- b) The villagers of the State are growing bamboos in their homesteads and the annual availability of homegrown bamboo is more than 3 Lakhs tons at 2.5 to 3 Lakhs tons of homegrown bamboos are going out of the State to cater the demand of the paper mills situated outside the State, in addition to the supply made to the local paper mills by the villagers.

Distribution of Bamboo Bearing Areas

Bamboo forests of the State are well spread over, in the form of pure bamboo forests and overlapping bamboo forests, with trees through out the State, but extensive in two hill districts of Assam, erstwhile Cachar, Kamrup and Goalpara districts. Bamboos of the two hill districts are mainly confined in the District Council Reserved Forests, Proposed Reserved Forests and Unclassified State Forests area, which are subject to extensive shifting cultivation. Actually 60 to 70% of bamboo areas of the two hill districts are confined in the above two categories of the forests. The total unclassified forests area of the two hill districts is 9,217 Sq. Km. out of the total geographical area of 15,222 Km².

District	Classified Forests Areas (km ²)	Unclassified Forests Areas (km ²)	Bamboo Bearing Area (km ²)
Karbi Anglong	2,334.20	3,650.00	3,890.00
North Cachar Hills	707.52	3,150.00	1,868.00
Cachar & Karimganj	2,396.20	-	831.45
Kamrup	829.00	-	491.91
Goalpara	383.84	-	280.00
Nagaon	836.70	-	196.00
Total	7,487.46	6,800.00	7,557.36

The districts mentioned above are the main bamboo bearing areas of the State but bamboos are also available in other districts of the State. Presently, about 16 per cent of the total bamboo resource of the country is grown in the State of Assam.

A.3.4.2 During sixties, two units of paper mills of M/s Hindustan Paper Corporation Limited and one unit of M/S Asok Paper Mills were established at Nagaon, Cachar and Jogighopa respectively and all bamboo bearing forest areas were leased out to these paper mills for production of pulp and paper at concessional rates.

A.3.4.3 Bamboo flowering occurs at periodic intervals in Assam and Muli bamboo is expected to flower between 2005-2007.

B. Rattans

B.3.1. North-eastern region can be referred as the center of genetic diversity of this renewable resource with nearly 45 species of Rattans belonging to 5 different genera, viz, *Calamus*, *Daemonerops*, *Plectocamia*, *Karhalsia* and *Zalacca*. Many of the endemic rattans of India are under severe threat due to destruction of their ecological niche, over exploitation and other biotic factors. The demand for rattan furniture is increasing now-a-days and the existing natural resource is not adequate, resulting in over-exploitation. Besides, the rattan industries in South India depends on N.E. States for supply of raw-materials. This is also leading to genetic erosion. In the absence of any large scale plantation, the present situation will soon lead to extinction of many species. The states of rattans in North Eastern States and Assam in particular is a major of serious concern. The forest area is diminishing fast primarily due to shifting cultivation and over-exploitation. In North Eastern India about 2.5 million people are involved in shifting cultivation in 2.7 million hectares (Jha, 1977), According to the State Forest Report (1989), the area under shifting cultivation has increased considerably in Assam (74.9 per cent) within a period of 10 years. Deforestation is taking place at a rapid speed due to heavy logging, though in recent times due to ban on felling of trees, there is some reduction of the speed. The reduced cycle of shifting cultivation has created environmental hazard like soil erosion and land slides. Thus, natural home of rattans is being destroyed leading to genetic erosion. Many of the species reported earlier are not present now in the reported locations.



Hence, there is an urgent need for habitat preservation for in-situ conservation. Effective measures are to be taken to conserve propagate this group of plants as below :

- Control on the exploitation of wild populations
- Check on the destruction of natural habitats
- Establishment of gene banks and seed orchards
- Evolving potentially useful methods for the propagation and improving the various existing methods
- Taxonomy of rattans with emphasis on phytogeography and intra species variations
- Propagation and introduction of elite species, which are rare and endangered. The poor regeneration rate of rattan can be attributed to the following factors
- Unscientific harvesting of the rattans
- Indiscriminate cutting of the rattans
- Biotic interference, and
- Degradation in the site quality due to change in micro-climate of the rattan growing area

B.3.2 The following important species of rattans are found in Assam: *Calamus erectus*, *C.flagellum*, *C.floribundus*, *C.gracilis*, *C.guruba*, *C.latifolius*, *C.leptospadix* and *C.tenuis*.

Table 1: Original and present distribution of rattans in Assam (Source: Beccari, 1996).

Species	Original Distribution	Present Distribution
<i>Calamus acanthospathus</i>	X	X
<i>Calamus erectus</i>	X	-
<i>Calamus erectus</i> var. <i>schizodspathus</i>	X	-
<i>Calamus flagellum</i>	X	-
<i>Calamus floribundus</i> var. <i>dapouperatus</i>	X	-
<i>Calamus gracilis</i>	X	-
<i>Calamus guruba</i>	X	-
<i>Calamus inermis</i>	-	-
<i>Calamus khasianus</i>	-	-
<i>Calamus kingianus</i>	-	X
<i>Calamus latifolius</i>	X	X
<i>Calamus latifolius</i> var. <i>marmoratus</i>	X	-
<i>Calamus leptospadix</i>	X	X
<i>Calamus nambariensis</i>	X	X
<i>Calamus palustris</i> var. <i>amtlissiums</i>	-	-
<i>Calamus tenuis</i>	X	X
<i>Calamus viminalis</i>	X	-
<i>Daemonorops jenkinsiana</i>	-	X
<i>Plectocomia himalayana</i>	-	-

(X Present , - Absent.)

- B.3.3. Rattans are used as a substitute for ropes as cables for suspension bridges and other purposes. Rattan industry is well-developed in Assam. Species like *Calamus erectus*, *C. flagellum*, *C. floribundus*, *C. gracilis*, *C. guruba*, *C. latifolius* and *C. tenuis* are used for making furniture. Furniture like chairs, tables, sofa sets, etc. made out of rattans are a novelty. The roots and leaves are used for medicinal purpose. The seeds of *Calamus rheedei* are powdered and applied in ulcer. The roots of *Calamus rotang* are a remedy for dysentery, biliousness and febrifuge and also used as tonic. The tender leaves of *Calamus travan-coricus* are used in dyspepsia, biliousness and as anthelmintic.
- B.3.4. There is need to develop packages for nursery and silviculture techniques. The nursery techniques have to be standardized for the climatic condition and a compact nursery package needs to be developed to make it suitable for raising large scale plantations.

4. Need for Bamboo and Rattan Policy

- 4.1 Bamboo and rattans being a multipurpose, eco-friendly crop and natural resource needs to be managed and exploited for sustainable use. Bamboo is conceived as a thrust area in the Industrial Development of Assam for the economic and ecological security of the people. These precious resources need to be fully tapped as Industrial raw material, as substitute for wood in rural/urban housing, engineering works, handicrafts, furniture and value addition through export. Undoubtedly Bamboo and Rattans can revolutionize the economy of the State ensuring employment opportunities to a large number of people. Extension and awareness about bamboo and rattan sector development needs to be given renewed thrust.

5. Aims and Objectives

Considering the Ecological significance and vast economic potential of Bamboo and Rattans in the State, aims and objectives of the Bamboo and Rattan Policy shall be as under.

- 5.1 Protection and preservation of mountain ecology, protecting the mountain slopes by affording protection to bamboo forests and bamboo re-growth areas for sustained productivity and environmental security for the people. Protection and preservation of Rattan bearing areas. Protection, Conservation of rich biodiversity associated with bamboo forest and rattan brakes and re-growth areas and their future development.
- 5.2 Sustainable development and utilization of bamboo/rattan resources through scientific management and research.
- 5.3 Promotion of private bamboo/rattan plantation (individual and community owned) as the key thrust areas for future economy of the State.
- 5.4 Promotion of bamboo/rattan cultivation in the homestead as a cash crop and an essential component of agroforestry to generate income and to meet the contingent need of rural households in the State
- 5.5 Improvement of bamboo/rattan productivity in farm and forestry sector by use of biotechnology and improved management practices thus making bamboo plantation a profitable and attractive economic enterprise for securing adequate return on investment.
- 5.6 Promotion of bamboo/rattan based industries at cottage level, small scale, medium and large scale for utilizing the resources at a sustainable level for generating assured income.
- 5.7 Revitalization and promotion of local traditional bamboo/rattan craft and art with improved technology, design and market linked trade for value added items for export through industrialized mode of production.
- 5.8 Promotion of bamboo/rattan sector development as an essential component of rural development strategy linked with forestry and agri-business sector in the State promoting rural employment.
- 5.9 Promotion of bamboo/Rattan as an essential wood substitute by increasing bamboo/rattan production. Promotion of



enterprises manufacturing bamboo based products and wood substitutes thereby reducing pressure on forests and reducing wood deficiency in the State.

- 5.10 Promotion of awareness and understanding of bamboo as “Green Gold” among Farmers, traders, industry men in the State with a view to utilizing its full potential and to galvanize the rural and industrial sector in the State.
- 5.11 Effective exploitation of the economic potential of bamboo before the expected gregarious flowering in 2005-07.

6. Approaches to Bamboo and Rattan Sector Development

- 6.1 Conservation of bamboo & rattan diversity, bamboo & rattan germplasm and preservation of mountain ecology.
- 6.2 Use of bamboo/rattan forest and bamboo/rattan re-growth areas for affording protection in critical watersheds, human habitations, civil engineering structures like national and state highways, rural roads and hydropower project, etc.
- 6.3 Regulating bamboo/rattan exploitation by involving village councils/Joint Forest Management Committees (JFMCs) and facilitating gradual change over to agro-forestry management and practices.
- 6.4 Sustainable management and use of dedicated bamboo/rattan forests and bamboo/rattan re-growth areas for providing essential bamboo/rattan materials for traditional use and commercial use in bamboo/rattan based industries, handicraft sector and for bamboo trade and commerce.
- 6.5 Promoting bamboo/rattan cultivation in homestead, agro-forestry sector as a cash crop using improved high yielding bamboo/rattan species for income generation and supporting bamboo/rattan based enterprises and bamboo/rattan trade.
- 6.6 Promoting private bamboo/rattan plantation as key thrust area for achieving the objectives enshrined in the policy. The focus will be on developing the sector as market driven and people oriented.
- 6.7 Providing supportive administrative, institutional framework to facilitate all round bamboo/rattan sector development by evolving a framework of incentives, subsidy, technical and professional support in regard to planting material, improved plantation, technology, processing facilities and support services like training, credit, marketing, export facilitation, etc.
- 6.8 Identification of bamboo/rattan species for plantation raising and providing raw-materials to selected industries like bamboo mat board, flooring and edible shoots having high demand in domestic and export market and adoption of improved technology and market & export linkages and supportive investments to promote such plantation & processing enterprises in the State.

7. The Strategy

7.1. Protection of Ecology and Environment

- 7.1.1 Environment and ecology shall be protected and preserved and existing imbalance due to inappropriate land use, over exploitation of natural resources beyond carrying capacity shall be checked and prevented. The detailed action plan/guidelines will be formulated.
- 7.1.2 Bamboo/rattan forests and re-growth areas in critical mountain slopes and around village habitation shall be afforded protection to ensure environmental security (protection of catchment, regulation of water flow, recharge of water table, conservation of flora and fauna etc. and protection of development infrastructure like roads, bridges, hydel projects, human settlement, habitations, etc.)
- 7.1.3 All variety of native bamboo/rattan species, ecotypes shall be protected and germplasm preserved. Efforts shall be made to conserve germplasm in *in-situ* and *ex-situ*. Bamboo Resource Development wing will be co-coordinating agency with technological inputs from Department of Biotechnology, National Institute of Bamboo and Rattan, ICFRE Assam Agriculture University and other scientific institutes within and outside the State.

7.2 Bamboo/Rattan Resource Assessment

7.2.1 Mapping/ Inventorisation

Database in regard to bamboo/rattan is poor. Bamboo/Rattan resource assessment i.e. mapping and inventorisation of Bamboo/Rattan shall be accorded highest priority and shall be completed in 2 to 3 years. This may be clubbed with non – spectral data base such as roads, market, community users, resources/product movement. This will enable identification of resource catchment areas for each resource head in terms of total value, annual increment and determination of management requirements. Available expertise of Forest Survey of India (FSI), National Remote Sensing Agency (NRSA) and services of State Remote Sensing Application Centre and Department of Environment & Forests shall be utilized to carry out the mapping and inventory for which required fund support shall be provided.

7.3 Dedicated Land use for Bamboo/Rattan Development

- 7.3.1 Bamboo/Rattan rich areas having bamboo development potential and having Economic and Ecological significance must be identified, surveyed, demarcated and dedicated to permanent bamboo/rattan growing (in Government, Community, Private Sector).

7.4 Management of Bamboo/Rattan Resource in the State

- 7.4.1 Bamboo/Rattan occurs as a lower storey in Evergreen, Semi-evergreen forests along river banks and bamboo grows profusely in abandoned jhum lands. It occurs pure in bamboo-brakes. The existing bamboo /rattan resources within the notified forests and outside in Government lands and jhum lands and village council areas shall be managed on scientific lines, keeping in view the end use, socio-economic need of local people and industrial need.
- 7.4.2 Bamboo/Rattan within notified forests shall be managed as per approved management plan keeping in view sustainable forest management principles in association with local village communities (under Joint Forests Management concept). Present system of bamboo/rattan harvesting by mahals shall be replaced in a phased manner. The existing bamboo/rattan shall be harvested and utilized employing, improved and modern harvesting and utilization technology.
- 7.4.3 Bamboo/Rattan outside Govt. notified forests and in jhum land shall be managed i.e. conserved, protected and harvested (from dedicated bamboo/rattan areas under Government/Community control) on scientific lines. Appropriate guidelines shall be evolved in consultation with the village council. Local Administration Deptt. (LAD), Environment & Forests, Revenue, Agriculture and other development department. Harvesting would be done by village council/JFMCs through labour Co-operative Societies or family lease system.
- 7.4.4 As an incentive and to wholly involve the village council/JFMCs in conservation, protection and sustainable management of Bamboo/Rattan Resources in the respective village areas, bamboo management shall vest with village Council/JFMC Village Council/JFMCs shall be empowered to manage the Bamboo Resources for which Act/Rules shall be enacted Representative of Environment & Forest Department, Rural Department, LAD, Revenue Shall be represented in Village Council/JFMCs to ensure management of bamboo/Rattan resources is in conformity with Bamboo/Rattan Management Regulations for each village. Thus Bamboo/Rattan Resource Management will be a community enterprise with delegated powers/vested interest created to conserve, protect, harvest bamboo/rattan resource in the village council area involving willing families in bamboo/rattan production, management, harvesting and supporting bamboo/rattan craft, bamboo industries in the rural sector.

7.5 Protection from Fire

Bamboo/Rattan resources inside notified forests and in Village Council areas shall be protected from spread of fire. Every year a forest fire prevention strategy and measures shall be adopted and implemented by making joint efforts by various government departments, Village Councils and Social organizations. Required fund support shall be made available from government sources and village council fund (Bamboo/Rattan Revenue).



7.6 Regulation of Bamboo/Rattan Harvest

- 7.6.1 Bamboo/Rattan at present, is collected in an unregulated manner by villagers to meet their bonafide domestic need free or on payment of royalty. Bamboo/Rattan from Government Notified Forests is sold by Mahal system. With a view to manage the bamboo/rattan resources in a sustainable manner and to ensure a support base to increasing bamboo yield to meet the local need and export of bamboo/rattan and improved bamboo/rattan produce, annual bamboo/rattan harvest and yield need to be predetermined through silvicultural availability, felling regulation, seasonal requirement, market need and in consultation with all concerned and regulated so that bamboo/rattan resources are optimally harvested and used.
- 7.6.2 Where market need exists, limited bamboo/rattan shall be harvested from jhum areas by the respective Village Council/JFMC to meet the local bamboo/rattan need and industrial need.
- 7.6.3 In place of current system of harvesting of bamboo/rattan from forests by Mahalders, alternate means for harvesting on long term lease to individuals, community enterprise needs to be explored. A better, effective management system with greater involvement of local communities will be evolved.

7.7 Bamboo/Rattan Regeneration in Natural Bamboo/Rattan Stands

- 7.7.1 Bamboo/rattan re-growth and regeneration is not a problem in Bamboo/Rattan brake and open areas, however appropriate management method shall be evolved and employed to ensure quality Bamboo/Rattan yield, keeping in view the end use, need etc.
- 7.7.2 Natural bamboo/rattan stands shall receive the technical support of forests and Agriculture department and available incentive to improve productivity and regeneration of Bamboo/Rattan.
- 7.7.3 Species of bamboo like *Melocanna baccifera*, *Dendrocalamus hamiltonii*, *D. longispathus*, *Bambusa tulda* are commercially significant. However, management and regeneration strategy of natural bamboo stand shall focus on preferred species keeping in view the end use requirement.

7.8 Bamboo/ Rattan Plantation Development

- 7.8.1 Bamboo/Rattan Plantation needs to be created in next 6-7 years essentially to replenish the bamboo resources, which may be steeply depleted during expected gregarious flowering in 2005-07 and to replenish the over exploited rattan crop.
- 7.8.2 Bamboo/Rattan Plantation raising shall be encouraged and promoted due to their high value, productivity, uniformity of crop, choice of species linked to peoples need and industrial need. Such plantation of selected species shall be raised in private, community and Govt. sector. The required technical and scientific support and guidance shall be provided by the forests. Agriculture Department financial incentive shall also be given to willing beneficiary families interested in raising bamboo/rattan plantation from the State Agriculture. Horticulture Environment & Forests, Rural Development, Soil Conservation Department through funds from beneficiary oriented schemes. Such willing farmers shall also be granted lease land on specific terms and conditions for raising bamboo/rattan plantation in Government lands outside notified forests.
- 7.8.3 Bamboo/Rattan nurseries shall be established in the rural development blocks with selected species of Bamboo/Rattan and quality seedlings of colonel original shall be raised for meeting the requirement of bamboo/rattan plantation in region. A central nursery shall cater to the need of several blocks. Modern nursery and plantation technology shall be adopted and technical support and guidance provided to the Bamboo/Rattan Plantation programme in the Districts. Expert advice from National level institute like ICFRE. Agriculture Universities, State Forest Research Institute etc. shall be obtained for adoption, dissemination of improved nursery, plantation technology in the State.

- 7.8.4 Linkages between bamboo/rattan Plantation Growers and Enterprise, Industry and craft centres shall be established so that bamboo/rattan Plantations support bamboo/Rattan trade, industries and marketing of produce and products within and outside the State.
- 7.8.5 Accessibility and market linkages should be the guiding factors for site selection of bamboo/rattan plantations.
- 7.8.6 The guidelines and modalities for raising and maintenance of plantations shall be worked out by Environment and Forests Department.

7.9 Expected Bamboo Flowering and Strategy to Utilize Surplus Bamboo Before Flowering

- 7.9.1 Fullest possible utilization of bamboo before the expected flowering in 2005-2007 shall be encouraged & promoted. Scientific harvesting of bamboo inside and outside the Government Forests, Jhum lands shall be encouraged, by granting concessional rates of royalty so that bamboo is harvested and utilized locally for traditional uses including house construction, etc. Subject to fulfillment of local need, surplus raw/treated bamboo would be permitted for export under stipulated guidelines till the expected gregarious flowering in 2005-2007.
- 7.9.2 Bamboo harvest and establishment of Bamboo Enterprise, Craft Centres and bamboo industries in small and medium industry sector shall be encouraged through incentive frame work.
- 7.9.3 Improved design for house construction, increasing use of improved products from bamboo for infrastructure development works like constructions, road laying, retaining walls, jhum terracing, water harvesting structures and gabions shall be encouraged improved design and technology shall be obtained from National and International Institute to support and maintain such initiatives.
- 7.9.4 Bamboo Plantation in private, Joint Sector shall be encouraged with a view to establish a resource base at the district level to provide raw materials for the established industries in the State so that after the expected gregarious flowering, the established industries do not suffer from want of sufficient quantity of bamboo.
- 7.9.5 A State Level rodent control committee should be constituted for evolving a suitable strategy for combating the potential threats posed by the abnormal increase in rat population during gregarious flowering. The Committee will evolve suitable logistical linkages in terms of striking an adequate balance between preventive techniques and damage control exercises.

7.10 Bamboo/Rattan Trade

With the policy reform in regard to management, harvesting, utilization of natural bamboo/rattan resources in the State and promoting bamboo/rattan plantation development, it is expected that bamboo/rattan trade shall receive a fillip. With increased bamboo/rattan harvesting before the gregarious flowering and establishment of bamboo industries and with support incentive frame work, trade in bamboo and their products within and outside the State shall grow. It shall be the endeavor of the State to promote trade in bamboo/rattan and their products among the Assamese people. The Bamboo traders shall be organized in to trade association with linkage with bamboo/rattan growers and the bamboo processing industries and bamboo exporters to rationalize the bamboo/rattan trade practices. Export will be promoted

7.10.1 Treatment of Bamboo/Bamboo Products.

Bamboo is easily attacked by insects and fungi due to due to presence of starch and sugar in abundance. Prophylactic treatment of either bamboo or bamboo mats is very essential to enhance their life during storage. There are two types of prophylactic treatment, *i.e.* – (1) Traditional or Non-Chemical, and (2) Chemical.



7.11 Bamboo/Rattan Industries

- 7.11.1 The Bamboo policy framework shall be encouraged to promote establishment of bamboo/rattan enterprises and industries in cottage, small and medium industries sector linked to the need of Bamboo/Rattan produce/products within and outside the State e.g. manufacturing Bamboo/Rattan mat board, chop sticks, bamboo shoots, agarbatti sticks and other handicraft products. There shall be a thrust on bamboo industries development and associated incentives and subsidy framework shall encourage establishment of such industries and enterprises. Conjointly, the bamboo/rattan policy shall lay emphasis in adopting and using proven technology suitable for manufacturing improved quality products catering to very specific needs and markets and establishing linkages within and outside the State. While simple technologies and manufacturing processes can be adapted by cottage and handicrafts sectors, import of technology shall also be encouraged and adopted in small and medium sector industries to produce quality products for sale within and outside the State and for export purposes. Bamboo mat boards and bamboo ply boards can be promoted as wood substitute for the growing construction needs within and outside the State. This will not only result in a value addition to bamboo products but will also be a substitute reducing use of timber within the State. Use of bamboo and bamboo products shall be emphasized in Government constructions where such uses are feasible and incentives shall be given for use of bamboo products in private and community constructions. Standard housing designs for various constructional purposes shall be evolved taking help of national and international expertise available. Public Works Department building codes are also to be suitably amended to incorporate use of newly developed bamboo products.
- 7.11.2 Other Industrial use of bamboo is in manufacturing bamboo flooring, bamboo shoot industry and bamboo furniture in conjunction with timber and rattan. These sectors need adoption of improved technology, standard/improved designs and improved artisan skill, which will be actively promoted. Assistance of experts shall be taken in identifying suitable technology, product designs and in imparting training to artisans and craftsman. Promotion of Bamboo/Rattan industries would be undertaken by the State Industries Department. State Public Works Department (PWD) building code to incorporate provision for use of bamboo and newly developed bamboo based products for building applications.
- 7.11.3 High value products will necessitate effective and appropriate manufacturing process and market and export linkages. This policy shall encourage joint ventures with entrepreneurs outside the State including foreign enterprises with technology, finance and export linkages. This arrangement will channelise the resources through local traders and manufacturing industries in to domestic and international markets earning handsome revenue for the State. Present export policy in Agro-industry encourages such arrangement, which should also be adopted and encouraged for bamboo/rattan development in the State including incentive for the plywood industries to shift to bamboo as raw material base.

7.12 Entrepreneurial Development

Entrepreneurship will be promoted through organized and voluntary participation of people. The Government shall facilitate the growth of entrepreneurship skills through several means such as education and training, promoting group formation, providing supports such as funding, credit, leases, tenurial security and consultation with peoples groups and involving them in management committees.

7.13 Market Information Dissemination

Dissemination of information regarding existing markets within and outside the States to the growers, traders, bamboo/rattan enterprises, etc. would be done through brochures, involvement of media, IT Network, etc.

7.14 Research and Development

- 7.14.1 Research support for bamboo/Rattan sector to improve quality, enhance productivity and value of products, sustainable management, conservation of germplasm and diversified products would be promoted through interactive involvement with the National Institute of Bamboo and Rattan Development.
- 7.14.2 An interface with research wing of the Assam Agricultural University and technical Institute outside the State would be established for problem specific and site specific research regarding bamboo/rattan growing, plantation development, management of natural bamboo/rattan stands etc.
- 7.14.3 Appropriate Technology and Technology Transfer. Technology park would be set up to facilitate effective lab to land transfer. Dissemination of technology shall also be through campaigns involving media, exhibitions, demonstration centers, etc.

7.15 Human Resource Development

Adequate pool of trained manpower needs to be created for bamboo/rattan resource development, propagation and supply of high yielding planting material to farmers, harvesting, management, industrial production, infrastructural uses, marketing and export. Due emphasis would be given to training of personal within the State, Central Institutions and outside the country.

8. Funding Support

Funding support to implement the various policy initiatives enunciated shall be provided from the programme funds of the various development departments. While bamboo resource development within the notified Forest area shall be supported by bamboo/rattan development project under CSS through FDAs and JFMC to grow bamboo to ensure quality and sustained supply of raw materials. Development of bamboo/rattan plantation in agro forestry sector shall be supported from respective programme funds of Agriculture, Horticulture, Rural Development Department. Special programmes to finance bamboo/rattan plantation in farm sector shall be prepared for support institutional finance by NABARD and NEDFI. Establishment of craft centers, training of artisans and craftsman and establishment of cottage and small and medium sector industries can be supported by Government subsidies and institutional finance from industrial financing agencies and industrial investors and exporters. Support external finding shall be solicited from UNIDO, UNDP and other International funding agencies for supporting bamboo sector development including bamboo industries in the State.

9. Institutional Arrangement

9.1. State Level Bamboo/Rattan Coordination Committee

The implementation of bamboo/rattan policy and bamboo/rattan development programmes in the State shall be implemented by a number of development departments. Hence, it is necessary to coordinate implementation strategy through an apex body under the Chairmanship of Chief Secretary, Assam. A State Level bamboo/rattan development coordination committee shall be constituted with Commissioners, Secretaries and Head of Departments of line departments and representative from Trade, Commerce, Industries, Banks, NGOs and farmers with the primary function to review and coordinate implementation of bamboo/rattan development programmes in the State.

9.2 The State Bamboo/Rattan Development Agency

While the Sectoral fundings shall be utilized and implemented by various development departments to implement and facilitate the special funding arrangement for establishment of bamboo/rattan industries. Craft sectors, training and HRD and bamboo plantations to support the industries. A special agency namely Bamboo and Rattan Development Agency (BRDA) shall be established in the State drawing multi-sectoral experts from various development departments. Bamboo/Rattan Development Agencies (BRDA) shall report to the State level bamboo Coordination Committee & shall be responsible for bamboo/rattan development works under their charge.



9.3 Screening Committee for Grant of Licenses for Bamboo/Rattan Based Industries

An executive committee consisting of representatives of Departments of Environment & Forests, Industries, Finance, Trade & Commerce & Rural Development and Chief Conservator of Forests, (T) will scrutinize the applications from entrepreneurs and recommend grant of licenses for various categories of units for final decision by the Bamboo/ Rattan Development Agency. The Screening Committee will verify the availability of raw material, financial position, investment source and the entrepreneurial capability of the application and on merit recommend grant of Industrial licenses.

9.4 Bamboo and Rattan Resource Development Wing

A permanent Bamboo and Rattan Development wing will be set up in the Environment & Forest Department in the State. The Primary function of the wing would be resource development and providing technical expertise for conservation and management of bamboo/rattan plantation within Notified Forests and Plantations outside. A Chief Conservator of Forests will head the Bamboo and Rattan Resource Development wing.

9.5 Constitution of Task Force for Fast Track Implementation of Bamboo Development and Harvesting and Utilization before 2007 (i.e. before gregarious flowering)

Task Force will be constituted under the Chairmanship of Chief Conservator of Forests(T). It will be dedicated exclusively for formulating a strategy for harvesting and marketing for local industries and export before expected gregarious flowering i.e. 2005-07.

9.6 Bamboo and Rattan Development Institute

It is proposed to establish a Bamboo & Rattan development institute in the State with support funding by Government of India. The Bamboo and Rattan Institute, which will cater to the research and development requirement of bamboo/rattan development in the State shall be activity associated with implementation of bamboo and Rattan development programme.

10. Acts and Rules

It is proposed to establish a Bamboo & Rattan development institute in the State with support funding by Government of India. The Bamboo and Rattan Institute, which will cater to the research and development requirement of bamboo/rattan development in the State shall be activity associated with implementation of bamboo and Rattan development programme.

11. Action Plan

The policy shall be implemented through appropriate action plan packages and the implementation of programmes shall be monitored from time to time so that policy objectives are achieved.

12. Policy Review

The Policy shall be reviewed periodically so that essential policy directives and imperatives are evolved from time to time.





SECTION-V
**Recent Government Notification
on Transit of Bamboo**





V-A: Recent Govt. of India Order on Pan-India Card/ Transit Permit for Inter-State Movement of Bamboo

F.No.9-1/2016-FP (Vol.2)
Government of India
Ministry of Environment, Forest & Climate Change
Forest Policy Division

Indira Paryavaran Bhawan,
Vayu Wing, 6th Floor,
Jor Bagh Road, Aliganj,
New Delhi -110 003
Dated 09th October, 2017

To
The Principal Chief Conservator of Forests & HoFF's,
All States/ UTs

Sub: Pan India Card/ Transit Permit for inter-state movement of bamboo - reg.

Sir/Madam

I am directed to refer to the decisions of the meeting of PCCF & HoFFs of all States/ UTs held on 18.9.2017 regarding the amendment of Section 2 (7) of the Indian Forest Act, 1927 and Pan India Transit permit for movement of Bamboo. The minutes of the meeting have already been circulated to all the States/ UTs for information and necessary action.

2. In continuation of the above, the format for Pan India Permit for the transportation of bamboo throughout the country is enclosed. This will remove the hardships faced by farmers / traders while moving the Bamboo/Bamboo products across the country. The States/UTs may issue necessary directions for adoption of this national permit and if required the same may be incorporated in the respective transit rules of the States/UT's also.

3. The following operational guidelines may be adhered to in respect of the said permit:

- (i) Permit to be issued in bilingual (English and Hindi/Regional Language)
- (ii) Permit to be issued in four copies (one for DFO office, one for the trader, one for Range Office, one for concerned Conservator of Forests)
- (iii) Pass to have a limited validity of 45 days from the date of issue.
- (iv) No in lieu Transit Permit (T.P.) will be issued by other State. Only an endorsement to be made by the Check post of States in transit.
- (v) Gradually this system can be shifted to an electronic national portal system.

4. This may be accorded priority and the action taken report may also be furnished to the Ministry.

Yours faithfully,

(Noyal Thomas)

Deputy Inspector General of Forests (Forest Policy)
Tele fax: 011-24695323

Copy to:

The Chief Secretary, All State/ UT Governments

**Forest Department
Name of State**

Transit Permit for inter-state movement of all species of Bamboo within the Country

1. Details of Issuing Authority
 - a) Name of Officer :
 - b) Designation of Official :
 - c) Office Address with Telephone No.:
 - d) Email and Mobile Number :
2. Permit No. _____
3. Details of the person(s)/entity to whom the permit is granted:-
 - a) Name :
 - b) Aadhar Number/
Registration No. in case of a firm) :
 - c) Address :
 - d) Email and Contact details :
4. Date of issue :
5. Details of Produce :

S.No	Produce	Quantity in number / weight as applicable	Source of Origin	Remarks, if any
1	Bamboo Species: (i) (ii) (iii)			
2	Bamboo produce: (i) (ii) (iii)			

6. Route(s) by which bamboo produce will be transported:
7. Mode of Inter-State transport:
8. Details of Final Destination:
9. Marking through Transit by the concerned States:
10. Date of expiry of permit is 45 days from the date of issue (Date to be indicated):

DIVISIONAL FOREST OFFICER,

Forest Division
(Name, Date and Seal)



SECTION-VI

**Recommendations of Symposia/Seminars/
Workshops/Congresses/Conferences**





VI-A: All India Bamboo Study Tour and Symposium 4 December 1963 to 16 January 1964, FRI, Dehradun

Preamble

The role of bamboos in the rural economy of the country has since long been recognized and its utility as an essential raw material for paper and pulp industry and allied uses has further increased its importance in the national economy. Therefore, sound management and proper utilization of such a vital resource is considered essential for planned production which is necessary not only to meet the current demand but also to cater to the future requirements which are likely to be enormous.

In pursuance of a resolution of the Tenth All-India Silvicultural Conference held in 1961, this All-India Bamboo Study Tour and Symposium was organised by the FRI in collaboration with the States to study, amongst other aspects, silviculture management and utilization of bamboos and reeds. The symposium party consisting of some F.R.I. officers and delegates from the State Forest Departments, with Central Silviculturist as the Leader, toured ten States (U.P., Assam, Bihar, M.P., Orissa, Maharashtra, A.P., Mysore, Madras and Kerala) from 4-12-1963 to 16-1-1964 and made field observations and collected information during tours and also at State Sessions held in each State at the end of tours.

More than 38 papers, of both general and technical nature, were contributed to the symposium. Although about 136 species of bamboos belonging to the tribe *Bambuseae* (family *Gramineae*) occur in India, the Symposium party could study in some detail only the major commercial species of bamboos which included inter-alia *Dendrocalamus strictus*, *Bambusa arundinacea*, *Dendrocalamus hamiltonii*, *Bambusa tulda*, *Melocanna bambusoides*, *Oxytenanthera nigrociliata*, *O. monostigma*, *Ochlandra travancorica*, and *Teinostachyum dullooa*. The study included such aspects as silviculture and ecology of bamboos, their distribution, climatic and edaphic factors, management and exploitation, gregarious flowering, natural and artificial regeneration, yield, etc., subject to the limitations of time and availability of data.

Information from States not visited was collected by correspondence or by discussion with the delegates of the States participating in the study tour and symposium.

Based on observations during tours and discussions at the State Sessions and the Plenary Session, the symposium made the following recommendations while the detailed proceedings of the symposium along with papers contributed to it are being published separately. The recommendations are in two parts, viz., General and State-wise. The State-wise recommendations are based on the regional problems of each State.

Recommendations

A. Resource Surveys

Whereas no reliable data on the yield potential of bamboos is available in many States, and whereas a correct assessment of the existing bamboo resources in each State is considered imperative; It is recommended to conduct bamboo resource surveys as early as possible and to classify bamboo-bearing areas according to quality and density.

B. Management

Whereas (i) sound management is essential for sustained production, (ii) the resources of long-fibre raw material from bamboos and reeds are limited, (iii) the demand for domestic, commercial and industrial consumption is fast increasing, (iv) large forest areas containing bamboos and reeds are not fully exploited due to poor communications, (v) cost on extraction and transport requires to be minimised to get better return for the raw materials.

It is considered essential to augment production by improved management, stricter observance of felling rules, and intensive working; improved communications; and rational allocation of bamboo areas to the industry in order to help economic exploitation which is necessary for realisation of better royalty as a result of savings on transport, etc.

C. Utilization

Whereas existing resources of long-fibre raw materials from bamboos and reeds are limited and whereas rayon grade pulp could be manufactured from suitable pulpwoods and whereas there is need for augmenting paper production by supplementing bamboos with suitable pulpwood and other raw materials; and whereas gregarious flowering results in mortality of bamboos and reeds over extensive areas;

It is recommended that:

- (i) Paper mills be urged to utilize suitable broad-leaved pulpwoods in mixture with bamboos in the maximum possible proportion (which according to recent research could be as high as 80% woodpulp to 20% bamboo) in order to not only utilize the considerable resources from untapped broad-leaved pulpable species but also to tide over the slack periods of supply of long-fibred materials in the event of gregarious flowering of bamboos and reeds and to increase production from combined resources.
- (ii) Rayon grade pulp should be made exclusively from suitable pulpwoods and not from bamboos and reeds which are most needed for augmenting paper production.
- (iii) Raw materials like sabai grass, *Heteropogon contortus* and others, which are not fully exploited at present be utilized fully to supplement paper production.
- (iv) Exploitation of flowered bamboo be expedited by installing portable chipping units.
- (v) Improved processes for maximum recovery of pulp from raw materials be adopted by paper mills.

D. Natural Regeneration

Whereas natural regeneration following gregarious flowering needs tending and protection from fire and grazing for its establishment and early formation of exploitable clumps;

It is recommended that:

- (i) Suitable cultural operations be undertaken wherever necessary without detriment to principal tree species.
- (ii) Adequate protection from grazing and fire be ensured.

E. Artificial Regeneration

Whereas resources of bamboos require to be enhanced for meeting domestic, commercial and industrial requirements; large areas of degraded forests are to be rehabilitated and enriched; conservation of soil and reclamation of ravines is an urgent necessity in many places.

It is recommended that mixed or pure plantations of bamboos, depending upon the site and objects of management, be undertaken.

F. Forest Economics

Whereas large scale plantations of bamboos, pure and mixed, are being undertaken in many States for increasing supplies of raw materials to the industry.

It is essential to ensure that the investment in such plantations is financially remunerative with respect to the royalty that the industry should pay.

G. Gregarious Flowering of Bamboos and Reeds

Whereas it is essential to maintain authentic records on the periodicity of flowering in bamboo in different forest divisions; It is recommended that wherever gregarious flowering is observed in any locality, it is recorded in the Forest Journal both in the



Range Office and the Divisional Office and that maps showing the extent and progress of flowering in different years are maintained in each Range and copies supplied to the State Silviculturists for record in his ledger files. The Central Silviculturist should also be posted up-to-date with information of any gregarious flowering in any State.

H. Research

Whereas comprehensive knowledge on silviculture, management, physiology, productivity and suitability of various species of bamboos for different sites is essential:

Research is needed on the following items:

- (i) Removal of congestion in clumps (States):
- (ii) Study of growth behaviour and development of bamboo clumps (including longevity of culms; solidity of culms, effect of fire and grazing on production of new culms, formation of clumps, flowering of clumps and culms, measures to induce or delay flowering, studies on rhizome and root development, root competition with respect to trees, determination of age of culm for maximum cellulosic contents (States and FRI);
- (iii) Defining and standardizing of minimum size of clump (in terms of diameter and number of culms per clump) for economic exploitation of bamboo crops (States).
- (iv) Nutrient requirements of bamboos and also their uptake and return (States and FRI).
- (v) Use of fertilizers in artificial regeneration, particularly in region of low fertility (States).
- (vi) Suitability and artificial regeneration technique of various species of bamboos, including exotics and non-indigenous species, for different sites including the following (States and FRI).
 - (a) Ravines.
 - (b) arid sandy areas.
 - (c) saline, alkaline and degraded soils.
 - (d) grass-infested areas.
- (vii) Tree species both indigenous and exotic suitable for growing in mixture with bamboos (States).
- (viii) Genetical studies to investigate solidity, congestion, culm production and breeding for evolving improved strains (FRI).
- (ix) Determination of optimum felling cycle correlated with optimum intensity of cutting, including experiments on selective versus partial cutting and clear felling (States and FRI).
- (x) Growth statistics and yield (States).
- (xi) Best method of preserving dead bamboos for the maximum period to tide over shortages consequent to gregarious flowering (FRI).
- (xii) Identification and preparation of a complete catalogue and key of various bamboos and reeds of India (FRI).
- (xiii) Syn and aut-ecology of bamboos in different forests, with special reference to clump formation and gregarious flowering (FRI).
- (xiv) Most efficient and economic method of survey of bamboo, reed and cane resources (FRI).
- (xv) Strength properties of bamboos of various ages and localities (FRI).
- (xvi) Anatomical studies of different species of bamboos with a view to help their identification (FRI).
- (xvii) Suitability of different trees for pulping and determination of optimum proportion of short-fibre pulp from suitable pulpwoods in mixture with long-fibre pulp (FRI).

VI-B: Third International Bamboo Workshop KFRI & IDRC, Cochin 14-18 November 1988

Recommendations:

- Propagation of bamboos: Development of methods for collection, storage and exchange of bamboo seeds; increasing the efficiency of conventional vegetative propagation methods including the use of growth regulators, better containers, etc.; use of tissue culture methods for the mass propagation of bamboos.
- Conservation of the bamboo resource and its improvement: Collection of gene-pools in germplasm banks both in the regional and national contexts; germplasm exchange: the use of plant tissue culture methods to facilitate germplasm exchange was emphasized; collection of data on the flowering cycles of bamboo; work on the reproductive physiology of bamboos; research on the induction of flowering by both in vivo and in vitro methods; breeding and all items related to bamboo breeding for the improvement in quality; generation of variants through tissue culture.
- Estimation of the present resource base: Documentation of the existing stock through remote sensing and field surveys; development of a field-guide for the identification of the bamboos.
- Management of bamboo forests: Intensive management of monocultural stands; examination of the question of monoclinal versus polyclonal plantations; effect of spacing on productivity; management practices for maximizing production in unit area; effect of fertilization on productivity; intercropping of bamboos with other plants; work on the allelopathic characteristics of bamboo.
- Physiology, ecology and cytology of bamboos: Basic studies such as plant nutrition, plant-soil relationships, growth studies, water use efficiencies, photosynthetic efficiencies; matching of bamboos to soil conditions; effect of flooding on survival of bamboos; cytology of bamboos.
- Diseases and pests of bamboos: Protection from pests and diseases especially in plantations.
- Bamboo as a construction/housing material: Investigation into joints with bamboo to facilitate construction; strength properties as affected by specific applications; development of a design code for bamboo; establishment of an engineering database to facilitate the use of bamboo in the construction and building industry; bio-deterioration management and alternative architectural strategies.
- Utilization of bamboos: Continuous product development to ensure that bamboo remains in vogue including engineering products for urban and rural use; documentation and dissemination of cottage industry technologies.
- Economics of bamboo: Assessment of the employment generation potential of the bamboos; cultural-anthropological impact on product development; market surveys and development of marketing strategies; socio-economic implications of the depletion of the bamboo resource.
- Bamboo information system: The Bamboo information system should be able to complement each other in compiling and disseminating all available information on the monopodial and sympodial bamboos.



VI-C: Consultation on Constraints to Production of Bamboo and Rattan with Special Reference to Planting Materials and Management of Natural Stands, INBAR and Khoday Biotek, Bangalore 9-13 May 1994

Recommendations:

- In view of the fact that most methods of collecting seeds are sub-optimal for maintenance of viability, it is recommended that a manual is produced on practicable and scientifically optimal methods and also on methods of storing seeds. The latter should be linked to distribution methods to ensure maximum viability, genetic integrity and representation of original population structure.
- Quarantine procedures should be made known more widely. (It was noted that INBAR is currently producing up-to-date reviews of pathogens and that IPGRI has offered to develop safe methods for movement of germplasm after the INBAR data are available).
- To aid the ready availability of materials, national collections/orchards should be promoted. These should fill a strategic role in storage and distribution.
- Seed testing methods for the individual species need to be refined and information gathered together in an INBAR manual. In the first instance, these should be concentrated on priority species.
- Seed production areas, incidence of flowering and institutes from where seed can be obtained should be fully documented by national programmes, and data should form part of the INBAR Integrated Information System based in the two Information Centres in China and India.
- Various methods apply to different species. For priority species of INBAR, these should be summarized in a manual, possibly supplemented by audio-visual training kits, and wider training.
- Although protocols are not available for all species, they exist for many of the priority species. Rather than continued support to basic research, INBAR is asked to act as a focus, making known the protocols and which institutes have expertise, especially when there are interests in commercialization.
- INBAR should facilitate exchange of information by establishing a small group of experts to focus, in particular, on commercialization, exchange of materials and for better awareness by the tissue culture community on applied needs for development.
- Some strategic research is needed on in vitro rooting of minor nodes of bamboos and on the methods of transference to soil.
- It is strongly recommended that a study of cost-benefits be carried out on the alternative methods of propagation (including comparisons across various agencies and localities).
- Since supply and demand data for planting materials are not widely available, it is recommended that such data are estimated and analysed (taking into account different user groups) in each country of the region.
- Methods of selection and criteria for selection as well as identification of superior planting materials require focus. INBAR and IPGRI are asked to study how this can be done.
- Cataloguing superior (or plus) genotypes and "biotypes" should be vigorously pursued throughout the INBAR network.

Collecting germplasm of diverse flowering genotypes of some species and pooling them in collections requires INBAR action so that material is readily available for selection, and also to provide continuous seed production stands in the proposed national seed collections.

- *In vitro* flowering offers possibilities for genetic improvement. INBAR should explore how strategic research could be implemented in this area.
- It was noted that baseline ecological studies in natural forests and managed stands are inadequate. In particular, research on nutrient cycling, adaptive tolerances and water relations need continued research. To promote such research, it was recommended that a study be carried out of the eco-silvicultural ranges and potentials of priority species categorized by altitude, rainfall, temperature and soil and that known production be correlated.
- INBAR is asked to request national programmes to establish permanent sample plots in representative natural stands.
- There is a need to standardize inventory techniques.
- Since bamboo resources of many countries are in decline, it is important that bamboo research and development is duly recognized in national policies.
- A detailed survey of traditional management systems should be carried out and, furthermore, analysis of the impact of diverse systems should be conducted.
- New management practices for optimization of productivity should be developed.
- Enrichment planting should be promoted as a rapid way to increase productivity but insufficient data exist.
- Regeneration after gregarious flowering requires further study.
- Cost-benefits of various management systems need to be determined in relation to the delivery of planting materials and the role of bamboo in rural economies.
- The INBAR integrated information systems, to be based in the Information Centres in China and India, should pay due attention to making available databases related to the above areas of research.



VI-D: Expert Consultation on Strategies for Sustainable Utilization of Bamboo Resources Subsequent To Gregarious Flowering in the North-East, RFRI, Jorhat, 24-25 April 2002

Recommendations:

Resource Survey and Mapping

- The need for detailed resource survey and mapping of the bamboo resources of the north-eastern states is emphasized. Immediate action need to be initiated for developing a 'Bamboo-GIS' of north-eastern India in collaboration with INBAR, New Delhi; FSI, Dehradun; IIRS (NRSA), Dehradun; Forest Departments and RFRI, Jorhat. INBAR's plan/initiative in this respect should be capitalized.
- Identification and grading of all Muli (*Melocanna baccifera*) bearing areas for development interventions need to be done on priority basis.
- For the areas already surveyed like North Cachar Hills and Barak Valley in Assam, cohorts need to be identified and incorporated in the 'Bamboo-GIS'.
- Past flowering records need to be pooled together as soon as possible which will ultimately be incorporated to the 'Bamboo-GIS'. Rain Forest Research Institute needs to take up this job through its web site (www.rfri.org) All concerned are requested to lodge their bamboo flowering records at this web site.

Resource Extraction and Management

- The deplorable condition of National Highways and other roads like State Highways, District Roads needs to be improved immediately.
- The autonomous District Councils of States are to be supported with fund through the North Eastern Council for improvement of their road networks.
- Introduction of improved tools both mechanized and hand tools, for economic extraction of bamboos is recommended.
- Development of ropeways in hills for easy extraction of bamboo is recommended. Paper mills in association with the respective forest departments to initiate the work.
- The feasibility of transporting bamboos by waterways up to the 'Farakka barrage' and to Orissa & Andhra coasts through Bangladesh needs to be explored for making bamboo resources available at competitive rates for users at other parts of the country.
- Transportation of bamboo by rail at preferential rate needs to be enforced by the Railway Ministry.
- The present Mahal system for extraction of bamboos needs to be modified and local communities to be directly involved in all activities. Effective and workable transit rules need to be formulated on uniform basis for all the states. The TP (Transit Permit) system needs to be waived in selected priority areas to facilitate harvesting and transportation prior to flowering.
- A regional 'Bamboo Board' needs to be constituted to act as a nodal agency to deal with the entire gamut of activities associated with the gregarious flowering in Muli bamboo. The 'Board' needs to coordinate with the state level 'Bamboo Cells' and the district level Task Forces' to smoothly carry out various activities starting from felling, extraction, marketing to different parts of the country, export to neighbouring countries to the final restocking of the areas. The 'Board' should identify / establish marketing centers (mandis) at various places of the region for effective marketing of bamboo poles, semi finished and finished products.
- The Forest Departments of the affected states need to be supported by infusing adequate funds through the 'Bamboo Board' to take up the ground level activities of felling, extraction and regeneration involving local communities. Soft loans should be made available to these Forest Departments taking the gravity of the situation into consideration.

- The necessity of a 'gateway' in the form of a government / private body to coordinate the procurement of Muli bamboos for users in different parts of the country is emphasized. The HPC Ltd. has proposed to act as the gateway.
- The law and order situation for working in the forest areas should be improved by the respective State Governments.

Resource Utilization

- Cottage industries requiring minimum investment like Agarbati Stick, Tooth Pick, Bamboo Mats etc. need to be promoted by forming clusters comprising 5-10 nearby villages and providing them with know-how, hand tools, machine tools and the marketing avenues. The work initiated by CBTC, Guwahati and UNIDO need to be expanded and more such clusters need to be established for local utilization of Muli bamboo.
- The Hindustan Paper Corporation Limited and paper mills located at other parts of the country should be persuaded to first consume the stocks of Muli bamboo of the north-eastern region by suspending consumption of other species during the period of flowering. A temporary ban needs to be imposed on extraction of bamboos other than Muli throughout the country.
- The feasibility of establishing mini mechanical pulping and chipping mills at strategic locations & compressing pulp/chip into high-density sheets/blocks in the small-scale industrial sector need to be explored for long term storage & economic transportation by Roadways/Railways/Waterways.
- The export potential for the processed bamboo items like high-density pulp, mats, chips etc, to other parts of country and to neighbouring countries need to be explored immediately.
- The technology for high value products like laminated board, composite board, corrugated sheets etc developed by FRI, Dehra Dun and IPIRTI, Bangalore need to be tested for their suitability in Muli bamboo.
- The possibility of using the Muli bamboo fruit/seed that is rich in protein content for animal feed and oil extraction need to be explored immediately.

Regeneration of Logged Over Area

- The steep & inaccessible areas are to be left to regenerate naturally. Of the accessible areas it is recommended that 50% should be taken up for regulated natural regeneration by retaining 50-70 clumps/ha as seed bearers and clear felling rest of the clumps; 30% for mixed bamboo (site specific species) plantation having different flowering cycle & the balance 20% for mixed tree plantation in the clear felled areas.
- The clear felled areas need to be restocked quickly by increasing investments in better and more valuable bamboo and tree species, genetically improved planting material & silvicultural practices. The Planning Commission through MOEF, as a special case, should allocate adequate funds to the forest departments of the affected states to carry out this gigantic task of restocking the flowered areas involving the local communities.
- The ground agencies (Forest Departments and NGOs) need to start producing bamboo seedlings through 'Community Nurseries' by providing the local communities with training, improved propagules and other inputs.
- Emphasis is to be given by Rain Forest Research Institute, Jorhat, State Forest Research Institute, Itanagar and other research Institutes to Introduce Improved planting stocks having shorter extraction period.
- Hindustan Paper Corporations Ltd. should take up large-scale captive plantation in the degraded forestlands and wastelands. Ministry of Environment and Forests should give clearance to the respective Forest Departments to allot degraded forestlands to Hindustan Paper Corporation Ltd. on long term lease basis, as has been done by the Karnataka Forest Department to Mysore Paper Mills.
- Besides the captive plantations, the Hindustan Paper Corporations Ltd. should enter into agreement with individual farmers for raising bamboo plantations under agro-forestry/farm-forestry systems. The success of WIMCO Ltd. in poplar species should be emulated in bamboos. NEDFI, NABARD and other banks should be approached to refinance such industry-farmer nexus projects.



VI-E: National Seminar on Conservation and Management of Bamboo Resources, IFP, Ranchi in collaboration with NMBA, New Delhi 29-30 November 2007

Recommendations

Diversity and variability of bamboo resources and their conservation

- Efforts need to be intensified for documentation of genetic diversity and in situ conservation of bamboo.
- Taxonomical studies of bamboos for their natural classification should be relying upon modern tools such as molecular biology.

Management of bamboos in forest and non-forest area

- Bamboo plantations should be scientifically managed for optimum productivity and sustainable utilization.
- Principles of integrated pest management should be followed for ensuring protection of bamboos under natural condition.
- Suitable and sustainable Bamboo based agro-forestry models should be developed and their economics should be worked out before transfer to the field.

Physiology, biotechnology and clonal propagation

- Mass Propagation strategies should can make use of modern technology including biotechnology (eg., tissue culture etc.).
- Efforts should be made for ensuring development of rhizome in clonal plantlets to ensure better survival and field performance.

Economics, process and product development and value addition

- Emphasis should be given for plantation of area specific bamboo species for production of edible shoots.
- Efforts need to be made for optimum value addition at the local level so that tribals/ farmers may use the benefit for which capacity building as well as infrastructural support should be provided.
- Ethnobotanical studies of various bamboo species should be carried out with a view to improve their economic importance.

IFP should be designated as the Nodal Organization in Eastern India for coordinating bamboo research and technology dissemination in the region.

VI-F: National Conference on "Bamboos: Management, Conservation, Value addition and Promotion" TFRI Jabalpur 12-14 March 2008

Recommendations:

- It is recommended that distribution of bamboo flora in protected areas and establishment of protected areas, field gene banks and botanical gardens devoted to the conservation of bamboo with their associate species should be focused in scientific research.
- Expansion of field collection activities to support further work in taxonomy as the basis for investigating additional uses of bamboo and to assess the status and distribution of floral richness using modern techniques like molecular phylogenetic technique.
- Collection, evaluation, documentation, conservation and finally utilization of germplasm existing in gene banks should be included in the improvement programme.
- Research should be emphasized on development of region specific agroforestry models.
- Research should be needed to work on pre-sowing nursery management technique for production of bamboo seedlings.
- The Government should promote and support the establishment of bamboo enterprises and industries in small and medium scale industries sector linked to market within and outside the state through innovative products.
- Adoption of new technology on value addition of bamboo on commercial basis to meet the local demand as well as global demand.
- Promote and facilitate plantations and bamboo based industries like paper industries in suitable public private partnership (PPP) model.
- Suitable modification of harvesting rules in plantation to strike the balance between the need of change vis-a vis conservation and development of bamboo stock.
- Management should be focused during Harvesting of flowered culms to reduce fire hazard and utilize the resources in all forest areas through natural regeneration and plantations.
- Retail outlets (showrooms) of bamboos can be opened in district as well as state level to popularize bamboo products including handicraft, wood substitutes and processed shoots.
- Farmers, artisans, communities, entrepreneurs are to be promoted and facilitate for participation in different trade fairs at various levels.
- Macro-proliferation technology should be included in the operational guidelines for production of quality planting material of bamboo through tissue culture.



VI-G: International Conference on Improvement of Bamboo Productivity & Marketing for Sustainable Livelihood, NBM, Ministry of Agriculture, GoI, New Delhi, 15-17 April 2008

Recommendations:

Mass production and certification of quality planting stock: Recognizing that the non-availability of quality planting stock of desired species of bamboo is the major constraint in improving productivity and quality of bamboo, it is recommended that:

- NBM should take necessary initiative in collaboration with States, for establishment of clonal banks and clonal nurseries in different agro-climatic zone in India.
- NBM should support a bamboo breeding program in India.
- Guidelines and provision should be made for certification of nurseries and planting stock.
- States in collaboration with R&D organization should develop and implement program for genetic improvement of bamboos.
- Planting material could be a limiting factor for the development of bamboos. Tissue culture has potential but ways to be found out to make them affordable via text credits, etc.
- Presently bamboo is not eligible for carbon credit. Government of India jointly with International Network for Bamboo and Rattan (INBAR), pursue vigorously to make bamboo eligible so that it will be attractive for the Bankers, farmers and others.
- To strengthen and generate human resource in bamboo sector there is urgency to establish a National Bamboo on Institute.

Post-harvest management and storage: Realizing that there are significant losses and damage to raw material due to inappropriate management and storage of harvested bamboo, the house recommends that:

- Standard harvest schedules and methods should be developed for priority species of bamboo.
- Standard techniques should be developed for treatment of harvested bamboo for its protection during transport and storage period.
- Appropriate methods should be developed for seasoning of bamboo and bamboo products to avoid possible defects which may deteriorate the quality of raw bamboo as well as products.
- Eco-friendly, cost effective preservatives and efficient bamboo treatment techniques should be developed.

New Generation value-added products: Realization that low return form bamboo plantation and bamboo products detract cultivators and entrepreneurs to invest in bamboo sector, the house recommends that:

- More emphasis should be laid on development of value-added products and the necessary technologies.
- Inventory of high value products, technologies, production houses and R&D institutions should be prepare and the information should be made available in web.

Investment potential and marketing: Realizing that difficulties faced be cultivators and artisans in marketing their product is the major hurdle in the way of growth of bamboo sector in India, it is recommended that:

- Market facilities should be created for disposal of bamboo and bamboo products in key bamboo areas.

Daily market news bulletin should be displayed on bamboo web.

- Farmers, artisans and entrepreneurs should be made aware of availability and price of quality planting stock, new products, product designs and technologies through interactive web and t.v. programme.
- Public sector banks and financial institutions should be sensitized for extending easy loan facility to farmers and entrepreneurs.

Cultivation and Stand Management: Realizing that unscientific cultivation and stand management practices have led to very poor productivity and quality in bamboo, it is recommended that:

- Package of practices should be developed for improved productivity and quality of desired species of bamboo for different agroclimatic zone.
- Suitable Agroforestry models and practices should be developed for cultivation of bamboo together with agricultural/horticultural crops.
- Necessary training should be imparted to farmers for scientific bamboo cultivation and stand management.

Policy Issues: Realizing that forest laws regulating harvest and transport of trees are the major impediment to the growth of bamboo sector in India, it is recommended that:

- State government should relax rules for harvest and transport of bamboo within and between States to facilitate private cultivation and trade of bamboo.



VI-H: National Level Workshop on Productivity and Marketing of Bamboo and Its Products, Orissa Bamboo Development Agency and Xavier Institute of Management, Bhubaneswar 12 February 2009

Recommendations:

- There is a need for an increase in bamboo conservation and area under bamboo plantation.
- Supply of bamboo to artisans in a regulated manner is required to be taken care, as far as marketing of the bamboo is concerned material security is highly important.
- Immediate steps are required to be taken for analysis of the subsidiary silviculture operation, emphasize the cultivation of enterprise specific species and operational research labs in the country.

VI-I: National Seminar on Bamboo Plantation, Management and Its Utilization, AFRI, Jodhpur, 17-19 March 2009

Recommendations:

- The clonal propagation techniques of bamboos needs to be reviewed and a compendium should be prepared
- Since the major constraint for establishing large plantations of bamboo is availability of plantations due to long flowering intervals and also because the traditional vegetative propagation methods like offset and rhizomes cannot meet the increasing demands of bamboo plantation material, therefore conventional culm-cutting method should be standardized and made available to all bamboo growers and stakeholders
- Techniques of vegetative propagation should be developed with focus on threatened species like *Dendrocalamus stocksii*. Work on other threatened species should be encouraged.
- Efforts on seedling proliferation using plant growth regulators should be explored for better bamboo production
- The Macro-proliferation Technology of ICFRE has many benefits and can directly be used in forest nurseries for mass production of bamboo planting stock. Ever since the technology was developed in 1991, great interest has been shown in it. This technology should be further taken to the masses.
- Constraints to commercial micro propagation were discussed. Constraints can be industry related, such as availability of market, availability of right micro propagation protocols or the constrains can be species specific and can have variable responses. It was suggested that at researcher level, efforts should be made to consider timely transfer of technology once developed and its continuous demonstration. Lack of follow-up after project period is one important constraint. The administration should facilitate post project funding for continued support that can lead to commercialization
- The bamboo handicrafts sector needs to be strengthened to respond coherently to unveiled national and global opportunities and capitalize the emerging horizons of international market.
- Pharmaceutical and nutraceutical potential of bamboo leafy biomass needs further exploration and research
- Focus should be on sustainable utilization and value added applications of bamboo, creating rural livelihood and rural enterprise. This is critical in achieving national success in bamboo sector.
- Bamboo also has potential in combating environmental pollution and climate change. This area should be explored further.
- Leaf Protein Concentrates (LPC) is a concentrated form of proteins found in leaves. The possibility of bamboo LPC should be explored and can serve the nation in meeting the requirements of protein rich feed to children particularly in the poor areas.
- Several constraints in bamboo marketing and trade in India were deliberated upon. It was found that there are many constraints such as:
 - bamboo still not widely recognized as a wood substitute
 - at national level, there is no standardized measuring unit, uniform size demand in the market
 - there is no scientific demand and supply position assessment so far done
 - lack of market intelligence



VI-J: National Seminar on Productivity Enhancement and Value Addition of Bamboo, IFP, Ranchi, 09-10 March 2010

Recommendations:

Management of bamboos in natural forests and plantations for optimal productivity

- Understanding natural bamboo resources through proper inventory and mapping preferably in GIS domain is required.
- There is a need of managing bamboo flowering and natural regeneration for
 - Achieving staggeness in flowering mainly for selected species.
 - Regeneration (AR and ANR) of flowered area and developing strategies for their utilization.
- Traditional Indigenous Knowledge (TIK) on production and management of bamboo resources should be documented and applied.
- Criteria and indicators for sustainable management of bamboo resources need to be developed.
- Species specific package of practices for various bamboos should be evolved.
- Development of site specific agro forestry models while incorporating interests and concerns of farmers and bamboo entrepreneurs based on end uses, and giving preference to indigenous species.
- Government should make suitable policy amendments for promotion of bamboo like other plantation crops and may fix minimum support price for bamboo poles/timber, providing a margin of profit for the growers.

Approaches and techniques for conservation, improvement and mass multiplication

- Ideotype-based selection of bamboo for Agro forestry system should be done.
- Modern tools and scientific approaches are to be applied to estimate the genetic diversity within species for its improvement and conservation.
- Parameters of mechanical and physical properties should be standardized and used uniformly during evaluation.
- Proper selection of bamboo species for agro-forestry practice should be based on regional basis.
- Bamboo processing industries, research and development, technical education and extension needs to be given priority in the state of Jharkhand for marketing and enhancement of livelihood development of local people.

Development of value added processes and products; Utilization and market linkages

- Inventorization of the latest range of value added products being processed in industries both in India and overseas and identification of suitable species needs to be carried out.
- Current and expected market potential for various value added products both for local and global markets should be evaluated for data generation.
- Identification and screening of bamboo species for energy production is required.
- All national efforts for value addition of bamboo should have an approach which is market oriented.
- There should be proper documentation of nutritional content before and after value addition of bamboo shoots.
- Grading rules should be formulated for various end uses of bamboos.

- A National Programme should be launched to create mass awareness for the nutritional benefits of bamboo shoots and food security commensurate with scientific management and harvesting of bamboo shoots.

Socio-economics of bamboo trade and entrepreneurship development

- Individual as well as cluster based entrepreneurship should be promoted by creating conducive environment and investment by public - private partnership for setting up mass production units.
- Policy support for promotion of bamboo based furniture and building materials as wood substitute is required.
- There should a thrust on setting up of bamboo Interpretation centers in bamboo growing areas for demonstration of technologies for resource production, value added products and capacity building through specific training programmes.
- Statutory provisions for movement of bamboo poles should be made simpler and a time frame be stipulated. The transit permit should be relaxed for exotic species like *Dendrocalamus asper*, *Guadua angustifolia* and domesticated bamboos like *Oxytenanthera stocksii*.



VI-K: International Seminar on Bamboo for Livelihood and Community Development, World Bamboo Organisation and Nagaland Bamboo Development Agency, Kohima 16-18 September 2010

Recommendations:

General Declaration

1. **Bamboo for a Green, Clean and Healthy Mother Planet:** We emphasise the unique potential and significance of bamboo in mitigation of the gravest challenges of the twenty-first century, being deforestation and global warming; and call upon all stakeholders to act locally and globally in harmony to generate awareness and to bring in effective policy shift, financial back up and infrastructure support to create an environment conducive to holistic development of bamboo sector to secure a green, clean and healthy mother planet.
2. **Participatory Approach in Planning and Review of Implementation:** We urge the Governments of bamboo growing nations to set up appropriate mechanism to associate elite academic bodies and institutes of technology; eminent scientists and professionals; representatives from industries, civil society and community organisations – national and international - in framing strategy and action plan for development of bamboo sector and review of implementation thereof with free on time access to documentation of these activities on official websites.
3. **Development Grassroots Upward for Equity and Sustainability:** We recognise the vast yet untapped potential of bamboo to improve quality of life and to generate prosperity even in rural areas of the developing world by pursuing judicious integration of traditional as well as modern industrial applications with the strategic approach for development from grassroots upward for equity and sustainability.
4. **Convergence of Activities to Promote Micro-Enterprises & Employment:** We call upon all stakeholders in the bamboo sector – local and global – to recognise the importance of convergence of their diverse activities to retain focus on building village level micro-enterprises close to resource base and to enhance livelihood and employment generation as primary objectives.
5. **Technology & Management Model for Enhanced Productivity & Coverage:** We express deep concern on the tardy progress in many bamboo growing nations in enhancing productivity and in augmenting area coverage; and we call upon these governments to closely follow success stories elsewhere in the world to adopt, adapt or to develop new technology and management models suited to each target species in keeping with its agro-climatic conditions, ownership status, etc. We appeal further to those governments to put in place appropriate policy and legal framework as well as access to institutional finance and other cost opportunities to encourage development of private farming as well as industrial plantations. We emphasise further to promote participatory forestry with bamboo as a priority species, subject to agro-climatic limitations, in government forestland with 100 per cent right on bamboo harvest to the forest community in the capacity of management partner of the government based on appropriate MoU.
6. **Innovation & Product Development Initially Targeting a few Exportable Products:** We reiterate the urgency for the bamboo growing countries, lagging behind in technology and commerce, on concerted action on species specific innovation, product development and adaptation both for traditional as well as industrial products with the strategy to invest time and resources initially to produce only a few high value products targeting major export markets to build skills and expertise needed to compete globally.
7. **Financial Feasibility Study of Bamboo based Enterprises:** We emphasise the imperative need to promote professionalism in banks and other funding institutions in financial feasibility study of bamboo based enterprises to ensure support and clearance to viable projects; and urge the concerned authorities for appropriate capacity building to that end.

8. Access to Global Carbon Credit to Benefit Bamboo Growers & Entrepreneurs We note that bamboo sequesters CO₂ much faster than other forest and plantation crops and that it meets the requirements for Clean Development Mechanism (CDM) under the Kyoto Protocol such as socio-economic and environmental criteria for sustainability, cost benefit analysis, etc.; and urge the bamboo growing nations for initiating steps for entry into global carbon credit mechanism to benefit bamboo farmers and enterprises and to attract investments.
9. UN Millennium Development Goals: We recognize the enormous potential of bamboo as a resource and as an enterprise to contribute directly and significantly to achieve three out of the eight millennium goals - to eradicate extreme poverty from bamboo growing areas; to ensure environmental sustainability through increased carbon sequestration and by substituting tropical timber; and to develop global partnership for development of the bamboo sector for sustainable benefit to the world community.

India - Specific Declaration

1. Revocation of Statutory Regulations on Harvest and Transit of Bamboo: We reiterate the need for the bamboo growing States in India to utilise their powers under the Forest Act to withdraw statutory regulations on transit of bamboo to stimulate growth in the sector with enthusiastic participation of farmers, traders and industries in keeping with the mandate of the National Bamboo Mission of India; while continuing persuasion with the Ministry of Environment & Forests, Government of India to effectively and permanently mitigate the hurdles arising out of regulation on harvest and transit of bamboo in forest and non-forestland by an amendment of the Indian Forest Act to delete the provisions treating bamboo as a 'tree'.
2. Export Promotion Capital Goods (EPCG) Scheme: We recognise the multiple constraints in the bamboo sector in India for resource generation and sustained supply; technology deficit and lack of trained manpower; and the perceived need for a more responsive policy and legal framework vis-à-vis enormous potential of bamboo to improve livelihood of rural masses and its comparability with other cash crops. We, therefore, strongly recommend treating bamboo at par with 'agricultural products' for the purpose of concession on Custom Duty under the EPCG Scheme; and to grant a total moratorium on export obligations under EPCG Scheme for ten years from the date of issue of notification introducing the proposed moratorium.
3. Safeguard duty on import of bamboo products from China: We note with concern that import of bamboo products from several South East Asian countries has surged in the past few years causing injury to the nascent Indian bamboo industry, and urge the Government of India, therefore, to impose 30 per cent safeguard duty on import of bamboo products.
4. Exemption from Value Added Tax: We call upon the concerned authorities to grant exemption for ten years to industrial bamboo products and handicrafts from Value added Tax in consideration of the fact that this is an emerging sector of immense potential for economic emancipation, especially of the rural poor, of the bamboo growing states of India; the potential of the sector in employment and wealth generation through plantations and rural enterprises; multiplicity of challenges the sector faces at this nascent stage due to scarcity of appropriate technology and trained personnel, policy and legal framework not yet adequately responsive for development of the sector.
5. Commodity Body for Bamboo: We emphasise the importance for declaration of bamboo as a commodity at par with tea, coffee, rubber, spices, coconut, etc. and the need for constituting an Indian Commodity Body for Bamboo in view of the immense potentials of the sector to provide Single Window Solution, from resource generation to value addition and certification to marketing for the sector; and to facilitate international cooperation by networking with the International Commodity Body for Bamboo and other global technology or funding agencies for the benefit of the sector in India. We further suggest that it would be prudent and effective if a worthy professional institution already active in the sector takes on the role; and considering the pioneering role, competent technical back-up, rich experience in project formulation and implementation, consultancy, networking; and the advantage of its location in the North East, the Cane and Bamboo Technology Centre (CBTC), Guwahati fits the bill; and we recommend CBTC be designated as the Indian Commodity Body for Bamboo in India.



6. **Bamboo Value Addition Park:** We note that bamboo value addition units – handicrafts and industrial - utilise raw material in diverse forms beginning from bamboo culms to intermediate products like sticks, slivers, strips, bamboo mats, treated poles, etc. We appreciate under the circumstances the importance of establishment of integrated chains of selected bamboo based units together in an appropriate locality to internalize, to the extent feasible, backward and forward linkages within the system for targeted cooperative action for mutual benefit; and we, therefore, appeal to the Government of India to provide 100 per cent grant-in-aid to bamboo growing states to create sound basic infrastructure for Bamboo Value Addition Parks with top grade road network, water supply and effective drainage, electric network substation and other common facilities of warehouse, training centre-cum-conference-hall, communication hub, fire station, security, etc. to encourage and facilitate prospective entrepreneurs to venture into the yet largely uncharted territory of bamboo based industries
7. **Campaign for Bamboo:** We emphasise the vital need for bamboo as an appropriate vehicle for both grassroots and industrial development; its ameliorating environmental attributes; unique potential in mitigation of the challenges of deforestation and global warming; the beauty and utility value of bamboo products; and the pride that one is entitled to for his or her service to the cause of environment and ecology by using products made of bamboo instead of wood; and call upon the Government of India to organize well planned long term orchestrated campaign through electronic and print media to create awareness, support and participation of citizens for the development of the bamboo sector.
8. **2020 Vision to Bring Smile to Billion Faces:** We recognize the enormous potential of bamboo as a resource and as an enterprise to enhance quality of life and prosperity in the relatively under developed bamboo growing regions of India and impress upon the Government of India and the State Governments and all other authorities and stakeholders in the bamboo sector to remain committed to the 2020 Vision to make India a prosperous, happy and secure nation, where the rural and urban divide is reduced to a thin line; and wherefrom poverty is eliminated bringing smile to billion faces.

VI-L: National Seminar on Bamboo Productivity in Forest and Non-Forest Areas, FRI, Dehradun, 30-31 January 2014

Recommendations:

- **Need for Improving Bamboo Productivity Database Management Practices:** The prevailing poor data management and reporting practices were highlighted as one of the reasons for reported low bamboo productivity in the country. The available bamboo productivity data in the country was based largely on the inferences drawn from the bamboo sale data maintained by the state forest departments. The removals by right holders, forming significant part of the annual bamboo production, were generally not included in these records. Lack of reliable comprehensive productivity data was adversely impacting the resource strengthening initiatives in the country. An immediate need for putting in place a comprehensive and reliable system of data management based on actual removals of bamboo from forests, both by right holders for domestic consumption and by the forest departments for commercial purposes was highlighted in the Seminar. The initiative by the National Bamboo Mission in developing a national bamboo database was appreciated by all and it was recommended that the National Bamboo Mission should make efforts to develop the proposed dynamic national bamboo database at the earliest and also chalk out a parallel program to build capacity of the designated state nodes in data updation and management.
- **Need for High Quality Germplasm:** Non-uniformity of bamboo germplasm that was available for plantation programs was highlighted as one of the main issues coming in the way of enhancing bamboo productivity. It was pointed out that main source of bamboo propagation remained seed, with no mechanisms to certify the productivity credentials of its source. It was strongly recommended to initiate comprehensive programs for (a) screening and developing genetically superior germplasm in respect of commercially important bamboo species, (b) making available the superior germplasm on mass scale through macro and micro propagation methods, and (c) extend farmers friendly propagation technologies through training programs, on-field demonstrations and establishment of clonal nurseries at farmers' field. The initiative by the National Bamboo Mission in developing nursery stock certification protocols was appreciated with the recommendation to finalise the same and make these operational at the earliest.
- **Need for Rehabilitation of Bamboo Flowered Forests:** The poor rehabilitation of many bamboo areas in the country post-flowering came out as an important area of concern. Many of the flowered bamboo areas were reported to have come under weed infestation and the stocking of rehabilitated areas was reported to have drastically reduced, affecting the local artisans the most. The State Forest Departments and the National Bamboo Mission were called upon to initiate and implement focused programs to develop and rehabilitate the bamboo-flowered areas.
- **Need for Encouraging Scientific Bamboo Farming:** The bamboo as an agro-forestry crop was reported to have good potential for enhancing bamboo production in the country. Benefits of high density plantations to meet energy requirements were also highlighted. It was recommended to develop sound and replicable protocols and promote scientific farming of different bamboo species, including for high density plantations, across different agro-ecological zones in the country. These protocols would need to be based on right species selection, assurance of quality planting material, improved management practices including irrigation, fertilization, pest management, and harvesting regimes.
- **Need for Modifying the Present Practice of Calculating Bamboo Yield:** The existing practice of calculating bamboo yield "by area", as was being presently followed in the Working Plans, usually tended to include many areas with very low frequency of bamboo clumps, pulling the average productivity figures/ hectare down. It was mainly due to this reason that the average bamboo productivity figures in the country were worked out to be less than one metric tonne/ hectare/ year, whereas bamboo productivity of more than 10 metric tonne/ hectare/ year for plantations was reported by many authors in the Seminar. It was recommended that a more reliable data in respect of bamboo productivity, especially for plantations, was required. Calculating bamboo yield "by number of clumps" instead of "by area" was suggested to be one of the options to have more realistic productivity data.



- **Need for Uniformity in Units of Bamboo Trade:** The different states in the country were following different measurement units to record bamboo harvest and trade data, viz. metric tonnes/ notional tonnes/ air-dried metric tonnes/ cubic metres/ numbers (score), etc. This practice was making it difficult to collate data at the national level and encourage bamboo trade across different states. A need for putting in place a uniform system (measurement unit) for recording bamboo harvest and sale data was highlighted with recommendation that the National Bamboo Mission should initiate a comprehensive study on the issue and suggest improvements in the system.
- **Need for Strengthening Programs for Capacity Building of Bamboo Crafts persons:** Bamboo is generally viewed as a group of plants having vast potential for improving socio-economic condition in rural areas in the country through its use in craft. There was, however, a need to create capacity of the people to develop high value bamboo articles. It was recommended that wide ranging national programs to build capacity of the rural artisans in bamboo craft be initiated towards developing bamboo based cottage industry in the country and enhancing cash incomes of rural artisans.
- **Need for Enabling Policies and Regulatory Regimes:** The existing policies and regulatory regimes related to cultivation, transport and trade of bamboo from forests and from even homesteads as well as the ones related to import of bamboo and its products came out as major stumbling blocks in promoting bamboo cultivation in the country. The farmers rued that they were finding it difficult to transport bamboo harvested from their fields in view of the Forest Department's regulations. It was recommended that a thorough review of the existing policies and regulatory regimes at the state and at the national level be taken up and enabling policy and regulatory regime structure developed to promote bamboo in the country. Some of such policies and regulatory regimes are:
 - Comprehensive review of the regulatory regime related to harvest and trade of bamboos from forests and private lands with the state and across states.
 - Review of provisions under Land Ceiling Acts and Income Tax laws to allow for relaxation under these Acts to attract private investment for bamboo plantations.
 - Rationalisation of Import Duties to encourage growth of bamboo sector in the country.
- **Bamboo for Rehabilitation of Difficult Sites:** Bamboo, with its intricate rhizome system, has come to be accepted as having good potential to stabilise and rehabilitate difficult sites, and promising results of afforestation of degraded lands and ravines were shared in the seminar. It was recommended to initiate large scale programs for restoration of degraded sites, soil and water conservation, stabilization of gullies, reducing run-off across the country.
- **Promotion of Hill Bamboos:** Hill bamboos, playing a very significant role in the rural socioeconomics and in hill ecology, came up in the seminar as a largely neglected group of bamboos. The National Bamboo Mission was called upon to initiate programs with focus on this group of bamboos and promote actions to strengthen their resource base through afforestation and agroforestry.

VI-M: National Seminar on Recent Advances on Bamboo Research and Development in India, RFRI, Jorhat, 6-7 February 2014

Recommendations:

- There is a need to develop mechanism for certification of bamboo seeds which is a very important aspect in bamboo research and the certification of finished bamboo products, especially the generation of standard handicrafts keeping in mind the globalisation scenario.
- Institutes of ICFRE can act as Nodal Agencies and establish Bambusetum of different species in different states so that various organisations can come and seek advice regarding bamboo plantation and these institutes must be generous to share the collected materials.
- Rules and regulations apart from other forest policy/s are a problem not only in Northeast but also in other states like Karnataka. Bamboo Society of India and National Bamboo Mission must take these issues with a nation-centric view and frame some rules and regulations for industrial important species.
- There is need to strengthen the linkages between industries and all the concerned agencies dealing with bamboo at the national level.



VI-N: National Seminar on Hill Bamboos – An Important Resource for Improving Rural Livelihoods, HFRI, Shimla, 17-18 October 2014

Recommendations:

Socio-economics of bamboo products, trade, marketing and entrepreneurship

- Since the raw material resource is scanty, the extraction of the Nirgal for manufacturing the products should be in a scientific and sustainable manner.
- State Forest Department should grow nurseries of hill bamboos and undertake plantations to strengthen the resource base on forest lands, community lands and promoting integration with agricultural crops.
- Need to diversify the product design and quality for better socioeconomic outcome through trainings.
- Need for better treatment and seasoning to increase the longevity of hill bamboos products.
- Need to conserve and develop Nirgal for carbon sequestration along with livelihood sustenance.

Hill bamboo propagation through improved nursery techniques and biotechnological interventions

- Standard protocols for micro-propagation, macro-propagation/ techniques for multiplying hill bamboo on large scale should be worked upon and be extended to the field for adoption and replenishing the continuing depleting hill bamboos resource.
- The priority of Hill Bamboo in plantation programmes should be enhanced from to high priority.
- The work on filled/ empty seeds in hill bamboos needs to be studied in detail both for sporadic and gregarious flowering.
- Expertise of all organizations, working in propagation of hill bamboos be pooled for exploiting hill bamboo for improving rural livelihoods in future.

Management of hill bamboos in natural resources including resource augmentation

- Hill bamboos, in view of their critical role in local socio-economy and ecology, should be included under National Bamboo Mission as a special group.
- There is need of research on diversity, phenology, utilization and ecological aspects of hill bamboos.
- Fodder and nutrition values of Hill Bamboos need to be worked out since the fodder is used during the winter season when there is scarcity of the fodder.
- Management of invasive weeds in temperate regions should be worked upon through planting of Hill Bamboo.
- Plantation of Hill Bamboos as under-storey should be encouraged in temperate forests.
- *Sinarundinaria fulcata* and *Thamnocalmus falconeri* should be encouraged to grow in agroforestry systems between 1800 m to 3000 m amsl.
- *Sinarundinaria falcata* can be taken into Silvi based agroforestry systems whereas *Thamnocalmus falconeri* into Horti based agroforestry system.
- Hill bamboos dominated area should be conserved for sustaining the large mammal (Herbivore) population during resource scarce and breeding period.
- Creating awareness amongst masses and ensuring participation of State Forest Departments and local people for its conservation and management.

- There is need of mapping of population and modeling using GIS based platforms.

Potential of hill bamboos for enhancing livelihoods:

- Mass community mobilization capacity building for development of hill bamboos needs to be emphasized.
- Innovations/ scaled-up designs for commercialization of hill bamboos for livelihood options.
- Formulation of cooperative and cluster concept for marketing of bamboo products.
- Promotion of nurseries for production of analytic planting material by renowned agencies/ organizations.
- There is need of rebuilding of population after post flowering and screening for high quality germplasm.
- Simplification of transit rules for bamboo products.



VI-O: National Seminar on Role of Technology in Enhancing Bamboo Use, FRI, Dehradun, 4 November 2014

Recommendations:

Bamboo for diverse uses

- Promote use of engineered bamboo products like panelling, flooring and even structural bamboos in government sector as well as in private sector to lessen the burden on wood resource.
- Wherever possible, try to adapt the existing technologies followed by the wood industries.
- In-depth research into construction design using Indian bamboo species for earthquake prone areas needs to be carried out vigorously in collaboration with premier technological institutions.
- Scientific research into the potential of bamboo as an energy source needs to be taken up urgently and the existing knowledge needs to be shared between stakeholders like industry and research sectors. Parameters like heat value, content, calorific value, gases evolution etc. need to be studied.
- The flooding of Indian market by Chinese bamboo composites requires to be looked at as an inspiration to modernizing our existing technologies and adopting new ones urgently using Indian bamboos.
- The bamboo processing machine Industry needs to upgrade itself to meet global standards. Equipment for fast and economic harvesting of bamboos needs to be designed.
- Preservative treatment of bamboos to be made mandatory by all industries so that service life and acceptability of bamboo products as an alternative to wood could be enhanced.
- Lack of co-ordination between Industries and Research organizations is a matter of serious concern to all involved in the bamboo sector. This can be circumvented only by collaborative/interactive research projects among them.
- Govt. should promote bamboo houses in place of brick houses under NREGA with at least 50 per cent houses constructed by using bamboos.
- Production and promoting use of bamboo corrugated sheets developed by IPIRTI as roofing material needs to be taken up by manufacturers.
- Mechanical strength measurements of culms to be adopted.
- NMBA or NBM should support initiatives for inputting technology in bamboo structures that are coming up.
- Adoption of cluster models developed in Tripura by other States.
- Promotion of Bamboo for water channels and bridges.
- International standards for bamboo products should be developed further and standards for bamboo management to establish step-by-step bamboo specific certification schemes need to be prepared.
- Technological awareness should be extended to stakeholders through news channels, trade fairs, etc. A separate channel may be introduced or added as a part of "Krishi Darshan" programme every day.

Bamboo cultivation:

- An accredited National agency should be established to ensure supply of quality bamboo planting stock. Cost of quality planting Bamboo material to be brought down by promoting mass propagation ventures through incentives like financial support and buy-back arrangements.

- Farmer-friendly bamboo propagation technologies need to be demonstrated at district/block level to train farmers for producing their own low cost bamboo planting stock.
- Provision for introduction of premier bamboo species native to other countries into India and standardization of cultivation practices for maximizing the productivity of the most important of those species for various regions should be taken up by research institutes and made available to farmers.
- Government should promote entrepreneurship by smaller craftsmen.
- Government should facilitate loans for growing bamboos and allow subsidy for tube wells and chemicals.

Marketing of bamboo and bamboo products

- National Bamboo Mission may take lead role for adoption of a uniform unit for measuring bamboo yield data at National level.
- Marketing strategies for bamboo and its products need to be developed at the National level in such a manner so that all the stakeholders involved in the trade are benefitted.
- The success story of KONBAC should be shared with Industries so that a healthy competition may develop.
- Bamboo surveys should include homestead production (district-wise) along with the bamboo in forest areas.
- A community-based market information system may be developed at national, regional and local levels for quick dissemination of market intelligence to promote bamboo trade.
- Harvesting and transportation of bamboo and bamboo products should be made free from all legal bindings particularly from the Forest Departments.



VI-P: National Workshop on Exploring the Best Practices in Bamboo Management: Investing in Green Gold, Madhya Pradesh State Forest Department and NBM, 24-25 January 2015

Recommendations:

Bamboo management in forest areas

- There is a need for certified planting stock in order to ensure the quality of the product. It is necessary to recognize the role of community in the management of nursery and the requirement based planting material, keeping in mind the end user of the product.
- It is prerequisite to ensure right kind of bamboo for the right farmer. Monoculture was the another issue which should be avoided by allowing natural associates to grow.
- There is an increasing need to create massive awareness and increase ownership by the community.
- The selection of species should be done taking into consideration the agro climatic zones.

Bamboo management in private areas

- Demonstration plots, of around 1-3 hectares, may be taken up at different place to generate awareness amongst the farmers and help them in producing better products leading to higher price and benefits.
- The role of clear felling in bamboo management may be examined form farmers point of view.
- There should be segregation of different types of bamboos at depots. Products can be segregated according to market requirements in the depot and the final products can be used for furniture makings, incense sticks and biomass industry.
- Support price should be based on the species, diameter and length of the pole.

Bamboo nursery and quality planting stock, Monitoring and evaluation practices in bamboo sector: The third group discussed about Bamboo nursery and quality planting stock and Monitoring and evaluation practices in bamboo sector. The group gave the following recommendations:

- Bamboo resources (culms per ha) in the state can be broadly divided in 5 zones monitored under different management objectives for bamboo production and restocking of the clumps

Bamboo region	Management objective	Expected produce
Bamboo in Semi-Moist region	High production through intensive management	80,000
Bamboo in Dry Teak forest	High production through management	60,000
Bamboo in E. Vindhyan region	Sustainable production and restocking	40,000
Bamboo in W. Vindhyan region	Sustainable production and Restocking	20,000
Bamboo in Miscellaneous forest	Sustainable production and restocking	20,000

- Nursery of bamboo should only be raised through certified seeds essentially.
- There is a need to introduce silviculture intervention for removing congestion in degraded bamboo forest.

- Genetic improvement of the existing species and introduction of new species for different agro climatic zone can be done. Germplasm bank of bamboo at State level should be maintained.
- Identifying the end-uses in different region and ensuring management of bamboo to cater the demands of the local market.

Skill Development, Capacity Building and Product Management

- Need to ensure proper intense research, Product designing and Product manufacturing.
- Introduction of Certified diploma courses and refresher courses in colleges and institutes.
- Regular Skill development for Private entrepreneurs especially in newer bamboo application and technology.
- Development of aggressive marketing practices like IT, Media, social networking sites, creation of consumer awareness, buyer – seller meet, demonstrations, etc.



VI-Q: Regional Seminar on Livelihood Opportunities with Bamboo and Rattan in the North-East India, ARCBR, Mizoram 14 March 2015

Recommendations:

- The bamboo resources of Mizoram and other neighbouring states are predominant with *Melocanna baccifera* which may be a challenge to the local society and to the environment during the next flowering cycle. The house expressed an immediate concern for species diversification in bamboo plantations by using quality planting stock. It was recommended to explore the possibilities of introducing suitable species for mixing with existing and future plantations.
- Though *Melocanna baccifera* and other species have huge potential to produce edible shoots, silvicultural practices are needed to be standardized to significantly enhance the productivity. Research projects on these aspects should be taken up by Advanced Research Centre for Bamboo and Rattan in collaboration with Joint Forest Management Committees /Village Forest Development Committees. Bamboo shoot has a huge market and therefore, ARCBR must develop a complete package of practices right from harvesting to export.
- To understand the present scenario of species-wise distribution and density, mapping of bamboo resources is an utmost important task of immediate concern. ARCBR should immediately take up the mapping of bamboo resources in collaboration with the State Forest Department of this region. Bamboos are one of the important resources of the North-Eastern region. The dependency of the local people is very high on bamboo for meeting their requirement of housing and other day to day needs. Bamboos are being over exploited for paper mills and other industries. Natural Bamboo areas have reduced in some of these states considerably.
- Though Mizoram and other NE states are 'surplus bamboo States' in the Country, utilization of bamboo resources is not up to the mark and therefore, it is recommended to explore new dimensions of value addition for promoting innovative uses of bamboo based raw materials for the benefit of the people of this region.
- The house also appraised the need for setting up of the new bamboo based industries like small paper mills and other handicraft industries by using modern machineries so that the bamboo resource can be utilized to its full strength and ample job opportunities are generated for the local. In this regard it is decided to make collective efforts to develop such projects in collaboration with Indian Plywood Industries Research and Training Institute, Indian Institute of Technology, Guwahati and State Forest Department.
- It was also advocated to establish a 'Community Common Facility Centre (CCFC)' at ARCBR to train the local communities for skill upgradation and facilitate innovative usage of bamboo.
- The house proposed to install bamboo Chipper Machines on-site to reduce the transportation cost and labour and time of supply of semi-processed raw materials to the bamboo based industries.

VI-R: Seminar on Bamboo Resource Management and Advances in Utilization Options, IWST, Bengaluru, 23-25 February 2016

Recommendations:

- Development of cost effective technology in a mechanized way is needed for the development of bamboo sector.
- Bamboo regeneration is also one key area to think.
- Value added products from bamboo have to be given more importance since bamboo is well known in terms diversity of products. Optimize bamboo products according to demand.
- Integrate technology transfer and strengthening of the marketing sector for bamboo is required. As Kerala Government has stopped growing bamboo as no taker for bamboo.
- Wood preservative and prophylactic treatment is not given much importance to store the bamboo in forest as well as in private land (Post harvest management is the most neglected field in the bamboo sector). More emphasis may be given to this aspect.
- Power generation from charcoal and ethanol production has to be looked into bigger way.
- Farmer should be involved the research group right from the beginning of the project.
- Develop suitable management protocol for utilization of dead Bamboo culms
- Digitized maps of flowering of bamboo in different locations and should be made available, which can help in collection of suitable quality planting materials.



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