

# *Bamboo and Rattan Resources in Odisha*

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# Contents

## ■ Acknowledgement

Abbreviations

Foreword

Executive summary

## ■ Chapters

1. Introduction - Odisha
2. Assessment of bamboo and rattan in Odisha
3. Bamboo and rattan cover & species distribution
4. Inventory of current uses of bamboo & rattan in Odisha
5. Economic value of bamboo in Odisha
6. Benefit cost analysis for potential use of bamboo for land restoration
7. Conclusion & recommendations

## ■ References

### Tables

1. Bamboo bearing areas in Odisha
2. Bamboo growing stock in Odisha forests
3. Bamboo outside recorded forests
4. Forest types with natural occurrence of bamboo in Odisha
5. Production of agarbatti sticks under ORMAS
6. Estimated value of current important bamboo uses in Odisha

## ■ **Figures**

1. Location map of Odisha
2. Bamboo bearing forest areas, Odisha
3. Distribution of bamboo species in Odisha
4. Rattan (Canes) spp. Distribution in Odisha
5. Bamboo and cane handicraft centers in Odisha
6. Recorded production of forest bamboo, Odisha
7. Odisha bamboo areas with transport network

## ■ **Annexures**

1. Forest and bamboo areas under working plans
2. Methodology for inventory of bamboo resources
3. Success story of bamboo plantations in backyards/other lands in Nayagarh district
4. Bamboo plantations under OBDA
- 5a. A success story of private bamboo plantation in private land in Bolangir district
- 5b. A success story of bamboo plantation in private land in Mayurbhanj District
6. Main characteristics, occurrence and uses of bamboo species found in Odisha
7. Protected Area in Odisha with natural occurrence of bamboo
8. Recorded production of bamboo from forests in Odisha
9. Recorded production of canes in Odisha
10. Draft Odisha Bamboo Policy
11. Common facility centers/ bamboo bazaar established under OBDA
12. Legal provisions and regulations related to bamboo
13. Short List of participants at multi-stakeholders consultative workshop on 12<sup>th</sup> January 2106 at Bhubaneswar
14. District wise waste lands and degraded lands in Odisha
- 15a. A case study of bamboo plantation with intercrop in Ramanguda, Mayurbhanj district
- 15b. A case study of bamboo plantation with intercrop in Maa Bhairabi micro-watershed, Mayurbhanj district.
16. Cost benefit analysis of bamboo plantations with intercropping

## Acknowledgement



This report is about a pilot study of the Global Assessment of Bamboo and Rattan (GABAR) program recently launched by International Network for Bamboo and Rattan (INBAR), which is an inter-governmental international organization headquartered in Beijing, China. INBAR merits to be lauded for launching this innovative initiative, which is highly relevant and timely, especially for better understanding and knowledge sharing about Bamboo and Rattan resources on the planet.

This report is an outcome of extensive statewide surveys, travels, inventory work and consultations with various stakeholders associated with bamboo and cane sector in Odisha. That, inter-alia, includes the state forest department, Odisha Bamboo Development Agency, divisional forest officers, entrepreneurs and traders, artisans, bamboo cultivators, NGOs, nodal persons of various bamboo clusters and Community Facility Centers, apart from drawing upon state entity and other documents, published reports and research outcomes related to bamboo, forests and overall landscape in the State.

I place on record our gratitude to INBAR for assigning this important assignment, and hereby express my appreciation for the HEADS team members and all organizations and individuals, without whose support the completion of this task would not have been possible in such a short time. I wish to make special mention of Mr. H.S.Upadhyay, Project Director, OBDA, Mr. Pravakar Sethi, Conservator of Forests, O/O PCCF Odisha, Mr. Subhdarshi Mishra, MD & Mr. Jyoti Mohanty, SPARC, Bhubaneswar (for helping in the preparation of bamboo/cane cover maps), Mr. Ashok Sarada, Mr Govind Mohapatra, Mr Basudeb Pati, Mr. Satish Sahu, Mr. Partik Joshi, Mr. Bharat Dhal, Mr. Ananta Mohanta and Mr. Ravi Mohapatra.

Among other meetings and workshops, an enlightening multi-stakeholder consultative workshop to interact with various stakeholders was held in Bhubaneswar on 12<sup>th</sup> January 2016, facilitated by OBDA, it merits recognition, also appreciation for the contribution of participants. Thanks are due to all other individuals whose names are not mentioned above, but who patiently provided requisite data and answered questions put to them during various interactions in the field, bamboo bazaars and at Bhubaneswar.

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### Abbreviations



<b>BMB</b>	Bamboo Mat Board
<b>BMCS</b>	Bamboo Mat Corrugated Sheets
<b>BMVC</b>	Bamboo Mat Veneer Composite
<b>CF</b>	Conservator of Forests
<b>CFC</b>	Common Facility Centre
<b>COP</b>	Conference of Parties
<b>DFID</b>	Department for international Development
<b>DFO</b>	Divisional Forest Officer
<b>DGPS</b>	Differential Ground Positioning System
<b>EC</b>	Executive Committee
<b>EDC</b>	Eco Development Committee
<b>EGW</b>	Equivalent Green Weight
<b>FD</b>	Forest Department
<b>FRA</b>	Forest Rights Act
<b>FSI</b>	Forest Survey of India
<b>GABAR</b>	Global Assessment of Bamboo and Rattan
<b>GIS</b>	Geographic Information System
<b>GOI</b>	Government of India
<b>Ha</b>	Hectare
<b>HEADS</b>	Hari Environment And Development Society
<b>ICAR</b>	Indian Council of Agriculture Research
<b>IDRC</b>	International Development Research Centre
<b>INBAR</b>	International Network for Bamboo and Rattan
<b>INDC</b>	Intended Nationally Determined Contribution
<b>IIT</b>	Indian institute of Technology
<b>IPIRTI</b>	Indian Plywood Industries Research and Training Institute
<b>ISFR</b>	India State Forest report
<b>ITC</b>	Indian Tobacco Company
<b>JICA</b>	Japan International Cooperation Agency
<b>KFRI</b>	Kerala Forest Research Institute
<b>LCA</b>	Life Cycle Analysis
<b>MFP/NTFP</b>	Minor Forest Produce/ Non Timber Forest Produce
<b>MoEF</b>	Ministry of Environment & Forests (recently renamed as MoEFCC)
<b>MoEFCC</b>	Ministry of Environment, Forests and Climate Change
<b>MT</b>	Million Ton
<b>NGO</b>	Non-Governmental Organization
<b>NMB</b>	National Bamboo Mission
<b>NMBA</b>	National Mission on Bamboo Applications
<b>OBDA</b>	Odisha Bamboo Development Agency
<b>OFSDP</b>	Odisha Forestry Sector Development Project
<b>OFSSP</b>	Odisha Forestry Sector Support Project
<b>OFDC</b>	Odisha Forest Development Corporation
<b>ORMAS</b>	Odisha Rural Marketing Society
<b>PA</b>	Protected Area
<b>PCCF</b>	Principal Chief Conservator of Forests
<b>PRI</b>	Panchayati Raj Institutions
<b>R&amp;D</b>	Research and Development
<b>RF</b>	Reserve Forest
<b>SHG</b>	Self Help Group
<b>SPARC</b>	Spatial Planning & Analysis Research Centre
<b>Sq. Km.</b>	Square Kilometer
<b>TDCC</b>	Tribal Development Cooperative Corporation
<b>VSS</b>	Vana Samrakshyan/Surakshya Samiti

## Foreword

Do we really know about bamboo and rattan and its potential to create jobs, boost local economies, support forest regeneration and reverse land degradation? Not fully. This is the reason for a global assessment, which promises to bring together a wealth of existing practical information on the development of these resources.

INBAR's new global initiative, the Global Assessment of Bamboo and Rattan (GABAR), aims to boost rural incomes and protect forest resources, and unlock the potential of bamboo and rattan for rural communities for creating jobs, local income streams, and regenerating degraded lands and forests. GABAR is a partnership of the INBAR Secretariat and its members (currently 41 countries), and a range of national and international partners. The initiative aims to work with countries and producers of expertise on bamboo and rattan to increase the visibility of these two plants and share information across countries.

GABAR was first launched in Durban, South Africa, at the World Forestry Congress in September 2015. This was followed by launch of this initiative in Indore, India, at the Global Bamboo Summit in April 2016.

GABAR is intended to produce new evidence to inform the global post-2015 development agenda and guide countries to include bamboo and rattan resources in national sustainable development action plans. As it evolves, the Initiative will produce a knowledge base of practical information, tools and policy guidance. It is designed for countries and development partners to use to include bamboo and rattan resources in their green development plans. These resources and tools will highlight benefits, such as job creation; private sector development; value chains for rural areas; cases and scenarios; rapid landscape restoration approaches; or climate-smart activities being applied today at national and village level.

If countries are to craft development policies and action plans based on bamboo and rattan, they need much more precise information on the extent, and potential limitations, of these resources. They also need examples of value chains and business cases that are validated and can be used as the basis for investment plans. There are many good examples out there but much of this is anecdotal and needs further scrutiny, as a basis for scaling-up.

India has the second largest bamboo resources in the world with huge potential to contribute to the country's economy and sustainable development. This report is the result of a first extensive study commissioned by INBAR for Odisha state, a state situated on the eastern coast of India and endowed with natural growth of bamboo. The study ranged from an assessment of available bamboo and rattan in the State and covers a roadmap for the management of the resource to harness its full potential.

INBAR sincerely thanks Mr A.K.Bansal, HEADS, India, and the team, the Odisha State Government, the Odisha State Bamboo Mission and all those officials involved, for their support in carrying out this study, and acknowledges the enormous efforts to come out with this comprehensive report that should benefit the stakeholders in general and in particular the state of Odisha.

Dr Hans Friederich  
Director General

### Executive summary

International Network for Bamboo and Rattan has launched a new initiative of Global Assessment of Bamboo and Rattan (GABAR) for unlocking the potential of bamboo and rattan resources. Although benefits of bamboo and rattan are known and recognized throughout the world, the opportunities available for new and innovative uses need to be better understood. Goals of GABAR include synthesis of existing data, assessment for generation of new information, and filling knowledge gaps.

India has the second largest bamboo resources worldwide and the sector has huge potential to contribute to sustainable development. A pilot study for GABAR was conducted for Odisha, a state situated on the eastern coast of India and endowed with natural growth of bamboo in about 20% of the total forest areas of the state. Moreover, people have also been planting bamboo in their private lands. Bamboo in Odisha has been an integral part of traditional culture and socio-economic milieu and a large section of state's population depends on bamboo in more than one way.

*Dendrocalamus strictus* and *Bambusa bambos* form the bulk of bamboo found in the forests. *Bambusa vulgaris* and *Bambusa nutans* are extensively cultivated in homesteads and private lands. The state does not have significant cane bearing areas, except in Khurda division.

In the present study, bamboo bearing forest areas have been mapped based on the information extracted from the forest working plans and the state forest cover map. Species distribution maps of bamboos in forest as well as in private lands, and canes have also been prepared. Status and uses of bamboo in the state have been studied and also the constraints in the development of bamboo sector. The major application areas include rural housing, for scaffolding in urban constructions, handicrafts, and baskets for use in agriculture, betel farming, and bamboo shoots. In western Odisha local people use bamboo shoots, locally called karadi, as food supplements and in making pickles. Dried shoots, (locally called hendua), are added to a number of dishes prepared from vegetables and fish to get special flavor. Balasore, Puri, and Ganjam are the main regions having good demand of bamboo for betel farming.

The main industrial use of bamboo for manufacturing paper started around 1936. Large forest areas were allotted to paper mills on long term lease till nationalization of bamboo working in 1988, and continue to be managed under "Culm Selection-cum-Clump Improvement" system for production of raw material for paper industry. Starting in the 1990s, paper mills shifted to fast growing hardwoods and hence demand for forest bamboo reduced drastically. Consequently, extraction of bamboo from the forests has reduced from 3-4 lakh tons in eighties to practically zero in recent years.

The economic value of ecosystem services of bamboo forests has been estimated and is about Rs. 10,000 million per annum, whereas the current use value of bamboo in various applications is Rs. 1,600 million per annum.





There is a need to look for other potential industrial uses of bamboo in the wake of reduced demand of bamboo for paper manufacturing. The study has revealed that the state has enough potential for new applications of bamboo, such as bamboo food and beverages, bamboo bio-energy, charcoal and also bamboo fabric. India's commitment under Intended Nationally Determined Contribution for the period 2021-2030 to create additional carbon sink of 2.5 to 3 billion tons equivalent through additional forest and tree cover is a great opportunity for development of bamboo sector due to its high carbon sequestration potential along with creation of additional livelihood opportunities through industrial and handicraft sectors.

Odisha has sizable land areas that are degraded to various degrees and offer a good opportunity to restore and reclaim these degraded lands through bamboo plantations and create additional livelihood opportunities for the rural/tribal people. Financial analysis of raising bamboo plantation with suitable intercropping reveals a benefit-cost ratio of 3:1 with an Internal Rate of Return (IRR) of 21%. The economic benefits can be further enhanced through traditional value addition activities of handicrafts and local processing of bamboo for feeding other industries.

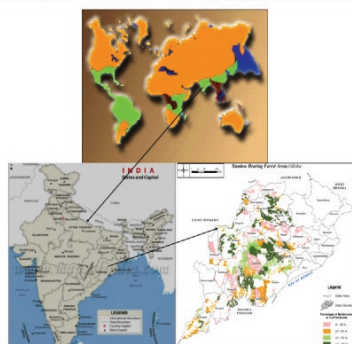
It is concluded that Odisha has sizable area under bamboo in forests as well as in private lands, and has potential to raise additional bamboo resources through reclamation of degraded and wastelands to meet the requirement of specific bamboo processing industries. Bamboo sector can contribute significantly for the socio-economic well being of poor and under privileged tribal and rural people by addressing concerns of Shelter Security, Food Security, Livelihood Security and Ecological Security through strategic planning for development.

Suggested roadway for the management of bamboo resources of the state to harness its full potential includes (i) Integration of bamboo development activities of various departments by creating an empowered nodal agency; (ii) Detailed survey of bamboo resources in forest and private areas comprising species-wise areal extent, clump density and vitality, and regeneration status and preparation of geo-reference and GIS compatible maps; (iii) Redefining bamboo management prescriptions to facilitate working of bamboo area for production of raw materials for different industrial uses; (iv) evolving simplified procedure for harvesting and transport of bamboo from private areas; (v) developing plantation models for different regions in the State and financial/technical support for adopting bamboo plantation as an important economic activity; (vii) Identification of suitable industry specific bamboo processing zones, based on current availability and potential for growing required species; and (ix) Certification of selected bamboo forest and chain-of-custody certification to promote export of bamboo products.



# Chapter 1 Introduction

**Figure 1 Location Map of Odisha**



Odisha is situated on the eastern coast of India between 17° 30' N to 23° N latitudes and 81° 30' E to 87° 30' E longitudes. Bounded on the North by Jharkhand and West Bengal, on the South by Andhra Pradesh, it is flanked on the West by Chhattisgarh state, with the Bay of Bengal washing its entire East Coast (Figure 1). Total geographical area of the State is 155,707 sq. km.

The State on the whole is characterized by a very diversified topography and its river system has a direct outlet to the Bay of Bengal. On the West there is a mountain system, which is a continuous range of hills broken by the Mahanadi valley that constitutes the northern end of the Eastern Ghats. Topographically the State can be divided into four zones, namely The Northern Plateau: covering Mayurbhanj, Keonjhar, and Eastern parts of Sundargarh District; The Central Zone consisting chiefly of the valleys of Mahanadi with its numerous tributaries, the Brahmani and Baitarani with their tributaries extending over Sambalpur, Bolangir, Dhenkanal and parts of Kalahandi, Sundargarh and Kandhmal districts; The Eastern Ghats consisting of the undulating plateau extending over Koraput and portions of Kalahandi, Kandhmal and Ganjam districts; and The Coastal Region - a belt of flat open country formed mainly by the alluvium and silt brought down by the river systems flowing to the Bay of Bengal more or less parallel to the coast extending over Balasore, Cuttack, Puri and parts of Ganjam district.

There are three well-defined seasons in the State. The cold season from mid-October to mid-February, the hot summer from mid-February to June, and the rainy season from July to October. The rainfall is mainly derived from southwest monsoon. Average annual rainfall of the State is 1500 mm with 75 rainy days. Mean annual maximum temperature is 32.8°C which rises to 38.3°C in April-May and falls to 29.4°C and 35°C in June and July respectively. The mean minimum temperature is 22.7°C which falls to 15°C in December-January.

Total population of the State is 41.97 million as per the latest 2011 census (3.47% of total population of the country -recording a decadal growth rate of 14.05% compared to 15.94% during the previous decade). Economy of the State depends mainly on agriculture sector, including agriculture, animal husbandry, fisheries and forestry subsectors, which provides employment and sustenance, directly or indirectly, to more than 60 percent of the population. About 35% of rural and 17% of urban people were below poverty line. About 35 % of the total area is under cultivation, of which 60% is irrigated. 90 % of total land holdings are marginal and small covering 70% of the cultivated area. About two-fifth of the population comprising Scheduled Castes (16% of total population) and Scheduled Tribes (22% of the total population) are socio-economically disadvantaged groups. Large segment of this population lives in the vicinity of forests. Of the total about 51,000 villages in the State, 29,200 villages are forest fringe villages, which is around 16% of the total number of such villages in the country.



## Chapter 2

# Assessment of bamboo and rattan in Odisha

Bamboo resources in the State are largely situated within the forests extending over 58,135 sq.km. [Reserved Forest 26,329 sq.km., Protected Forest 15,524 sq.km, and Un-classed (including Revenue Forest) 16,282 sq.km]. A sizable proportion of forest area is degraded in varying degrees due to heavy pressure from both human population and cattle population<sup>1</sup>. According to the latest -13th India State of Forest Report (FSI, 2015) based on interpretation of satellite data (October 2013- February 2014), the total forest cover of Odisha is 50,354 sq. km. [7,023 sq. km. Very Dense Forest, 21,470 sq. km. Dense Forest, and 21,801 sq. km. Open Forest], which is 32.34% of the State's geographical area<sup>2</sup>. The State ranks 5<sup>th</sup> among India's States and Union Territories in terms of forest cover.

The State is endowed with natural growth of bamboo in its forests, generally as understory mixed with various dominant/co-dominant tree species, and limited areas as pure bamboo breaks, except three districts namely Mayurbhanj, Keonjhar and Nabarangpur which have no natural occurrence of bamboos. Bamboo bearing forest area is managed according to approved Working Plans prepared every ten years. However, the Working Plans<sup>3</sup> cover only 36,640 sq. km. forest areas in 33 Forest Divisions. In addition, about 8,000 sq.km forests are in protected areas (national parks and wild life sanctuaries) is managed under wild life management plans. Thus about 20% of the total forest area, which may contain bamboo clumps, is not covered by working/management plans. Of these 33 Forest Divisions, six -namely Baripada & Karanjia, Rajnagar, Cuttack, Keonjhar and Nabarangpur, have practically no bamboo bearing areas. In the remaining 27 forest divisions, total bamboo management area is 13,969.06 sq. km., which is about 47.75% of the forest area in these divisions and 38% of the total forest area covered by working plans in the State. Division/District wise extent of bamboo areas covered by management plans is recorded in Annexure 1. Considering that about 20% of the forest area is not covered by management plans, actual bamboo area may be more than 13,669 sq. km.<sup>4</sup>

While preparing working plans of the forest divisions, sample enumeration of bamboo clumps is done but information about total bamboo growing stock in the state is not compiled at state level.<sup>5</sup>. As a part of National Forest Inventory being undertaken by the FSI, data about bamboo resources is also collected along with forest inventory data following an elaborate

<sup>1</sup> Cattle population in the State was 23.51 million, 4.35% of country's livestock population as per the 18th Live Stock Census, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India (GoI).

<sup>2</sup> The Forest Survey of India (FSI), Ministry of Environment, forest, and Climate Change, GoI has been undertaking biennial assessment of forest cover of the country since 1987.

<sup>3</sup> Working plan is a ten year management plan containing detailed description of the forest areas covered, rights, concessions and privileges of the people in surrounding villages, condition of forest resources, analysis of past management practices and results thereof, and prescription to be followed during the plan period.

<sup>4</sup> The website of Odisha Bamboo Development Agency (OBDA) mentions mixed bamboo forest area of the State to be about 17,795 sq. km. in addition to pure bamboo forest (occurring mostly as bamboo brakes) extending over 375 sq.km.

<sup>5</sup> There is wide variation in clump density (number of clumps per ha) and number of culms per clump in bamboo forests across the state. Rairakhol Forest Division clump density ranges from 30 -158 per ha. with average number of culms to be 12-16 in the areas sampled during preparation of working plan. Similarly, in Puri Forest Division clump density was found to be around 6-7 per ha. In Angul Division average clump density was 66 per ha. with average culms per clumps to be 18. In Balliguda Division average clump density was 65 per ha. with average culms per clumps to be 11. In Koraput Division average clump density was 24 per ha., with average culms per clumps to be 20. In Rayagada Division average clump density was 20 per ha. with average culms per clumps to be 20. In Nayagarh Division average clump density was 67 per ha. with average culms per clumps to be 13. In Parlakhemundi Division average clump density was 29 per ha. with average culms per clumps to be 22. (Working plans of the respective Forest Divisions)

## Bamboo and Rattan Resources in Odisha, India

**Table 1**  
Bamboo bearing areas in Odisha

Description	Bamboo bearing area Odisha Sq. km.	Bamboo bearing area India Sq. km.
Pure bamboo	35	1,240
Dense bamboo	2,479	52,068
Scattered bamboo	5,230	60,596
Clumps completely hacked	1,066	9,511
Bamboo regeneration	1,708	16,162
Total bamboo bearing area	10,518	139,577

**Table 2**  
Bamboo growing stock in Odisha forests

Type of culms	Culms in (millions)	Equivalent Green Weight (EGW) '000 tons
Green	720	3,336
Dry	169	1,404
Decayed	54	
Total	943	4740
No/Tons Per ha.>>	897	4.50 <sup>7</sup>



sampling design (detailed methodology is given in Annexure 2). Based on the data collected in 178 inventoried districts in the country over a period of six years (2002 to 2008), FSI had published a separate chapter on Bamboo Resources in its 11<sup>th</sup> ISFR, where in the total bamboo bearing area of the state was estimated to be 10,518 sq. km.<sup>6</sup> constituting little more than 20% of the forest cover of the State and 7.5% of the total bamboo area of the country (FSI, 2011). The details are given in Table 1.

In the 11<sup>th</sup> ISFR, along with the bamboo bearing area, total number of bamboo culms by soundness and equivalent green weight in the recorded forest areas was also estimated, which is the only authentic data available (FSI, 2011). Total Number of culms in Odisha was estimated to be 944 million, comprising of 720 Million green culms (76%) and 169 million dry culms (18%); remaining being decayed culms (Table 2).

Similarly, total equivalent green weight of bamboo culms in Odisha was estimated to be 4.74 million tons (3.34 MT of green culms, and 1.4 MT of dry culms). Considering a four-year working cycle, the potential bamboo production of the State forests, excluding the areas under National Parks and Wild Life Sanctuaries, is about 0.6 MT per annum (green weight).

In addition to bamboos in forest areas in several coastal and other districts, people have been raising bamboo plantations in their homestead lands (back yards) as well as in farmlands. The main areas are in Mayurbhanj, Balasore, Bhadrakh, Nayagarh, Bolangir and Bargarh. Mayurbhanj is an important district, not having natural presence of bamboo in forests, where practically in all villages bamboo is grown in homestead and cultivated lands. In fact, Mayurbhanj and the adjoining areas of Balasore, Bhadrakh and Keonjhar districts, is an important region of the state for production of bamboos from private areas. Based on interactions with several bamboo traders from Baripada and Betnoti in Mayurbhanj district, it is estimated that from this area approximately 40,000 tons of bamboo is supplied to the two paper mills in the State and several paper mills in other states. Moreover, about 8-10,000 long bamboos (22ft. (7 meter) and longer) are being transported to different places in Odisha for use as tent poles, in construction industry, as also for use in betel farming, and also the neighboring state Chhattisgarh. A success story of bamboo plantation in homestead lands in Bhapur village of Nayagarh district is given in Annexure 3.

<sup>6</sup> This includes bamboo regeneration area which is around 17% of the total bamboo bearing area which reflects that despite biotic interference (including repeated fires and grazing) bamboo areas have good regeneration potential.

For the country as a whole, EGW/ ha. is 12.15 tons, indicating the state of degradation of bamboo forests in Odisha.





Due to the importance of bamboo to meet the needs in rural housing, construction industry for scaffolding/centering and tent poles as well for improving local livelihood in handicraft and also in recognition of bamboo's soil conservation properties, plantation of bamboo, either as pure block plantations or as a component in plantations of mixed species, have been undertaken in various Development Programs implemented in the State. These include the Integrated Watershed development program and Orissa Forestry Sector Development Project. The Road Transport and Highways Ministry, Gol has recently unveiled a policy framework for plantation along National Highways under which bamboo will get planted and also used as tree guard (Anon., 2015)

Till 2014-15, bamboo plantations have been raised over 13,000 ha. (9,172 ha of forest areas, 455 ha. of non-forest Government lands, and 3,414.66 ha. of private lands). Of this, 3,958.28 ha. have been raised during 2008-09 to 2015-16 under the OBDA in 7,646 land parcels. A quick analysis of the data (Annexure 4) reveals that bulk of the plantations are in small parcels ranging from 0.01 to 0.25 ha. each. Only 29 parcels are more than 5 ha. in area. The districts in which more than 200 ha. bamboo plantations have been raised are Kalahandi, Mayurbhanj, Koraput, Kandhmals, and Sundargarh. The districts with large number of land parcels/beneficiaries (more than 200) are Mayurbhanj, Balasore, Kalahandi, Kandhmals and Sundargarh. Since, like other grasses, bamboo flowers once in lifetime (40-100 years), the availability of bamboo seeds is an issue in planting bamboos. Under OBDA, all out efforts have been made to propagate and perfect the vegetative propagation (layering) technique. It may be pertinent to mention here that most of these efforts for planting bamboos are not planned for linkages with any specific bamboo product or processing industry. Details of two success stories of bamboo plantation in Bolangir and Mayurbhanj districts with technical and financial support from OBDA are given at Annexure 5a and 5b.

Bamboo resources outside forest areas in different physiographic zones are also being assessed by FSI in the course of National Forest Inventory (FSI, 2011). In the absence of any other detailed information of bamboo resources outside the forest areas, this data has been used to compute extent of bamboo resources in non-forest areas in the present report. Average number of culms and weight for Odisha was calculated based on number of culms and weights in the three physiographic zones relevant to

Physiographic zone	Geographic area sq. km.	Total culms millions	EGW million tons (MT)
East Deccan	336,289	212	0.97
Eastern Ghats	191,698	3	0.02
East Coast	121,242	55	0.24
India Total	3,287,263	2,127	10.2
Odisha	155,707		
Bamboo area Odisha	10,518		
Estimate for Odisha		64.76	0.29
Equivalent area in sq. km.		722.26	654.59

Odisha, namely: East Deccan, Eastern Ghats, and Eastern Coast (Table 5). Considering growth pattern to be similar to that in forests, the non-forest bamboo growing area, comprising small patches scattered in rural areas of the State is estimated to be between 650 and 725 sq. km. (Table 5). However, the equivalent area may be higher, due to better growth conditions of bamboo clumps in private areas.



### Rattans:

Rattans, called canes in Odisha, (locally known as beta) are spiny climbing palms belonging to the tribe Calameae of sub-family Calamoideae of the Palmae or Arecaceae family (Palms). Of the 600 odd species of rattans belonging to 13 genera in the world, 60 species in 5 genera are found in India, mainly in moist forests of Andaman and Nicobar Islands, Karnataka, Madhya Pradesh, Kerala, Maharashtra, Nagaland, Manipur, Arunachal Pradesh and Mizoram (Renuka, 1999).

Odisha does not have significant areas under canes. Northern tropical Semi Evergreen Forests, in which Cane (*Calamus*) is one of the important species, are met within Odisha in the proximity of the seacoast as well as plateau above 200 ft., particularly in the moist valleys. Detailed study of the working plans of the forest divisions revealed that cane areas are found in the forests of Boudh, Cuttack, Dhenkanal, Gajapati, Kandhmal, Khurda, Nayagarh, Mayurbhanj, and Puri districts.

In Nayagarh Forest Division, cane breaks are found in Semi Evergreen Forests (2B/ C3) and occur to limited extent in some forest blocks, namely Gochha, Sapua, Central, Pokharigochha and Chadiapally. At present very few cane stalks are exploitable for commercial use.

In Parlakhemendi Forest Division cane breaks are found in small pockets of moist areas in Mahendragiri RF. Canes are of medium height and not very thick and most of them are erect.

Khurda Forest Division harbours good diversity of canes in moist deciduous, semi-evergreen forests in some blocks of Balugaon, Ranpur and Tangi Forest Ranges.

At present there is no authorized harvesting of canes in the state, ostensibly for conservation of cane forests.



## Chapter 3 Bamboo and rattan cover and species distribution

**Table 4**  
**Forest types with natural occurrence of bamboo in Odisha**  
(FSI, 2011a)

2/2S1	Secondary moist bamboo brakes	253.86
3C/C2	Moist peninsular Sal	14746.96
3C/C3/2S1	Northern Secondary Moist Mixed Deciduous forests	4919.52
5B/C1c	Dry peninsular Sal	8204.93
5B/C2	Northern Dry mixed deciduous forest	12710.14
5/E9	Dry bamboo brakes	714.24

Natural bamboo growing areas in the State occur in several forest types<sup>8</sup> as under/middle story along with tree species. These forest types are 3C/C2e Moist Peninsular Sal, 3C/C3 2s1 Northern Secondary Moist Mixed Deciduous forests, 5B/C1c Dry Peninsular Sal, 5B/C2 Northern Tropical Dry Mixed Deciduous Forest. Pure bamboo crop is also found in some areas classified as 5/E9 Dry bamboo brakes and 2/2S1 Secondary Moist Bamboo brakes. Total extent of these forest types in the State is 41,549 sq.km. (Table 4)

### Mapping bamboo bearing forest areas

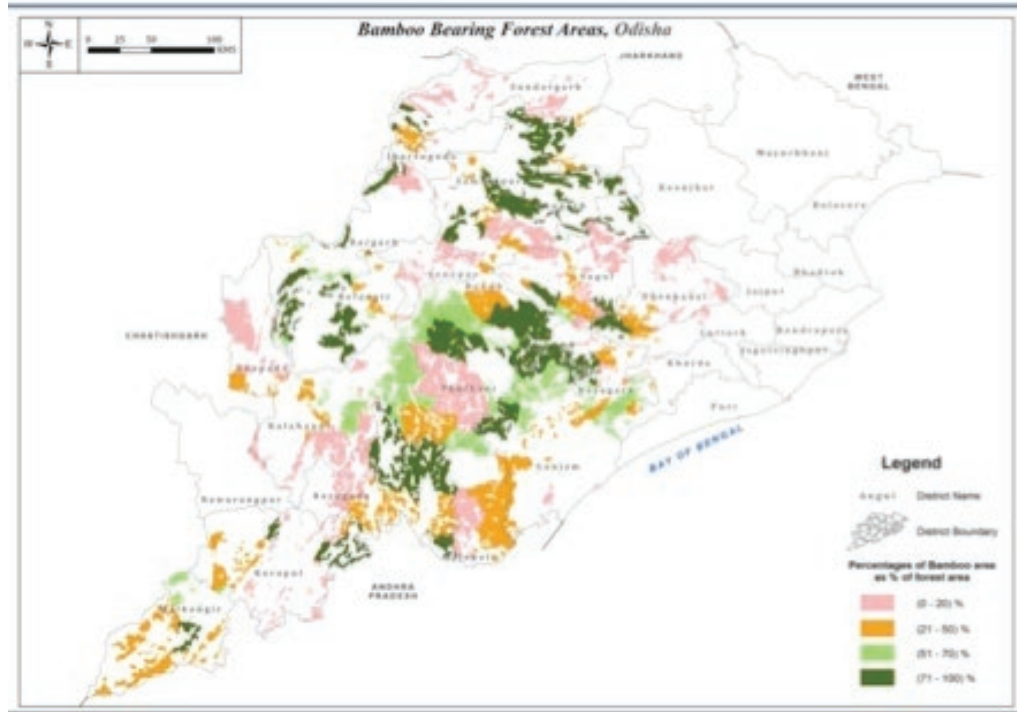
Mapping of bamboo forests was attempted using satellite data analysis in two forest divisions, Phulbani and Baliguda, for which forest vegetation maps of some areas prepared earlier by 100% ground survey containing bamboo areas were available. Resources at LISS IV multispectral satellite images (5.8m resolution) used for forest cover mapping were considered for identifying bamboo areas. Forest cover maps specifically procured from the FSI for these two divisions were used to mask non-forest area. Ground truth data available for the satellite image showing identified bamboo areas in the known areas were used as signature data for classifying "bamboo areas" within forest areas. The bamboo classification (obtained by using signature data) was compared with forest vegetation maps of the areas based on 100% ground survey. It was observed that some areas surveyed as non-bamboo areas also get classified as bamboo areas and vice-versa.

The process was therefore abandoned. Information contained in the working plans of all forest divisions in the state was analyzed to capture range wise bamboo and forest areas. A Base map was generated, integrating forest cover map (projection system GCS\_WGS\_1984 Datum-D\_WGS\_1984)<sup>9</sup> with Forest Division and Forest Range boundaries in GIS. A classified range boundary map was generated in GIS indicating percentage of bamboo areas to forest area. The classified range map (indicating % Bamboo area) was superimposed on the base map in GIS to show bamboo forest in different ranges. Map of bamboo bearing forest areas thus generated is shown in Figure 2.

<sup>8</sup>Forest type is defined as a unit of vegetation which possesses broad characteristics in physiognomy and structure sufficiently pronounced to permit differentiation from other such units irrespective of physiographic, edaphic or biotic factors

<sup>9</sup>All maps in this report are based on this projection System.

Figure 2 Bamboo Bearing Forest Areas, Odisha

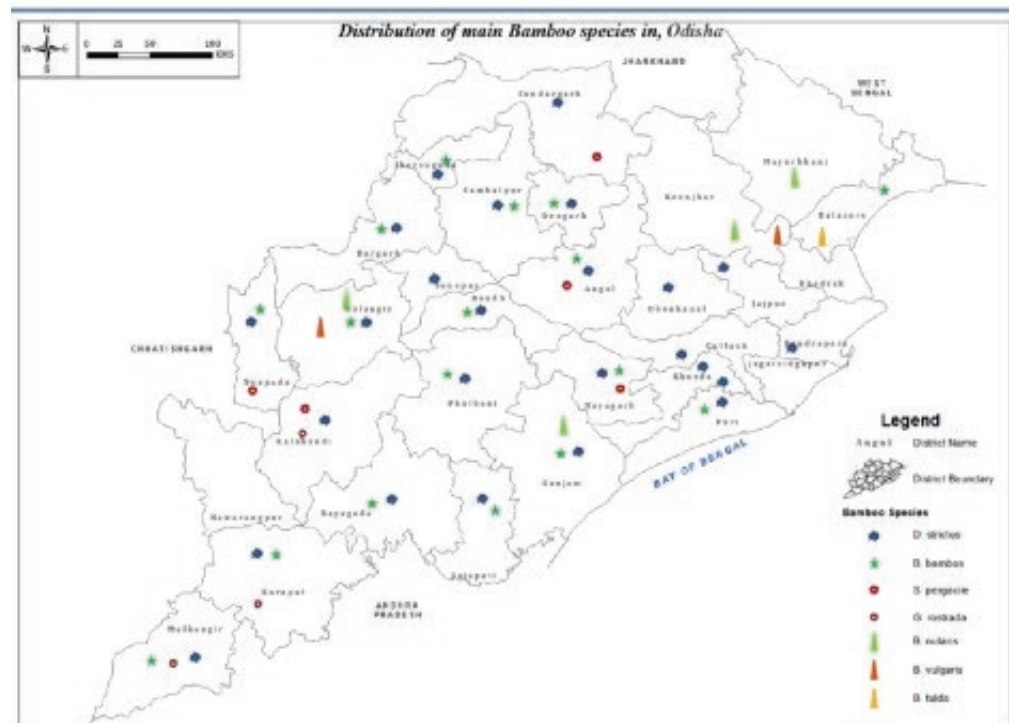


### Distribution of bamboo species

Of the 136 odd species of bamboos under 22 genera found in India, only a few species are in Odisha. Three species, namely *Dendrocalamus strictus* (locally called “Salia/dongar” also called male bamboo of commerce), *Bambusa bambos* Voss [*Bambusa arundinacea*] (locally called “Kanta/Daba”), *Gigantochola rostrata* & *Oxytenanthera albociliata* (locally called Pani bans), *Schizostachyum pergracile* Munro [*Cephalostachyum pergracile* Munro] (locally called “Dangi/Bolangi” Topi bans) are found in the State forests. Salia is the predominant bamboo species constituting nearly 80% of the total bamboo in the State and grows generally in hilly tracts with Kanta/daba bamboo found in moist valleys constituting narrow belts (generally having rich soils) along streams. The other two species found in specific pockets in limited extent are *Schizostachyum pergracile* [Rourkela, and Kalahandi divisions] and *Gigantochola rostrata* [Malkangiri, Jeypore, and Kalahandi divisions].

*Bambusa vulgaris* Schrad (locally called “Sundarkani”) and *Bambusa nutans* Wall. (Locally called “Badia”), not found in the forests, are the preferred species for plantation in homestead lands and other private lands. Another species, *Bambusa tulda*, is also cultivated in some parts of the State but is not wide spread. Dangi bans (*Schizostachyum pergracile*) and Pani bauns (*Gigantochola rostrata*), which are found in small numbers in forest areas, are also found in some village lands. Another species, namely *Thyrsostachys oliveri* Gamble, locally called Nala bauns, is found in some villages

**Figure 3 Distribution of Bamboo Species in Odisha**

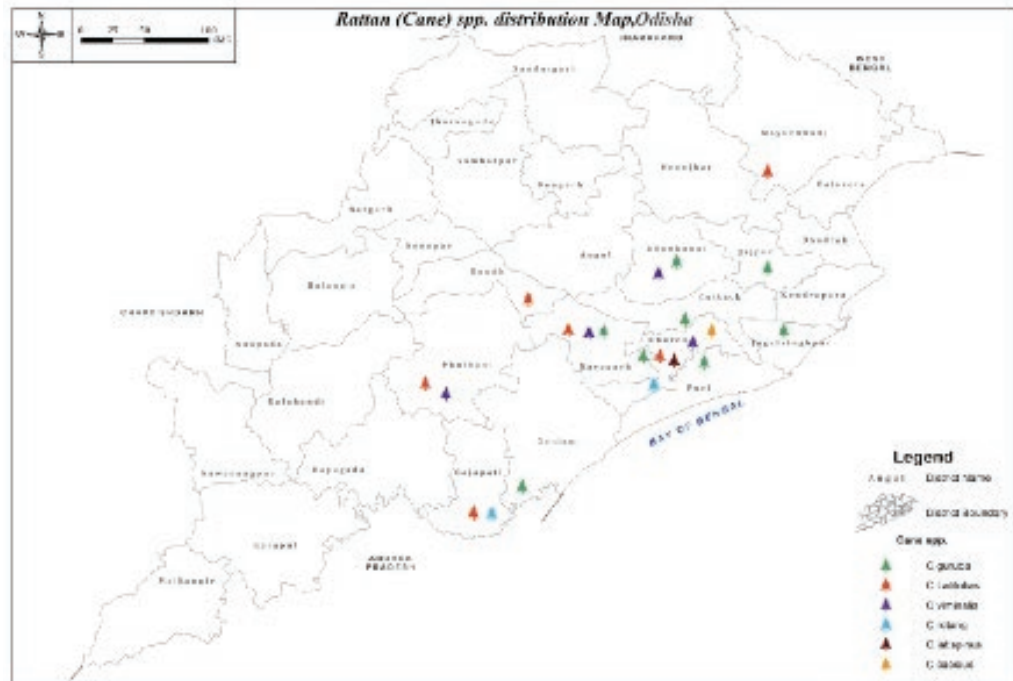


in Nayagarh and Ganjam districts, and was perhaps brought by some travelers and introduced in these areas due to absence of branches on the lower portions. Moreover, the forest department in silviculture research gardens introduced some species. They are *Thyrostachys regia* (locally called lathi bauns) and *Bambusa wamin* (planted in gardens as an auspicious and ornamental bamboo) in Khandagiri research garden; *Dendrocalamus giganteus* Munro in research garden at Kalinga; *Bambusa striata* (locally called Champa bauns - used for ornamental purposes) in research gardens at Khandagiri and Jashipur. Distribution of bamboo species in Odisha is mapped in figure 3. Main characteristics, occurrence, uses of the species found in the State are given in Annexure 6.

**Rattans:**

Three species of canes, namely *Calamus guruba* (Katha/Kanta Beta), *Calamus viminalis* (Pani Beta) and *Calamus latifolius* (Goura Beta) are generally found in the State. A quick study of successive working plans reveals that cane areas have already degraded, mainly due to lack of proper management and inadequate conservation efforts.

Figure 4 Rattan (cane) spp. Distribution in Odisha

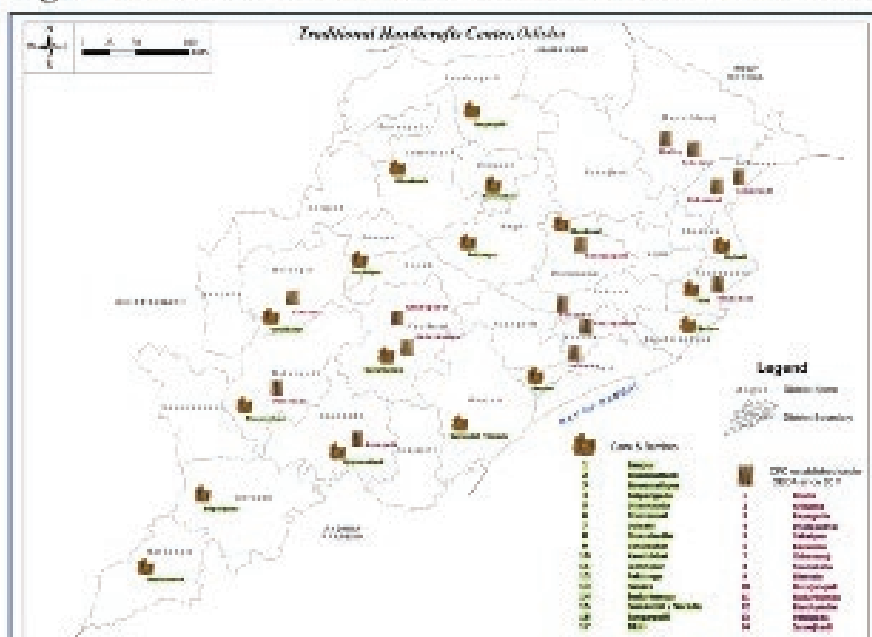


However, Berbera forests in Khurda Division, continue to have good presence of the three species of canes found in the State. *Calamus guruba* is widely distributed. *Calamus viminalis* is restricted to swamps, valleys and stream banks, and *Calamus latifolius* is found in high forests-moist deciduous and semi-evergreen types. Occurrence of three more species, namely *C. rotang*, *C. latispinus* and *C. caesius* were found recently during a study conducted by the Regional Plant Resources Centre, Bhubaneswar (Mahapatra et al. 2012). Natural regeneration of canes is hampered due to biotic disturbance, and unauthorized collection of immature cane berries by local people for manufacturing of ornaments. Distribution map of cane species found in the State is given in Figure 4.

A study of phylogenetic relationship of the six *Calamus* species using ISSR molecular marker method revealed close similarity among *C. latifolius*, *C. rotang* and *C. caesius*, and segregation of *C. latispinus* from all other species. Population genetic diversity study identified Rajin population of *C. viminalis* and Barbara population of *C. latifolius* as having maximum intra-species genetic variability, which therefore need special attention for conservation (Mahapatra et al. 2012).

## Chapter 4 Inventory of current uses of bamboo and rattan in Odisha

**Figure 5 Bamboo and Cane handicraft centres in Odisha**



Bamboo utilization and its cultivation continue to be an integral part of traditional culture and socio-economic scenario in Odisha for centuries. Most of the uses of bamboo have evolved in different regions in the context of species distribution and in recognition of their specific properties. Due to the unique properties of bamboo—including light weight, good tensile strength, straightness, smoothness and almost ready to use natural material for housing construction, bamboos have been a favored material for rural/semi urban housing and for scaffolding in urban constructions in the State. According to the 2011 National Census about 37.8 % of rural households and 13.3% of urban households in Odisha have roofs with grass, thatch, bamboo, and wood as predominant materials. Moreover, about 6.5 % of rural households and 3.1% of urban households in Odisha have grass, thatch, and bamboo as primary wall materials ([censusindia.gov.in](http://censusindia.gov.in))

Due to ease of splitting, bamboos have been used in weaving mats and baskets required in agriculture (right from seed sowing to stocking of grains) and for other essential house-hold items. For making baskets and artisan products, 1-2 year old bamboo culms are generally used. There are some communities in Odisha which have traditional skills in bamboo-crafts and the State has a sizable population of bamboo artisans (who earn livelihood making baskets, mats, and variety of containers and other articles of bamboo for sale). Some artisans have special skills in making fancy articles from the epidermal layer of bamboo culms which fetch higher price due to better durability and looks. Bamboo artisans of Sianbahal (a village near Sundargarh town) have developed

## Bamboo and Rattan Resources in Odisha, India

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expertise in making innovative items, such as eagle, dinosaurs, from bamboo rhizomes. Similarly, artisans of Nabarangpur district use lacquer on decorative bamboo products as is generally done for wooden toys and other decorative items. Odisha has a number of bamboo and cane handicraft centres. OBDA has also established several Common Facility Centres in the state to promote bamboo handicrafts (Figure 5). Odisha Economic Survey 2014-15 mentions that 50 different crafts are practised by about 130,000 artisans in Odisha. An earlier survey by Directorate of Handicrafts and Cottage Industries, Odisha (Anon., 2003) found 27,322 bamboo and cane artisans as doing well<sup>10</sup>. The Directorate of Handicraft, Odisha informed that total sale of bamboo handicraft products in the State during 2014-15 was Rs. 191.69 million. However, this may be an underestimate as all sales do not get recorded.



Bamboo shoots, locally called kardi, are used by local people to prepare bamboo pickles and food supplements, particularly in western parts of the State. Shoots of Salia bamboo are preferred over those of Daba bamboo due to better taste and the fact that as they do not turn sour easily. Young fresh shoots are cut into thin slices and are fried to prepare the dish. It is also added to other dishes made from tomato and lady's finger to add to taste. As bamboo shoots are available only during monsoons, villagers convert the young shoots to small pieces like noodles, dry them, and store for use during the rest of the year. These dried shoots, locally called hendua, are added to a number of dishes prepared from vegetables and fish to get special flavour. Since harvesting of young shoot is not permitted from the forests, there is unauthorized and unsustainable collection of kardi from the forest areas to meet the huge demand in the local markets. Annual production in the State may be anywhere around 1,000 tons of kardi and 500 tons of hendua (@ 300-400 gram kardi & @ 250 gram hendua per household per year, based on estimates at a conservative level). In some areas, bamboo culms are also used for preparing special dish of roasted meat.



Bamboo culms are also used in the cultivation betel leaves for consumption within the country as well as for export to Pakistan, Bangladesh and the Middle East<sup>11</sup>. Bogarai and Baliapahar blocks of Balasore district are known for betel leaves cultivation, where total area under betel cultivation is around 400 ha. (about 4,000 plots with an average area of 1,000 square meters each). Annual requirement of bamboos used for chanchana, guda, vinchana, adia, and potha in betel cultivation in Balasore district is 500 to 600 thousand (based on the repair and maintenance @15% every year). It is estimated that on an average 7-8 truckloads of betel leaves packed in

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<sup>10</sup>It was confirmed by the Director of Industries, Odisha that no subsequent survey of artisans has been done in the state.

<sup>11</sup>Total export value of betel leaves during 2014-15 was Rs. 3789. Lakhs (Bangladesh 2800 Lakhs Rs., Pakistan 376.75 Lakh Rs, UK 339.81 lakh Rs, Canada 45.79 Lakh Rs., Australia 37.44 lakh, Kenya Rs. 36.47 lakhs, Nepal 20.33 Lakh Rs.) [www.commerce.nic.in/eidb/](http://www.commerce.nic.in/eidb/)

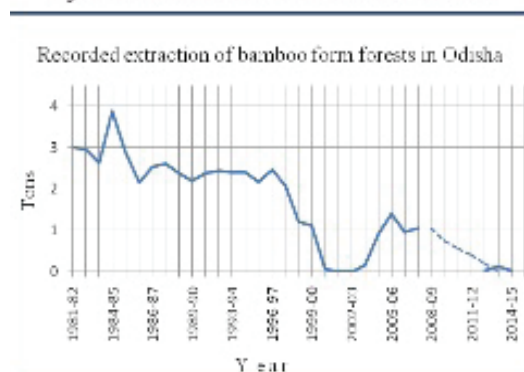
specially made bamboo Jhudis (baskets), each containing 3,000-5,000 betel leaves, are transported mainly to Kolkata for export as well as consumption within the country. Total requirement of bamboo for making Jhudis in Bhogarai area alone is around 20-30,000 per annum. Betel vine cultivation is also in Puri (involving about 20,000-30,000 plots with an average area of 400 square meters), Ganjam, Jagatsingpur and Jajpur. Directorate of Horticulture, Government of Odisha is providing onetime financial assistance for establishment of new betel cultivation areas along with technical support. Annual requirement of bamboos in cultivation/transport of betel leaves is estimated to be 50,000 tons.

Banslochan, a microscopically fine siliceous matter within the inner nodes of some bamboo species, has been used in Ayurveda preparations for cough and Asthma. Other parts of bamboo, e.g., roots, leaves, sap and dash are also used to treat a number of ailments like cough, bile, fever, swelling, cuts, ring worms, bleeding gums. Hendua processed in Mahua seed oil is believed to make the oil effective when massaged for the treatment of cold, both in case of humans and cattle. Fried hendua, when given with old jiggery, is known to cure gastric trouble of cattle.

The main industrial use of bamboo for manufacturing paper & pulp in the State was started around 1936 and since then management bamboo forests focused for this major industrial use. Bamboo forests are managed under "Culm Selection-cum-Clump Improvement" system with a four-year cycle and areas are allotted to "Bamboo (overlapping) working circle" in the Working Plans. Before nationalization bamboo working in 1988 under the Orissa Forest Produce (Control of Trade) 1980, large bamboo areas were allotted to different paper mills on long term leases. Post nationalization, Orissa Forest Development Corporation Ltd. (OFDC) is the sole agency for extraction and trade in forest bamboo in the State. Moreover, the Supreme Court of India, in IA 548 SC vide order dated 14.02.2000, prohibited removal of any wood or tree including dead, dry or wind fallen tree and any material including grass etc. from any National Park or Wild Life Sanctuary - subsequently incorporated in the Wild Life Protection Act, 1972. As a result, 8,352.19 sq.km. of forest area in 19 notified PAs (National Parks, Wild Life Sanctuaries, and Tiger Reserves) of which about 3,500 sq. km. have bamboo bearing areas in different proportions, is no-go area for bamboo harvests. (A map showing notified PAs is given at Annexure 7)

The paper industry continued to be the major industrial user of bamboo till late 1990s, when it started to shift to fast growing hard woods. Presently, the state has two paper mills with a total installed capacity of about two lakh tons of paper per annum<sup>12</sup>. One of them, SEWA paper mill is currently using about 25,000-30,000 tons of bamboo annually and the other, viz., JK Paper Mill at Rayagada uses only about 1,000-2,000 tons of bamboo per annum .

Figure 6 Recorded Production of Forest Bamboo, Odisha



The third paper mill in the State, namely EMAMI in Balasore district is based on agro residues. Recorded extraction of bamboo from forests since 1980-81 is graphically represented in Figure 6 (Annexure 8) which shows reducing trend of recorded extraction of forest bamboo. Apart from the recorded harvest, substantial quantity of bamboo is felled and removed from forests by local people and artisans for house hold use and occupational livelihood about which no detailed records are available.

<sup>12</sup>Based on personal discussion with the concerned authorities of the two paper mills.

### Rattans

The bare stem of rattans is used in the making of cane furniture, mats, and in handicrafts bags, baskets, walking sticks umbrella handles etc. because of its strength, flexibility and uniformity. Cane units, mainly for furniture, are located at Banpur (Khurda), Talabasta (Cuttack), Tumudibandha (Kandhamal) and Narla (Kalahandi). Katha/Kanta beta is in demand because of its suitability for quality furniture and ease of availability. Sometimes, artisans prefer thick Goura beta.

Cane work is considered superior to bamboo work, as it is comparatively more durable, delicate and requires higher skills. Perhaps due to this reason betara community avoided bamboo work, thinking that skill of the hand may be affected if a cane-worker concentrates simultaneously on bamboo also. Beta-jhudi are flexible, have smooth surface/edges, more convenient to cut and are preferred for use inside betel farms. The number of artisans depending on cane is not known, but their distribution is extremely sporadic and the number is small compared to bamboo artisans. People of Nilakanthapur also use cane for medicinal purpose. After cutting the culm, the leaves from the uppermost part are removed followed by peeling the bark, after which it is eaten either after boiling, or after pounding and frying in ghee. This is also said to be effective in certain type of rheumatism (Rath, 2005).

Cane harvesting<sup>13</sup> had taken place officially until 1992 by TDCC or OFDC as per the working plan prescriptions. Reported production from 1980-81 to 1988-89 is given in Annexure 9. Despite best efforts production in subsequent years could not be known. But unauthorized cutting of canes is taking place, and cane culms are procured by the artisans-cum-traders located in and around cane industries from villagers through middlemen. These locally collected canes are mixed with canes brought from Assam and other parts of the country. Interactions with cane furniture units revealed that they are using Assam Canes mostly procured from Kolkata traders but some use of locally collected canes cannot be ruled out but it is not possible to estimate quantity of local canes used. Calamus guruba and Calamus viminalis collected from the forest of Balugaon Forest Range are generally used as filler and binder along with thick Assam canes. Further, those being thinner in dimension are also commonly used in making handicraft items, such as flower vase, pen stands and wall hangings.

### Development since late 1990s

In the recent years bamboo is being rediscovered as a natural renewable fiber material of 21st century and having considerable latent potential to contribute significantly towards economic growth, employment generation, and rehabilitation of the enormous amounts of degraded land. Hunter (2002) had termed bamboo to be a solution to problems due to its numerous new industrial and other uses. Several environment and people friendly technologies have been developed for manufacturing innovative products. These products can be categorized into (i) wood-substitutes - bamboo mat board (BMB), bamboo mat veneer composite (BMVC), bamboo laminates, bamboo oriented strand boards, bamboo compressed wood,(ii) Food products - bamboo shoots, bamboo pickles, (iii) housing-construction products - bamboo mat corrugated sheets (BMCS) for roofing, bamboo based housing system, (iv) bamboo fabric textiles, (v) bamboo charcoal and activated carbon.

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<sup>13</sup>Canes are legally defined as tree/timber along with bamboos under the Orissa Forest Act 1972.

Indian Plywood Research and Training Institute of MoEFCC has been on the forefront and has developed technologies for bamboo mat board, bamboo mat veneer composites, bamboo mat corrugated roofing sheets (BMCS), bamboo mat ridge cap, which have been commercialized in India and are getting popular among the consumers (Bansal et al. 2014, Bansal et al., 2002; Bansal and Zoolagud, 2002). Bamboo wood (laminates) made from *Bambusa bambos* was found to have strength properties comparable to those of *Tectona grandis* (teak) a highly valued structural timber species (Bansal and Prasad, 2004). An innovative bamboo housing system has also been evolved and has been used in demonstration houses and eco-tourism in several part of the country and also in Odisha (Anon., 2001, Bansal et al. 2001).

Bamboo composites and plywood were found to have lower emissions compared to similar products of steel and plastics in carbon emissions audit studies underway at IPIRTI as a part of Life Cycle Analysis<sup>14</sup> (LCA). BMCS was found to have lower net energy required in production compared to Aluminium and galvanized Iron roofing sheets and also has an edge over other competitive roofing material with respect to energy efficiency, green-house effect, storage of carbon, and impact on environment (Sujatha et al., 2014).

The Government of India has taken several initiatives to give significant thrust on development of bamboo sector. Adoption of available technologies and development of new applications along with bambooplantations are being facilitated through two national missions, namely National Mission on Bamboo Applications (NMBA) under the Ministry of Science & Technology<sup>15</sup>, and National Mission on Bamboo Technology and Trade Development (NBM) under the Ministry of Agriculture<sup>16</sup>. Although under these missions protocols for adoption of new bamboo processing technologies have been developed and demonstrated, and bamboo plantations have been raised, there appears to be no focus on meeting raw material requirement of any specific bamboo based industry or product while selecting plantation areas and species. Recently the mandate of NBM has been enlarged to include Agroforestry, which may eventually bring out the untapped potential of bamboo as agro/farm-forestry/plantation crops due to its multifaceted applications.

In Odisha, INBAR got a study conducted to assess market opportunity for several bamboo products in 2003 (Anon. 2003) which projected market opportunity to the tune of Rs 600 Crores in five years comprising of bamboo composites, handicrafts, incense sticks and matchsticks with a total annual requirement of bamboo to be around 645,000 tons, and suggested cultivation of bamboo on degraded lands. The study observed that everything seems to be in place for the take-off of the bamboo industry except the vital mechanism to channel the raw material into a finished product and finally into the end-user market, and recommended interventions related to Markets, Policy and Training and Awareness for harnessing the potentials of bamboo in Odisha.

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<sup>14</sup>Life Cycle Analysis (also called Life Cycle Assessment) is a means of assessing the environmental aspects of a product's life from raw material extraction to disposal and/or recycling (Cradle to Grave). Such analysis is based on several environmental indicators including carbon foot print, energy consumption, and enhances our understanding of how environmentally friendly a product is and enables changes to be made at various stages of a product's life cycle to improve its the environmental sustainability.

<sup>15</sup>The National Mission on Bamboo Applications is a Technology Mission established during the 10th Plan. The funds for the Mission are meant to carry out research and development for value added products and applications and to promote the commercialization of developed technologies related to wood substitutes and composites, constructional and structural applications, Agro-processing, Industrial applications, consumer products, and propagation and cultivation.

<sup>16</sup>The National Bamboo Mission launched in 2005 is structured to address critical areas of bamboo development covering research, development, post-harvest management, product development and marketing by adopting a mission mode approach comprising of four Micro-missions, viz., (a) Micro-mission for Bamboo Research; (b) Micro-mission for Plantation Development; (c) Micro-mission for Post Felling Management and Bamboo Trade; and (d) Micro-mission on Product Development, Processing and Value-addition of finished products.

## Bamboo and Rattan Resources in Odisha, India

Year	Hand roll	Pedal Operated
2010-11	116.29	
2011-12	540.37	
2012-13	535.00	308.88
2013-14	326.97	490.95
2014-15	290.04	602.90

890 beneficiaries in 37 cluster are using pedal Operated Agarbatti making Machines.

A two-day state level workshop was organized at Bhubaneswar in 2004 in collaboration with INBAR for sensitizing various stakeholders, including academia, artisans, Govt. officers of various related departments, NGOs. A draft "Orissa Bamboo Policy" was subsequently prepared<sup>17</sup> under Orissa Forestry Sector Support Project (OFSSP) funded by DFID (Annexure 10). A study to identify strategic interventions for enhancing bamboo based livelihood options in the State was also conducted under OFSSP which inter alia identified opportunities and constraints in the development of bamboo handicrafts and other products, issues related to bamboo species, technology, regulatory environment and trade related bottlenecks, and recommended policy changes and other interventions (Muthoo, 2008). Demonstrative bamboo houses were constructed at Chandaka and Bhitarkanika wild life sanctuaries with following bamboo-housing system developed at IPIRTI. An eco-tourism destination developed at Chhotkai near Satkosia Tiger Reserve under JICA assisted Orissa Forestry Sector Development Project also utilized and demonstrated the environment friendly bamboo based housing system as a part of community based eco-tourism initiative (Cooper et al., 2008).

The Orissa Bamboo Development Agency (OBDA) was established in 2007 for integrated development of bamboo sector in the State. One of the important activities supported by OBDA is raising bamboo plantations in forest areas and private lands. Fourteen Common Facility Centers (list at Annexure 11a) have been set up by OBDA, between 2011 and 2014, to facilitate production of various bamboo handicraft items, bamboo preservative treatment, and bamboo-processing tools. The CFCs established in 2011 and 2012 are fully functional. Financial assistance has been provided to selected NGOs for establishing four bamboo bazaars (list at Annexure 11b) for marketing of bamboo products. Nine of these CFCs are associated with manufacturing incense (agarbatti) sticks. Discussion with the nodal persons of the CFCs revealed that Salia bamboo is suitable for making square bamboo incense sticks, but the quality of round sticks is not good and involves lot of wastage. A bamboo cluster namely Arikama bamboo craft cluster was established under the Khadi and Village Industries Corporation cluster scheme in 2007 involving 520 women artisans belonging to 43 SHGs in Khurda district. Bamboo sticks have ready market/use for manufacturing incense sticks for procurement both in the State and also for exporting to other states mainly Karnataka. Handicraft items are getting sold through exhibitions held in various districts and also at state/national level.

ORMAS is facilitating making agarbatti sticks from bamboo in 14 districts (Nayagarh, Cuttack, Khurda, Kandhamal, Balasore, Mayurbhanj, Puri, Bhadrak, Jagatsingpur, Kendrapada, Dhenkanal, Angul, Boudh and Jajpur) in collaboration with ITC. Year wise production of agarbatti sticks is given in table 8 ([www.ormas.org](http://www.ormas.org)). However, interaction with ORMAS officials revealed that Odhisa bamboo is not being used due to large scale rejection of sticks made from locally procured bamboos and ITC is organizing supply of raw bamboo sticks imported from Vietnam or North-East states of the country and the finished incense sticks are procured by ITC.

<sup>17</sup>The process of notifying the State Bamboo Policy is still underway.

It is a matter of concern that in a religiously conscious country like India, where perhaps every household uses incense sticks as a part of daily prayers, raw bamboo sticks used in making incense sticks are imported to an extent of 12-13,000 tons per annum<sup>18</sup>, thus spending precious foreign exchange and losing employment opportunity for local tribal/poor women. This is a missed opportunity, perhaps due to lack of adequate R&D, and low custom tariff for import of bamboo round sticks from Vietnam from where bulk of import of bamboo sticks is taking place. With strategic interventions, Odisha can easily produce about 2-3,000 tons of bamboo sticks for different uses such as incense sticks, matchsticks, and icecream spoons.

Forest and Environment Department, Government of Odisha have established a bambusetum over an area of about 5 acres during 2011 in the Medicinal Plant Knowledge Centre set up on the outskirts of the State capital Bhubaneswar. This has 80 varieties of bamboos, including some rare species: *Phyllostachys nigra* (Black Bamboo), *Bambusa aureostriat* (Yellow Bamboo) and *Bambusa sirosina* (White Bamboo), collected from different parts of the India and other countries (Japan, South Korea, Indonesia, Myanmar, Bangladesh, Sri Lanka and Thailand).

### **New potential industrial uses of bamboo in Odisha- Opportunities and Challenges**

In the wake of reduction of demand of bamboo for paper manufacturing, it is necessary to look for other potential industrial uses of bamboo, in addition to qualitative improvement in current uses through inputs for designs handicraft items and enhancing durability. Some of them are discussed in following paras.

**Bamboo wood** is an important product that needs to be explored and facilitated not only to utilize forest bamboo but also to fill the demand-supply gap of structural timber for various end uses.

**Bamboo shoots** is an important ingredient in many Asian cuisines and there is a growing market, both domestic and also for exports, for processed and packaged shoots. Bamboo shoots have high nutritional value and low fat - are rich in vitamins, cellulose and amino acids and are a good source of fibre. Odisha has an advantage in the establishment of bamboo shoot production units due to traditional production of bamboo shoots. With revised silvicultural practices<sup>19</sup> permitting harvest of bamboo shoots from selected forest areas and raising plantations of suitable bamboo species<sup>20</sup> the state has huge potential bamboo-shoot industry. Eventually bamboo shoots can also be used in nutraceuticals and food products.

**Bamboo vinegar** is extracted while making charcoal and is used for hundreds of treatments in almost all fields. This liquid contains 400 different chemical compounds and can be applied for many purposes, including cosmetics, insecticides, deodorants, food processing and agriculture. The products that can be prepared in cottage industries include Bamboo Wine, Bamboo Beer, Bamboo Vinegar in addition to Bamboo Shoots.

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<sup>18</sup>Actual imported quantity during last three years as seen from import data maintained by the Ministry of finance is 12914 MTs of bamboo round sticks (HS code 140110).

<sup>19</sup>At present, management prescriptions for bamboos are mainly for basic production, manufacturing paper, and long bamboos for scaffolding and housing .

<sup>20</sup>Bamboo cultivation for shoot production requires a different package of practices from that of bamboo culm/timber. Shoot cultivation normally requires better soil, water and light conditions, and more intensive management. A shoot stand consumes more mineral nutrients from the soil, and therefore the use of required organic manures to replenish the soil nutrients is important.

**Bamboo Energy:** The bio-energy from bamboo and waste from other bamboo industries can provide self-sustainability in the bio-energy sector. Moreover, contrary to production of power from coal, this bio-energy production is a renewable source of energy and is carbon neutral as it uses fast growing bamboo produced through photosynthesis trapping CO<sub>2</sub> from atmosphere. Recently a unit in Bolangir and another in Kalahandi district have started making bamboo briquettes and are also planning for making barbeque sticks, using waste from bamboo harvesting and handicraft sector, for which there is demand in urban restaurants. This alone offers a market opportunity of about 500 tons/annum.

Bamboo can also be used in gasifiers as a source of fuel, and also in thermal applications, replacing furnace and diesel oils. An added advantage of gasification of bamboo is that 15% of the biomass would also be available as a by-product in the form of high-grade charcoal. Bamboo can also be used for production of fuel grade ethanol as a substitute of petrol and diesel.

**Bamboo Charcoal:** Odisha, with a long history of manufacturing wood charcoal in several forested areas, and presence of bamboo in almost entire state, is in advantageous position for tapping the potential for bamboo-charcoal production to meet rural/urban energy needs (heating and cooking-by dhobis and in dhabas; by blacksmiths as industrial fuel), and as raw material to make activated carbon.

**Bamboo based housing in eco-tourism - destination development:** The State Forest and Environment Department has decided to boost eco-tourism and has initiated action to develop about 100 destinations and has prepared a budget of Rs. 1000 million for creating eco-friendly infrastructure and additional amenities. A dedicated Eco Tourism cell is being set up for the purpose<sup>21</sup>. Successful eco-tourism destination developed at Chhukai, Satkosia National Park and Tiger Reserve with eco-cottages made from bamboo, bamboo mat board, bamboo mat corrugated roofing sheets and other eco-friendly materials is a highly potential model to be adopted in other destinations. This will not only be a good opportunity for showcasing high-end bamboo housing but will also provide an avenue to create awareness on the potentials of bamboo and generate market demand for industrial bamboo products.

**Bamboo fabric:** Economical, ecological, aesthetically pleasing, comfortable and long-lasting bamboo fabric is going to be in high demand in future due to its antibacterial properties that can be ascribed to the presence of an anti-bacterial bio-agent called bamboo kun bound closely in the bamboo cells. Bamboo fabric is breathable (remains odorless even when attacked by odor-causing bacteria) and absorbent and does not cling to skin, and particularly good for people with skin allergies. The forest bamboo that was earlier being used in manufacturing paper can be easily used for making bamboo fabric in Odisha. However, a detailed techno-economic feasibility study is required to be done.

Under utilization of potential of bamboo in Odisha may be ascribed to technical knowledge deficit at various levels, inadequate marketing network in addition to continued lack of policy push. One of the oft-quoted bottlenecks is related to definition of bamboo as tree under the Forest Act and as MFP under FRA 2006, and "felling and transit regulations" even though bamboo species planted by

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<sup>21</sup>Express news of 11th March 2016 captioned "Government Goes for Green in Tourism", and confirmed through personal discussion with PCCF (Projects) Odisha, and Project Director OFSDP, Bhubaneswar.





people in private lands have been exempted from transit permits (A detailed note on apparently conflicting legal provisions and regulations related to bamboo is given at Annexure 12). Jamguda, in Thuamul Rampur Block of Kalahandi district became the first village in Odisha, and second in the whole country, where in 2013 transit passbooks were provided to the Gram Sabha to enable the villagers to harvest and transport bamboo<sup>22</sup>. A recent detailed analysis “the Bamboo Industry in India Supply Chain structure, Challenges, and Recommendations” by Baksy, 2013, has concluded that while easing restrictions on bamboo availability is a necessary condition for developing the sector it is not a sufficient condition. In a multi-stakeholder consultation, comprising bamboo farmers, artisans, entrepreneurs, FD officials and others facilitated by OBDA in January 2016 (short list of participants at Annexure 13), there appeared to be consensus among the participants about the need for transit regulations for forest bamboo albeit with a simplified regime for plantation bamboos. It was opined that existing bamboo plantations can be jointly verified by revenue and forest department officials and depending upon the number and health of clumps annual yield can be fixed for which permit can be issued by local forest staff or Gram Sabha without the need for joint verification every time bamboos are harvested. Similarly, for new bamboo plantations, land details, number of clumps and yield can be regulated through bamboo plantation passbooks. It was also apparent that efforts at upgrading the Bamboo sector must include a comprehensive end-to-end set of reforms and proactive action to be taken at each level in the value chain.

India in its Intended Nationally Determined Contribution (INDC) in response to COP decision for the period 2021-2030 has committed to create additional carbon sink of 2.5-to 3 billion tons equivalent through additional forest and tree cover (Gol, 2015). Bamboo forests have been found to be one of the best vegetation for carbon sequestration (Tariyal 2014, Thokchom and Yadav, 2015). Thus bamboo offers a unique opportunity in achieving the INDC target of additional carbon sinks, while creating sustainable livelihood opportunity for tribal and rural people living in and around forest area.

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<sup>22</sup>Personal communication from the concerned Divisional Forest Officer.



## Chapter 5 Economic value of bamboo in Odisha

At present the major uses of Odisha bamboo resource are: raw material supply to paper mills, in construction sector including scaffolding, centering, and temporary structures (pandals) for religious and other occasions, bamboo shoots (*kardi*) for local consumption, handicrafts, furniture and other household utility and decorative items, square/round bamboo sticks for incense, baskets in betel farming and transporting, tree guard (gabions to provide protection to newly planted trees along road side in initial growth years), bamboo mats for donnage and other uses in rural areas in addition to rural housing, and various type of baskets used in agriculture sector and rural houses. Following table gives the estimated quantities of bamboo used in most of these applications.

Table 6 Estimated value of current important bamboo uses of in Odisha (2014-15)						
Sl. No.	Bamboo Product / Use	unit	Estimated quantity (tons / no.)	Value Rs./unit	Quantity computed in tons	Value Million Rs.
1	Paper manufacturing inside the State and transported to other states	Ton	70,000	4,000	70,000	280
2	Long bamboo for tent pole/scaffolding for house/bridge construction etc. used within the State	No.	600,000	120	15,000	72
3	Long bamboo (~7 meters) for tent pole/scaffolding for house/bridge construction etc. (exported to other states)	No.	900,000	120	22,500	108
4	Betel cultivation	No.	3,500,000	100	52,500	350
5	Handicrafts including furniture and decorative items (bamboo & cane) under Directorate of Handicrafts*		lump sum	Lumpsum	25,000	200
6	Baskets and other items (bamboo & cane) under Khadi& Village Industries Board *		lump sum	Lumpsum	5,000	45
7	Bamboo sticks for incense sticks etc.	quintal	20,000	8,000	2,000	160
8	Tree guards (gabions)	No.	200,000	130	4,000	25
9	Fresh bamboo shoot (Kardi)	quintal	10,000	3,000	1,000	30
10	Dried bamboo shoot (Hendua)	quintal	6,250	6,000	625	40
11	Rural housing	no	14,500,000	20	217,500	290
	Total				419,625	1,600

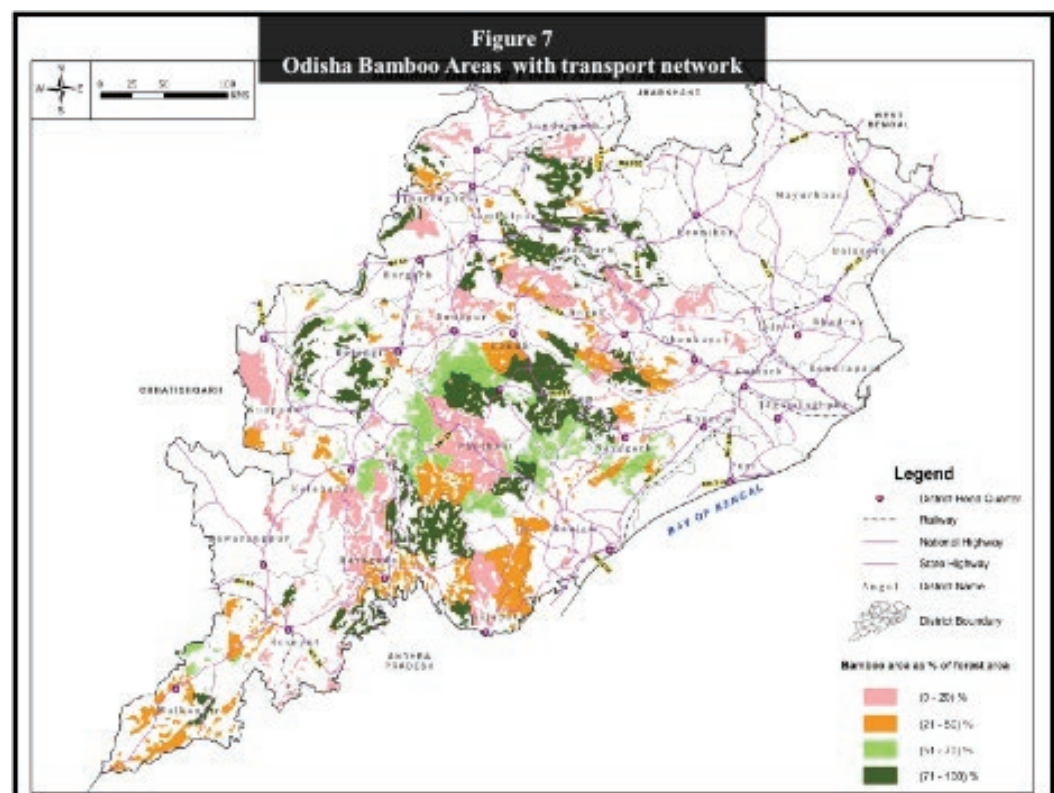
\* In addition to these, there is production of various type of baskets which are used locally and may not be included in the formal sale data.

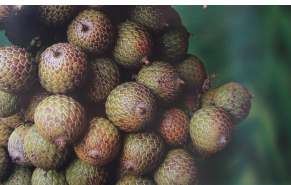
In addition to direct financial value, bamboos growing in forest as under-story along with various tree species forming the top canopy constitute an integral part of the forest ecosystem, which are multifunctional and provide various services. These ecosystem services are benefits that people derive from forests and include provisioning services, regulating services, cultural services and supporting services. A recent study "Revision of NPV applicable for different class/category of forests" for

MOEF&CC includes comprehensive estimation of the economic value of different types of forests (Verma et al., 2014). Forests have been classified into 14 forest type groups (on the basis of a modified Champion and Seth Classification) and 4 canopy cover density classes: (i) very dense forest; (ii) moderately dense forest (iii) open forest, and (iv) forests with less than 10% canopy cover. In the analysis, bamboo stands high in economic value based on estimation of 12 important goods and services from forests, including soil conservation, water recharge and purification, carbon sequestration.

As most of the bamboo in the State naturally occur in either tropical dry deciduous forest or tropical moist deciduous forest, the economic values of these types of forests, as estimated in the above mentioned study, have been used to compute the valuation of bamboo forest (adjusted to weighted average forest cover density and in proportion of bamboo biomass to the total forest biomass). The economic value comes to approximately Rs. 10,000 ha/year. Thus the economic value of bamboo forests alone is about Rs. 10,000 million/year (excluding the direct value obtained through use of bamboos harvested from forests and economic value of bamboos grown in private areas, which is also sizable as mentioned earlier).

A quick analysis was done on GIS platform by superimposing transport (Railway and Road) network over the bamboo map of the state (Figure 6) to ascertain the accessibility of bamboo resources for industrial and other applications. It was found that there are no areas that are termed as not accessible.





### Chapter 6 Benefit cost analysis for potential use of bamboo for land restoration

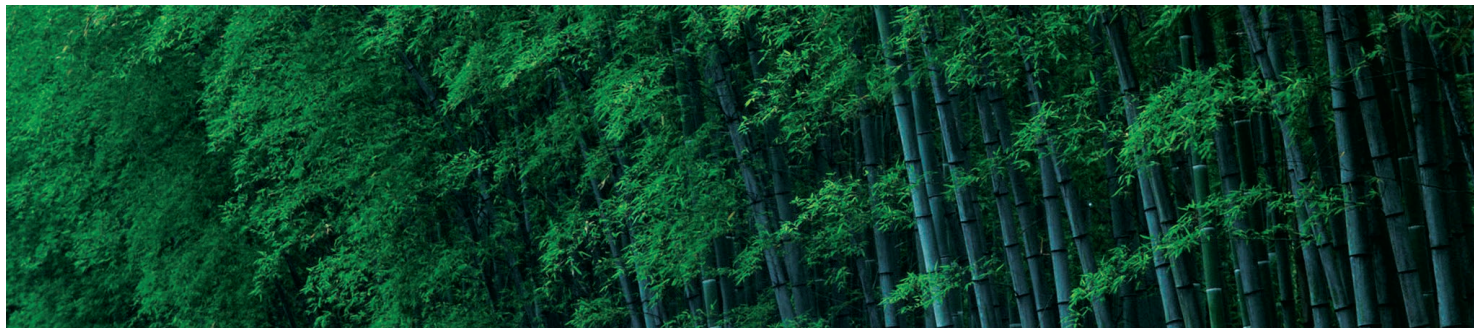
Needless to say that land is the earth's most important natural resource. It is available in limited extent and has many competing uses, inter-alia, including (a) urban and peri-urban use, (b) agricultural and agro-pastoral crop cultivation for food and fodder production, and (c) bamboo grass, trees and forests for environmental services, landscape soil and water conservation, food and other products (NTFPs and medicines), livelihoods for forest dependent communities, renewable energy needs (fuel-wood and bamboo charcoal), cattle grazing, raw material for industries, housing and civic amenities of roads and railways. For optimum and sustained production of various goods and services available land needs to be put to use according to its capability class. Unfortunately, a sizable portion of land in Odisha is suffering from degradation due to various natural and man-made factors such as soil erosion, increased population density, low yield cultivation practices, small land holdings, poor management of village commons, mining and industrial waste putting additional pressure on the remaining productive lands. In fact, land degradation is a serious disinvestment in finite land resources and is a threat to livelihood security in the long run in an agrarian economy. This has serious implications for sustainable development and urgent step are necessary for restoration of waste and marginal lands along with judicious management of forest and other commons.

In Odisha total degraded lands are 37,220 sq.km. i.e., approximately 24% of total land area of the State (district wise details are given at Annexure 14). Districts in order of severity of degradation are Koraput, Rayagada, Kandhmal, Kalahandi, and Gajapati. Moreover, mining has rendered many areas as wastelands in several districts, such as Keonjhar, Sundargarh, Balasore, Dhenkanal, Jajpur (ICAR & NAAS, 2010). Incidentally, most of these districts have either natural occurrence or planted bamboos. This provides an opportunity to reclaim degraded lands, particularly and effectively through plantations of bamboos.

Bamboo is a natural choice in afforestation of several categories of degraded lands - its fibrous root system has excellent soil binding properties and helps in building soil fertility through nutrient cycling. Planting of bamboo in marginal and degraded non-forest lands can bring them back to productive use. In the initial years and with reduced intensity in later years, bamboo plantations also can be used for raising intercrops of other grasses, pulses, oilseed etc., depending upon the agro-climatic condition, yielding additional returns to the farmers along with helping the better growth of bamboo clumps due to increased care. In Allahabad district of India, a successful bamboo restoration project, supported by IDRC/INBAR and jointly implemented with UTTHAN -a local NGO, has turned degraded brick mining area into green productive land and created additional livelihoods for local communities. There have been initiatives under several programs for rejuvenation of marginal, degraded and wastelands through plantation of bamboo along with suitable intercrops. Two case studies (Annexure 15 a & 15b) show that in Mayurbhanj district of Odisha, successful reclamation of wasteland in a watershed area is taking place under Integrated Watershed Management Project through plantation of bamboo with intercropping of Sabai grass and the beneficiaries have already getting good incomes from Sabai grass in from the second year and from bamboo from 4<sup>th</sup> year onwards. The total expenditure has been met with from the funds provided by the Government.

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<sup>23</sup>National Forest Policy of India 1988 mandates minimum one-third of the total land area of the country to be under forest or tree cover. In Odisha the Recorded Forest Area is 37.34% of the total land area and forest cover is about 32.34% and tree cover is about 2.56% of the TLA making total forest/tree cover to be 34.9% of the total land area. However, almost 45% of the forest cover is degraded open forest (ISFR 2015).



Bamboo plantations by two progressive farmers, one each in Bolangir and Mayurbhanj districts, are very encouraging success stories of converting a barren land into highly profitable productive use (Annexure 15a, 15b). The plantations raised with technical and financial support from OBDA have already fully established and the farmers have started harvesting bamboos. The IRR for these plantations is 45%. As already mentioned earlier successful bamboo plantations are being by farmers in Nayagarh district (Annexure 3).

Based on the above case studies financial analysis of raising bamboo plantation with intercrop with suitable crops on marginal/wastelands has been done with the following presumptions:

- (i) Including the need for Initial development of land, which have remained fallow for several years, higher cost norm of Rs. 1,20,000 per ha. for 278 plants (compared to Rs 42,000/- as cost norm under OBDA for 333 plants per ha.) have been taken,
- (ii) Intercropping during initial seven years, when the bamboo seedlings are fully developed/ grown, will take care of maintenance, and
- (iii) Bamboo yield @3 culms/per clump in fifth year, @4 culms/per clump in sixth year, @5 culms/ per clump in seventh year and @6 culms/per clump from eighth year onwards from 80% of the total clumps.
- (iv) A conservative sale price of Rs. 100 per culm (sold as long bamboo for current uses)

Considering 50% subsidy for plantation cost, loan @11% annual interest rate to cover balance fund required, and a for a project period of 20 year the IRR works out to 33% at 12% discount rate. Even if no subsidy is provided IRR 21%. Benefit cost ratio works out more than 3(Annexure 16).

The economic benefits can be further enhanced through value addition activities through handicrafts and local processing of bamboo for feeding to other industries. Moreover, the plantations will also yield foliage for cattle, and generate employment for poor tribal families and benefits from improvement in soil/moisture condition in adjoining cultivated lands.

Bamboo propagation for landscape restoration should be conducted to the highest standards for sustainable land and water management, serving the needs of the local communities and restoring vital environmental services as an economically viable business model.



### Chapter 7 Conclusion & Recommendations

The forgoing discussion indicates that Odisha has sizable area under bamboo in forests as well as in private lands and the bamboo industries which is currently in its infancy has huge potential for contributing to the economic well-being of poor and under privileged tribal and rural people through addressing four major national/regional concerns, namely the Shelter security through provision of safe, secure, durable and affordable housing and community buildings; the Food security through bamboo based reclamation of degraded/waste land and agro-forestry system, maintenance of soil fertility of adjoining agricultural lands, and bamboo shoots; the Livelihood security through generation of employment in planting and primary processing for manufacturing variety of bamboo products; and the ecological security through conservation of forests through timber substitution, efficient carbon sequestration, alternate materials to non-biodegradable & high energy consuming materials like metals, and plastics in housing and construction sector. A vibrant bamboo sector can play significant role in the achievement of several sustainable development goals (SDG), namely SDG 1, 2, 7, 11, 12, 13 and 15.

However, strategic planning for development of bamboo sector in the state will be a necessary prerequisite for harnessing its full potential and following quick road map is suggested:

1. Making OBDA as the empowered nodal agency for all bamboo and cane related interventions in the State and integrating the bamboo related activities of various Government departments.
2. A detailed survey of bamboo resources comprising species wise areal extent, clump density and vitality, and regeneration status and preparation of geo reference and GIS compatible maps.
3. Redefining bamboo management prescriptions to facilitate working of bamboo forests to produce appropriate raw materials for different end products.
4. Detailed survey of bamboo growing in private lands along with management prescriptions and annual harvests and to facilitate issue of bamboo passbooks for liberalizing harvests and transport.
5. Evolving simplified procedure for harvesting and transport of bamboo from private areas<sup>24</sup>.
6. Evolving plantation models for different regions in the State and financial/technical support for adopting bamboo plantation as an important economic activity.
7. Identification of most suitable industry specific bamboo processing zones considering the current availability of required species, potential of growing industry specific bamboo species, traditional human skills in the locality.
8. Forest and chain-of-custody certification of selected bamboo forests and private plantations is necessary to eventually promote exports.
9. Proactive management of cane bearing areas of Khurda and other parts of the State lest the State may lose cane resources due to unregulated removals.

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<sup>24</sup>This is required due to the fact although at present three species are exempted from transit regulation in reality since non-exempted species are also available in private areas and once cut it is practically very difficult to identify bamboo species. So with a simplified procedure under which bamboo grower do not get harassed in obtaining transit passes more and more farmer will come forward for planting bamboo. Any attempt to completely free bamboo from transit regulations is fraught with potential adverse effect on sustainability of bamboo forests and environment in the long run and it is better to follow precautionary principles.



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## Annexure 1

Forest & bamboo areas under working plans					
Sl. No.	Division	District	Forest area covered by the WP Sq. Km.	Area of Bamboo Overlapping WC Sq. Km.	%
1	Ghumsur North	Ganjam	920.49	589.20	64
2	Ghumsur South	Ganjam	1,441.96	628.90	44
3	Deogarh & Bamra WL	Deogarh	2,265.17	2,265.17	100
	Bamra WL	Deogarh	15.57	15.05	97
4	Bonai	Sundargarh	1,493.93	701.91	47
5	Dhenkanal	Dhenkanal	1,107.12	79.67	7
6	Athmallik	Angul	598.18	219.36	37
7	Parlakhemundi	Gajapati	2,089.03	1,021.14	49
8	Khariar	Nuapada	1,452.43	449.80	31
9	Angul	Angul	698.36	112.64	16
10	Boudh	Boudh	956.32	705.01	74
11	Phulbani	Kandhmals	1,466.35	1,010.91	69
12	Balliguda	Kandhmals	2,009.19	651.37	32
13	Subarnpur	Subarnpur	447.52	215.24	48
14	Bolangir West	Bolangir	752.92	644.66	86
15	Sundargarh	Sundargarh	1,227.71	303.62	25
16	Sambalpur North	Sambalpur	90.21	14.38	16
17	Sambalpur South	Jharsuguda	636.43	285.68	45
18	Bargarh	Baragarh	192.09	154.42	80
19	Rairakhol	Sambalpur	1,064.83	144.20	14
20	Nayagarh	Nayagarh	1,063.17	611.51	58
21	Puri	Puri	634.18	288.70	46
22	Athgarh	Cuttack	486.83	261.43	54
23	Rajnagar	Jagatsingpur	137.78	0.00	0
24	Cuttack	Cuttack	370.14	0.00	0
25	Rayagada	Rayagada	2,070.24	987.60	48
26	Koraput	Koraput	838.50	304.26	36
27	Jeypore	Koraput	376.82	194.84	52
28	Malkangiri	Malkangiri	891.26	394.47	44
29	Nabarangpur	Nabarangpur	1,661.87	0.00	0
30	Kalahandi North	Kalahandi	1,225.44	685.24	56
31	Kalahandi South	Kalahandi	739.08	28.69	4
32	Keonjhar & WL	Keonjhar	1,053.83	0.00	0
	Keonjhar WL	Keonjhar	633.97	0.00	0
33	Baripada - Karanjia	Mayurbhanj	3,531.14	0.00	0
	<b>Total</b>		<b>36,640.03</b>	<b>13,969.06</b>	<b>38</b>



## Annexure 2 Methodology for inventory of bamboo resources

The inventory of bamboos has been an integral part of National Forest Inventory undertaken by FSI. The data on bamboo resources are collected while carrying out the forest and Trees outside Forest (TOF) inventory. With modification of sampling design in year 2002, aiming at the national level estimates on growing stock, the bamboo data has been collected from 178 districts along with other forest/TOF inventory data, between the period from 2002 to 2008.

The sample design used for National Forest Inventory for assessment of Forest and TOF is two stage stratified sampling design. The first stage design which is same for both forest and TOF inventory, the country is stratified into 14 physiographic zones based on physiography, climate, vegetation etc. A sample of 60 district is then selected in proportion to area of physiographic zone for detailed inventory on a two year cycle. In the second stage, separate design is used for inventory of forests TOF (Rural) and TOF (Urban).

The information on bamboo resources from forests is recorded during forest inventory. The 60 districts selected in the first stage are taken for detailed inventory of forests. For inventory of forests, forest area is delineated based on green wash areas, double dotted lines and areas marked as thick jungle, forest on the Survey of India topographic sheets, which generally depict notified and other forests. In addition, forest areas indicated by the local forest officials are also taken into account. For such forest areas, 36 grids of  $2\frac{1}{2}' \times 2\frac{1}{2}'$  are further sub-divided into sub-grids of  $1\frac{1}{4}' \times 1\frac{1}{4}'$  grids from the 15'x15' SOI topographic sheets on 1:50,000 scale. These  $1\frac{1}{4}' \times 1\frac{1}{4}'$  grids form the basic sampling frame. Two of these sub-grids are then randomly selected to lay out the sample plots at the center of the selected grid. Other forested sub-grids in the district are selected systematically taking first two sub-grids as random start. The intersection of diagonals of such sub-grids is marked as the center of the plot at which a square sample plot of 0.1 ha area is laid out to record the measurements on field forms as per the manual. The information on bamboo resources is collected in the prescribed field forms.

### DATA COLLECTION

#### Forest Inventory

The data on bamboos is collected from each main plot of 0.1 ha and the circular plot of 2.0 ha around the plot center. The plot of 0.1 ha is actually laid out in the field for taking the measurements whereas the circular plot is not physically laid out but information from circular plot is observed ocular. The occurrence of bamboo in an area of 2.0 ha around the plot center is recorded according to density and bamboo quality. The density of bamboo is categorized in nine classes depending upon the number of clumps per hectare for clump forming bamboo species and number of culms per hectare for non-clump forming bamboos. The bamboo quality is determined on the basis of average height of culms observed in the circular plot. In addition to bamboo density and quality, information on bamboo flowering and regeneration is also recorded from an area of 2.0 ha around the plot center.

The information of total bamboo clumps and their respective diameters occurring in each 0.1 ha plot is recorded in the Plot Enumeration Form (PEF). For bamboo clump analysis, the data is recorded in a separate field form called as Bamboo Clump Analysis Form in which data of each individual culm occurring in certain selected clumps in the plot is recorded. For carrying out this analysis, at the outset, it is determined whether a culm is green sound, green damaged, dry sound or damaged and then further classified as current year's culms, one to two years old culms and over two years old culms. In case of dry and decayed culms (both sound as well as damaged), the age classification is not done. The culms other than the current years and decayed culms (both green and dry) are further grouped under diameter at breast height classes 2 cm to under 5 cm, 5 cm to under 8 cm and 8 cm and above.

For non-clump forming bamboos, there is a separate field form called Bamboo Enumeration and Analysis Form (Non-Clump Forming). In this form, information is collected for non-clump forming bamboos occurring in the sample plot. For the purpose of counting the culms, only 1/8th area of the plot (touching North West semi-diagonal) is considered. The other analysis of culms is done in the same way as is done for clump forming bamboo described above.

For determining correlation between green and dry weights of utilizable bamboo culm length, data are recorded in Bamboo Weight Form. This form is, however, filled up for plots, in which bamboo has actually been found in 2 ha area. One mature bamboo culm from each culm diameter class as described above is selected for felling from the first clump enumerated in the plot. If, however, the required type of necessary number of culms in any diameter class is not available in the first clump, the shortfall is made good from the clump next in the serial order of enumeration. In case, the requisite number of suitable culms is not available from any other clump of the plot, the required number of culms will be obtained from the area in the immediate vicinity of the plot.

The information on bamboos from rural areas is recorded in Plot Enumeration Form. The name of the bamboo species, the diameter of clumps and number of culms in each clump are recorded from each plot.

## **DATA PROCESSING**

### **Forest Inventory**

The information on bamboos collected from 178 districts during the period from 2002-2008 in the prescribed formats, viz. Plot Description Form (PDF), Plot Enumeration Form (PEF), Bamboo Enumeration Form (Clump and Non clump forming separately) and Bamboo Weight form are entered in the data base using data entry module after checking of all the data by the zonal offices. The entered data processed at FSI Hqs. is done after checking/cleaning it again manually and also by using computer based software. Cleaned data is processed at district level using a processing software developed by FSI.

For processing of the bamboo data, area factor (per plot area) is determined for a particular district on the basis of number of plots falling in the recorded forest area. Thereafter, the bamboo plots surveyed in the selected district are listed according to bamboo density and quality. The bamboo plots when multiplied with area factor gives the bamboo bearing area according to species and quality for that district. The number of clumps/ha is obtained from Plot Enumeration Form according to species, quality and size classes. The number of culms per clump is obtained from Bamboo Clump Analysis Form. Multiplying clump/ha with culms/clump, the culms/ha is obtained. The culms/ha multiplied with bamboo bearing area of the district will give the estimated number of culms in the district. The information on estimated culms is given in three categories namely green sound, dry sound and decayed. The estimated number of culms is converted into equivalent green weight using appropriate weight factors. The district-wise data is used for estimation of bamboo growing stock physiographic zone wise. The national level estimates are obtained by adding the estimates of all the physiographic zones.

### **TOF Inventory**

The data processing is carried out separately for block, linear and scattered stratum. The area figures for block and linear strata are obtained by digital interpretation of remote sensing data, whereas the area of scattered stratum is obtained by subtracting the area of block and linear patches from rural and agricultural non-forest area. In case of urban stratum, the area is taken from office of the Registrar General of India (RGI). Species and size class-wise number of clumps/ha and culms/clump is obtained for each stratum. Multiplying the clumps/ha with culms/clump, the culms/ha are obtained. Thereafter, area factor of each stratum is used for estimation of number of culms at district level. The district-wise data is used for estimation of physiographic zone estimates. The national level estimates are obtained by adding the estimates of all the physiographic zones.



### Annexure 3 Success story of bamboo plantations in backyards/other lands in Nayagarh District

A number of villagers in Bhapur village in Nayagarh district planted few clumps each in the backyards and other lands almost 10-12 years back. In a survey conducted during the present study it was found that in all there are 61 clumps owned by 23 villagers. Bulk of these clumps are of Sundarkani bamboo with one clump of Salia and one of Kanta bamboo. It was learnt that on an average 10 culms per clump are harvested every year by the villagers themselves and sold to traders at sale value of 120-150 Rs per long bamboo. The villagers doing soil working after harvesting bamboos and other maintenance works themselves and as such are not spending any money. Each clump is yielding an annual income of Rs. 1200-1500. The clumps are quite healthy and growing well.

BAMBOO PLANTATIONS IN BHAPUR VILLAGE, KHANDAPADA RANGE, Nayagarh Forest Division, Nayagarh						
Sl. No.	Name	Father's Name	Village	Spp. of Bamboo	No. of clumps	No. of bamboo culms
1	Sudam Charan Sahoo	Ramachandra Sahoo	Bhapur	Sundarkani	3	40, 80, 150
2	Kashi Baral	Maheswar Baral	Bhapur	Sundarkani	1	50
3	Bhagaban Baral	Maheswar Baral	Bhapur	Sundarkani	2	12, 25
4	Prahalad Sahoo	Dinabandhu Sahoo	Bhapur	Sundarkani	1	110
5	Benudhar Sahoo	Bhramar Sahoo	Bhapur	Sundarkani	3	50, 80, 60
6	Joginath Sahoo	Gouranga Sahoo	Bhapur	Sundarkani	3	40, 62, 90
7	Phakira Sahoo	Lokanath Sahoo	Bhapur	Sundarkani	1	40
8	Chandramani Sahoo	Kshetra Sahoo	Bhapur	Sundarkani	1	40
9	Indramani Sahoo	Kshetra Sahoo	Bhapur	Sundarkani	3	70, 80, 90
10	Kashinath Behera	Aratta Sahoo	Bhapur	Sundarkani	3	60, 80, 100
				Kanta	1	200
11	Bhobana Sahoo	Gadei Sahoo	Bhapur	Salia	1	40
12	Mahendra Sahoo	Chakradhar Sahoo	Bhapur	Sundarkani	1	50
13	Raghab Sahoo	Budhiban Sahoo	Bhapur	Salia	2	20, 50
				Sundarkani	3	80, 100, 120
14	Shantilata Sahoo	Pabana Sahoo	Bhapur	Salia	1	30
15	Bhikari Charan Sahoo	Udyanath Sahoo	Bhapur	Sundarkani	1	30
16	Kuber Sahoo	Ramachandra Sahoo	Bhapur	Sundarkani	4	150
17	Agadhu Sahoo	Giridhari Sahoo	Bhapur	Sundarkani	1	20
18	Rabi Sahoo	Mani Sahoo	Bhapur	Sundarkani	1	100
19	Gangadhar Mohapatra	Jaladhar Mohapatra	Bhapur	Sundarkani	1	30
20	Dandadhar Sahoo	Basu Sahoo	Bhapur	Sundarkani	1	100
21	Satrughan Sahoo	Hadu Sahoo	Bhapur	Sundarkani	1	25
22	Daitari Sahoo	Jagabandhu Sahoo	Bhapur	Sundarkani	1	40
23	Benudhar Sahoo	Bhramar Sahoo	Bhapur	Sundarkani	1	30
	<b>Total</b>				<b>61</b>	<b>2624</b>



## Annexure 4

Bamboo plantations under OBDA		
Year	No. of land parcels	Area
2008-09	289	294.94
2009-10	1,623	1,118.11
2010-11	420	348.21
2011-12	302	396.97
2012-13	778	155.00
2013-14	608	324.67
2014-15	3,074	844.62
2015-16	552	475.76
<b>Total</b>	<b>7,646</b>	<b>3,958.28</b>

Bamboo plantations under OBDA Areal distribution of bamboo plantations raised under OBDA 2008-09 to 2015-16	
Area ha.	No. of land parcels
Area not mentioned	72
< = 0.25	5,000
>.25 -<= .5	730
>.5 -<= .75	206
>.75 -<= 1.0	709
>1.0 -<= 2.0	494
>2.0 -<= 5.0	406
>5.0 -<= 10.0	22
>10	7
<b>Total</b>	<b>7,646</b>

District wise bamboo plantations under OBDA (2008-09 to 2015-16)		
District	No. of land parcels	Area in ha.
Angul	22	35.40
Balasore	739	49.00
Baragarh	42	108.13
Bhadrakh	122	18.04
Bolangir	110	124.49
Boudh	56	82.20
Cuttack	87	51.72
Deogarh	12	21.00
Dhenkanal	50	101.00
Gajapati	40	26.00
Ganjam	110	185.80
Jagatsingpur	0	0.00
Jajpur	0	0.00
Jharsuguda	0	0.00
Kalahandi	292	389.30
Kandhmals	277	281.30
Kendrapada	27	1.44
Keonjhar	50	49.20
Khurda	76	30.79
Koraput	124	311.10
Malkangiri	0	0.00
Mayurbhanja	1993	335.90
Nawangpur	60	29.94
Nayagarh	30	33.00
Nuapada	28	27.00
Puri	115	55.00
Rayagada	166	88.48
Sambalpur	25	47.50
Subarnpur	19	70.60
Sundargarh	247	218.80
Blank (district name not filled in)	2727	1186.15
<b>Total</b>	<b>7,646</b>	<b>3,958.28</b>



## Annexure 5a Success story of bamboo plantation on private land in Bolangir district



Area in 2008 ↑



Area in 2010 ↑

(as per details collected through personal interactions)

One farmer, Mr. Bhagwan Pati, village Sibtala, in Bolangir had planted *Bambusa vulgaris* in 25 ha. two patches (belonging to 4-5 individuals of the family) during 2008-09 with 400 clumps per ha. The site was a barren land, just like a playground with red sandy loam having no vegetation except some few bushes. Financial assistance to the tune of Rs. 8,500 per ha. was provided by OBDA along with technical assistance, and grant in aid of Rs 95,000/- for installing a deep bore-well with overhead tank for irrigating the plantation during summer season. In the initial 2-3 year along with soil working during monsoon season, 200 gms of NPK was also applied. The area started producing saleable culms from fourth year onwards and now have about 10000 fully developed bamboo culms. For watch and ward two persons are kept round the clock for each patch. Need based irrigation is done provide Soil working around the clumps is done once in three year and was done recently in one patch at a total cost of Rs. 2,00,000/-

Area in 2015 ↓





The plantation is now yielding on an average 10 culms per clumps every year and at site sale price between Rs. 100 to 130 per culm, depending upon base diameter and length. At present net annual income is about Rs. 350,000 per ha. and the

plantation have IRR of more than 50.

Recently, he has made a trial production of biomass briquettes (grinding semi-green bamboo including lops and tops followed by machine pressing) and sold to Britannia Biscuit Bakery @ 6000/ton and the product has been found to be suitable by the company and is ready to take regularly at competitive market



prices.

There is a scope for enhancing income through "Certification of the bamboo plantation and products".



### Annexure 5b Success story of bamboo plantation in private land in Mayurbhanj District

(as per details collected through personal interactions)



A progressive and enterprising farmer, Mr. Govind Mahapatra in Mayurbhanj district had been working to improve production from dry land through different farming practices in close association with Orissa University of Agriculture and Technology, Bhubaneswar. He started planting bamboo way back in 1989 and planted *D. strictus* but the experiment did not succeed. He was selected for training at Cane and Bamboo Technology Centre, Guwahati, Assam in 2007. He accepts that this training helped him prepare bamboo seedlings in the scientific way. Later on in 2008-09 with the support of OBDA he planted *B. vulgaris* and *B. nutans* (400 plants per ha. at 5m x 5m spacing) over an area of about 80 ha. Plantation over two patches measuring 24 ha. was analyzed for this report. The site was a dry land used for cultivating Sabai grass. Technical assistance and financial assistance to the tune of Rs. 8,500 per ha. was provided by OBDA. Farm yard manure and fertilizer was given to bamboo plants at the time of pit planting and subsequently during first and second year along with soil working. need based watering in the plantation is done through micro irrigation system established from grant in aid of Rs 1,60,000/- provided by OBDA. In initial years seedlings were protected by using old fishing nets. Actual plantation cost up to five year maintenance was 120/- per seedling including replacement of casualties, cost of seedlings, manure etc.

Young culms of small sizes were harvested during 2013-14 to maximize clump growth, which were sold for Rs. 2,50,000/-. The area is ready now ready for annual harvesting. Each clump is expected to yield 10 culms on an average with an expected sale price of Rs 60/- each, excluding the cost of harvest. The IRR for the plantation works out to 45%.

He has been awarded with Odisha Krushka Samman in 2011, and best bamboo farmer in Odisha in 2013. He tells bamboo cultivation as armchair cultivation due to the fact after planting and care for initial 2-3 years, bamboo plantation does not require intensive care for almost 30-40 years.



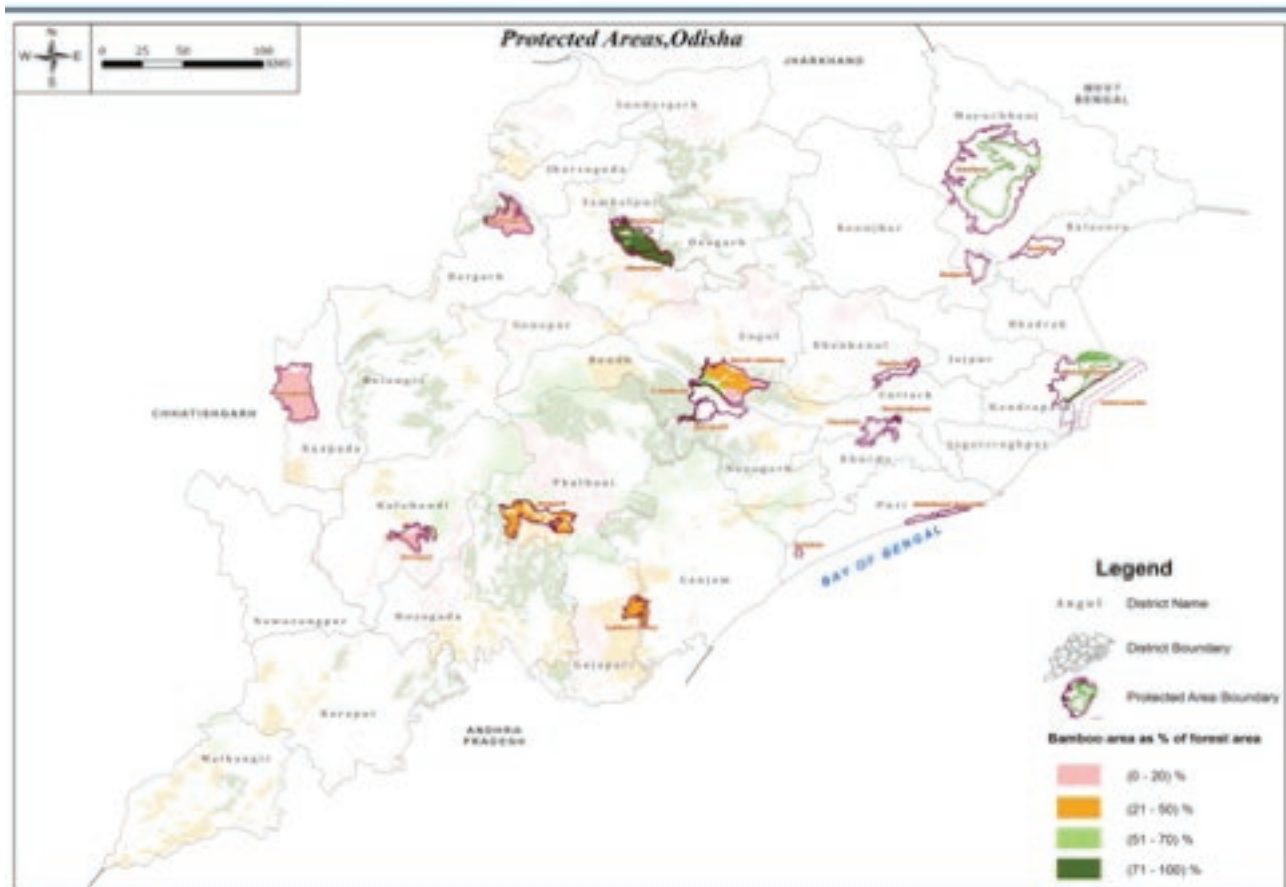
## Annexure 6 Main characteristics, occurrence and uses of bamboo species found in Odisha

Sl. No.	Botanical name	Local name	Occurrence in Odisha	Important Characteristics	Main uses
1	<i>Dendrocalamus strictus</i> Roxb/ <i>Bambusa stricta</i> Roxb	Salia / dongar bauns	entire State except Mayurbhajna, Nawrangpur, Keonjhar districts	Densely clumped/tufted bamboo.	Paper industry. Construction, agricultural implements, music instruments, furniture, mats and baskets. Young shoots are used as food (called kardi). Decoction of leaves nodes and siliceous matter is used in the traditional medicine. Suitable for reclamation of ravine lands.
2	<i>Bambusa bambos</i> Voss./ <i>Bambusa arundinacea</i> Retz.	Kanta / Daba bauns	Entire State except Mayurbhajna, Nawrangpur, Sambalpur, Bolangir Keonjhar districts	Large thorny bamboo with dense clumps of closely packed culms. Strong, cylindrical, erect, hollow culms	paper industry, scaffolding, rafters and roof thatching, baskets, bows, arrows, furniture, fencing. Young shoots are edible. Leaves used as fodder and medicine. Elephnats & Gaur relish young shoots in forests.
3	<i>Schizostachyum pergracile</i> Munro. / <i>Cephalostachyum pergracile</i> Munro	Dangi / Bolangi bauns	found in lower slopes with <i>D.strictus</i> , sporadic clumps in Angul, Kandhals, Kalahandi, Nawapara district	Internodes 35-50 cms, diameter 4-6 cm very thin walls	popular with artisans for fine works - hats, flower baskets, decorative mats. Acknowledged as the best species of lacquer ware. Hollow internodes - used as blow pipes in rural kitchens.
4	<i>Gigantochola rostrata</i> Wong./ <i>Gigantochola maxima</i> var <i>minor</i> holttum / <i>Gigantochola hasskarliana</i> / <i>Oxytenanthera nigroiliata</i> Munro	Pani bauns	in moist valleys along stream banks in Khurda & Khandmal districts	Small bamboo forming dense clumps. Internodes 30-35 cms, thick walled.	Hutments, basket making - specially for stitching of leaf plates.
5	<i>Bambusa nutans</i> wall	Badia bauns	Cultivated in Mayurbhanj districts	Culms are loosely clumped, straight with several branches at the top and lesser branches towards the bottom. Strong straight culms, internodes 25-40 cms, wall thickness .8 to 1.2 cms.	Paper industry. Most preferred spp. for poles in construction of rural houses, scaffoldings. Also for mat making and agarbatti sticks.
6	<i>Bambusa vulgaris</i> Schard.	Sundarkani bauns	widely cultivated in homestead lands Bolabgir, Mayurbhanj, Balasore, Nayagarh	Internodes 20-40 cms, wall thickness 0.8 to 1.4 cms.	Construction, scaffolding, roof thatching, agriculture implements, preferred by artisans for household articles and handicraft over salia bamboo.
7	<i>Bambusa tulda</i> Roxb/ <i>Dendrocalamus tulda</i> Roxb.	Taleda bauns	Cultivated in some parts mainly Balasore but not wide spread.	slender tufted bamboo with dense clumps. Internodes 35-45 cms, wall thickness 2 to 2.4 cms. Lower internodes - at times almost solid.	Favoured for basketary and woven applications for packaging beetle leaves and Pan baraja in cultivation of beetle leaves. Roof structure in thatched house, and in cultivation of betel vines. Young shoots fused for making pickles.
8	<i>Thyrsostachys oliveri</i> Gamble	Nala bauns	Village grooves in Nayagarh and Ganjam districts	Absence of branches in lower portion & persistent culm sheaths, internodes 30-40 cms, wall thickness 0.5-0.8 cm	good for basketery & mat making, and for roof thatching, handicrafts, and also for reinforcement in concrete cement. Young shoots edible.
9	<i>Thyrsostachys regia</i> (Munro) Bennet./ <i>Thyrsostachys siamensis</i> Gamble	Lathi bauns	Introduced in Khandagiri research garden	Thick walled and small lumen. Internode 25-30 cms.	Umbrella handles, furniture, basketary, handicrafts.
10	<i>Bambusa wamin</i> Camus./ <i>Bambusa vulgaris</i> var. <i>Wamin</i> McClure		Planted in gardens as an auspicious and ornamental bamboo	internodes 10-15 cms & swollen like pitcher,	Garden bamboo for auspicious and ornamental purposes
11	<i>Dendrocalamus giganteus</i> Munro/ <i>Bambusa gigantea</i> Wall.		Introduced in research garden at Kalinga, tried in other areas but not promising	Tall bamboo with close culms. Wall thickness 1.5-2 cms, internodes 35-40 cm	Decorative purposes, water pitchers, building purposes, boat masts.
12	<i>Bambusa striata</i> Lodd. Ex Lindl./ <i>Bambusa vulgaris</i> var. <i>Strita</i> (Lodd. Ex Lindl.)	Champa bauns	Introduced in research garden at Khandagiri and Jashipur	Light green with yellow strips, internodes 15-25 cms, thick walled	ornamental bamboo, also for construction purposes



## Annexure 7

Protected Area in Odisha with natural occurrence of Bamboo





## Annexure 8

Recorded production of bamboo from forests in Odisha <sup>25</sup> (bulk for paper industry)		
Year	Production lakh tons	Royalty to the State Million Rs.
1981-82	3.02	26.53
1982-83	2.95	21.59
1983-84	2.63	24.32
1984-85	3.88	30.88
1985-86	2.89	30.90
1986-87	2.15	29.97
1986-87	2.54	30.00
1987-88	2.61	75.93
1988-89	2.39	78.95
1989-90	2.2	74.55
1991-92	2.38	82.56
1992-93	2.45	87.31
1993-94	2.41	101.14
1994-95	2.4	103.5
1995-96	2.18	95.31
1996-97	2.46	90.00
1997-98	2.08	85.00
1998-99	1.2	85.00
1999-00	1.12	20.00
2000-01 <sup>26</sup>	0.075	4.81
2002-03	0.002	0.07
2003-04	0.16	5.39
2004-05	0.91	41.4
2005-06	1.4	62.01
2006-07	0.97	48.67
2007-08	1.05	52.59
2012-13	0.028	
2013-14	0.129	
2014-15	0.032	

<sup>25</sup> Apart from the recorded harvest, substantial quantity of bamboo is also felled and removed from forests by local people and artisans for house-hold use and occupational livelihood. No estimates are available about total annual harvest of bamboo from forests.

<sup>26</sup> Working in Protected (Wild Life) Areas was stopped from February 2000 in pursuance of the orders of the Apex Court (Supreme Court of India). Subsequently, the Wild Life (Protection) Act 1972 was amended in 2002 prohibiting removal of forest produce from a National Park or a Wild Life Sanctuaries for commercial purpose. As a result, it has impacted about 8,352.19 sq.km. of forest area in 19 notified PAs (National Parks, Wild Life Sanctuaries, Tiger Reserves etc.), of which 3,644.64 sq. km. is known to have bamboo bearing areas in different proportions and have become no-go area for commercial bamboo working.



## Annexure 9

Recorded production of Canes in Odisha (A decade of Forestry in Orissa 1981-1990)	
Year	Quintals
1980-81	69.49
1981-82	45.10
1982-83	47.20
1983-84	53.00
1984-85	32.09
1985-86	27.00
1986-87	69.00
1987-88	99.00
1988-89	256.00



## Annexure 10 DRAFT ODISHA BAMBOO POLICY

### 1. PREAMBLE

Ecological security and economic prosperity of any area greatly depends on forest which provide many tangible and intangible benefits to the poor and the people living in the vicinity of forests, many of whom depend on forests for their basic livelihood. Bamboo is an important resource of the state of Orissa whose full economic potential has not still been harnessed and the bamboo sector needs to be developed and promoted to ensure economic and ecological security for all round sustainable development of the people of Orissa. Bamboo is an essential component of forest eco-system, and about thirty percent of the total forest area of the State is covered with bamboo.

Development of bamboo sector will provide increased economic opportunities for rural households (especially tribal communities and women), small/medium enterprise and large industrial development, and improvement of the overall quality of the environment through increased green cover and arresting land degradation. This has the potential for rural poverty alleviation through additional and gainful employment generation along with environmental protection and rehabilitation. Use of bamboo, one of the most gifted plants found in the forests of the State, can become the engine of rural development because of its very unique properties as a material

that enables the rural poor and forest fringe dwellers not only to grow but also to process bamboo and participate in a symbiotic manner in the building of houses, industrial activities, and the production of value-added products that meet demands of mainstream consumer products and markets. Institutional markets, both domestic and export, exist for such products and are expanding with more and more people preferring eco-friendly products.

Use of the latest techniques for using bamboo for construction of safer and more durable and affordable housing and other buildings such as schools especially in rural areas will help in improving the quality of life of rural communities 48% of whom are below the poverty line.

The change over from traditional uses to modern uses tracking a high potential growth path using eco-technologies needs a clear vision with an enabling policy environment and long term plan of action. Hence there is a necessity of enunciation of the State Bamboo Policy.

## 2. OBJECTIVES

**2.1 General Objectives:** Considering the ecological significance and vast economic potential of bamboo in the State the Bamboo Policy has the following general objectives:

- a. Development of bamboo based economy in the state to harness full potential of bamboo in securing ecological, economic and food security.
- b. Creation of enabling environment for establishment and growth of bamboo industries including handicrafts.
- c. Progressive development of bamboo resources in the state.

**2.2 Specific Objectives:** The specific objectives of the State bamboo policy are:

1. Sustainable development and utilization of bamboo resources through scientific management of bamboo bearing forests for sustained production and environmental security.
2. Promotion of private bamboo plantations (individual land community owned) for growing quality bamboo for various industrial products as a thrust area for development of bamboo based economic activity in the State.
3. Promotion of bamboo cultivation in the homestead land as an essential component of agro-forestry to generate income and to meet the contingent needs of rural households in the State.
4. Improvement of bamboo productivity in farm and forestry sector by use of biotechnology, micro-proliferation and improved management practices to make bamboo plantation a profitable and attractive economic enterprise.
5. Promotion of bamboo based industries at cottage level, small scale, medium and large scale, for utilizing the bamboo harvests from the forests and home-farm grown bamboo for manufacturing wood alternates and other products for use in housing and construction thereby reducing pressure on forests and reducing wood deficiency in the State, bamboo food and breweries and other innovative products.
6. Revitalization and promotion of local traditional bamboo craft and art with improved technology, design and market linked trade for value added items for export through industrialized mode of production.
7. Promotion of bamboo sector development as an essential component of rural development strategy linked with forestry and agri-business sector in the State promoting rural employment.
8. Promotion of awareness and understanding of bamboo as “ Green Gold” among farmers and entrepreneurs with a view to utilize its full potential and to galvanize the rural and industrial sector in the State.

### 3. STRATEGY

**3.1 Bamboo Resource Assessment** - Detailed mapping and rigorous inventorization of bamboo in forests as also in homesteads, shall be accorded high priority and shall be completed using the expertise available with the Forest Survey of India (FSI), National Remote Sensing Agency (NRSA), Orissa Remote Sensing Application Centre (ORSAC) and the State Forest Department. Bamboo rich areas having economic potential and ecological significance shall be identified, surveyed, demarcated and dedicated to permanent bamboo growing (in state government, community and private sector landscapes).

**3.2 Potential Bamboo Industries** - 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. In the initial stage, bamboo based industries will be established based on available bamboo species through techno-commercial feasibility studies for their suitability for various products such as bamboo mat based composites, bamboo shoots, incense sticks and other handicraft products. To facilitate enterprise development with thrust on establishment of bamboo industries efforts will be made to tap the facilitation under the National Mission on Bamboo Applications under the Department of Science and Technology, Government of India. While simple technologies and manufacturing processes can be adopted 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.

Detailed analysis shall be undertaken in collaboration with National and State R&D institutes to assess the suitability of State climatic and edaphic conditions for introduction of new bamboo species for establishment of high value added industrial products based on eco-technologies. Major emphasis for such an intervention will be creation of additional employment opportunities for rural/tribal forest dependent communities. Bamboo products including bamboo mat boards, ply-boards, bamboo mat corrugated sheets, bamboo laminates, shall be promoted as eco-friendly alternate to wood and other materials for the growing construction and other developmental 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. Use of bamboo and bamboo products shall be emphasized in Government constructions and housing schemes under various schemes where such uses are feasible. 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 and organizations.

Other industrial products from bamboo are flooring tiles, shoots and furniture in conjunction with timber and cane. These sectors need adoption of improved technology, standard/improved designs and improved artisan skill that will be actively promoted. Assistance of experts shall be taken in identifying suitable technology, product designs and in imparting training to artisans and craftsmen. High value products will necessitate effective and appropriate manufacturing process as well as 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 channelize the resources through local traders and manufacturing industries into domestic and international markets earning revenue for the State. Present export policy in agro-industry encourages such arrangements which shall also be adopted and encouraged for bamboo sector development in the State.

With the policy reform regarding the management, harvesting and utilization of natural bamboo resources in the state and for promoting bamboo plantation, it is expected that bamboo trade shall receive a fillip. With increased bamboo production and establishment of 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 through organizing local bamboo traders into trade associations with linkages with bamboo growers and the bamboo processing industries and bamboo exporters to rationalize the bamboo trade proactive. Export will be promoted, inter-alia, through establishment of Export Promotion Zones.

**3.3 Management of Bamboo Resources** - The existing bamboo resources within the notified forests and outside in government/community/private lands shall be managed on scientific lines as per approved management plans keeping in view the socio-economic needs of local people and identified industrial end uses.

Joint Forest Management approach will be adopted in the case of forest areas assigned to adjoining Van Saran khan Semites for which appropriate guidelines for growing, harvesting, primary processing and linkage with handicrafts and other processing industries shall be evolved. Thus Bamboo Resource Management will be a community enterprise with delegated powers/vested interest created to conserve, protect, harvest bamboo resource in areas assigned to VSSs involving willing families in bamboo production, management, harvesting and supporting bamboo craft, bamboo industries in the rural sector.

Bamboo bearing forests shall be protected from fire. Every year a forest fire prevention strategy and measures shall be adopted and implemented by making joint efforts by the state forest department, VSS and NGOs. Required financial support shall be made available from government sources and Village Development fund

Effective management of the bamboo resources in a sustainable manner and to ensure a support base obtain enhanced yields, both quantitative and qualitative, to meet the local requirements and the needs of bamboo based industries, annual harvests of bamboo of different dimensions will be predetermined through silvicultural availability, felling regulations, seasonal requirement, market need assessment in consultation with all concerned and regulated so that bamboo resources are optimally harvested and used. Separate areas will be earmarked for production of bamboo shoot to meet both local and industrial requirements for which the harvesting rules will be appropriately modified.

**3.4 Quality Bamboo Plantation** - Plantation of *Bambusa nutans* and other suitable species shall be encouraged and promoted due to their high value, productivity, crop uniformity. Choice of species shall be linked to peoples' needs and specific industrial uses. Such plantations of selected species shall be raised in private, community and Government sector. Nurseries will be established in identified areas using tissue culture, micro-proliferation and other technologies suitable for bamboo so that adequate plantation material is available. The required technical and scientific support and guidance shall be provided by the Forest Department. Financial incentives shall also be given to willing beneficiary families interested in raising bamboo plantations from the State Agriculture, Horticulture, Environment & Forest, Rural Development, Soil Conservation Department through funds from beneficiary oriented schemes. Such willing farmers shall also be granted land lease on specific terms and conditions for raising bamboo plantations in government lands outside Notified Forests.

**3.5 Entrepreneurial development** - 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, tenurial security and consultation with people's groups and involving them in management committees.

#### **4. RESEARCH AND HUMAN RESOURCE DEVELOPMENT**

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 various national and international organizations such as Forest research Institute, Dehradun, Indian Plywood Industries Research and Training Institute, National Mission for Bamboo Applications, Center for bamboo and Cane Development Agartala, Centre for Indian Bamboo and Rattan Technology, National Institute of Design, International Network for Bamboo and Rattan.

An interface with research wing of the forest department would be established for problem specific and site specific research regarding bamboo growing, bamboo plantation development, management of natural bamboo stands, and bamboo species selection for diverse locations especially with reference to soil, watersheds and landscape restoration. Adequate pool of trained human power needs to be created for bamboo 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 personnel within the State, Central Institutions and outside the country. A bamboo technology park will be set up as a demonstration cum production center to facilitate effective adoption of bamboo processing technologies. Dissemination of technology shall also be done through media campaigns, exhibitions, and seminars

#### **5. INSTITUTION BUILDING**

Considering the potential of the bamboo sector in creating livelihood opportunities in rural/tribal areas and the need for multidisciplinary approach for strategic planning and implementation of schemes and programmers for development of the sector, a mission approach shall be adopted. The state shall set up the Orissa Bamboo Sector Development Mission that will aim at creation of sustainable livelihood opportunities through development of bamboo based production-to-consumption system involving rural communities in general and forest fringe dwellers in particular. Involvement of communities will be in growing, primary processing for development of small / medium enterprises for adoption of environment and people friendly technologies for production of value added products to harness the social, economic and ecological value of versatile Bamboo – a fast growing, renewable wonder grass. The Mission will network with various international and national organizations like INBAR, UNIDO, IPIRTI, CIBART, CBTC and the National Bamboo Mission on one hand and on the other hand will bring focus on bamboo development through various ongoing schemes/ development programs in the State. Forest & Environment Department shall be the Nodal Department for the Mission. Other related Departments of State Government shall collaborate with the Mission in achievement of its goals.

The Mission shall be registered as a Society under the Societies Registration Act, 1860 with its headquarters at Bhubaneswar. The Mission may receive such grants as may be provided by or through the State Govt. and such assistance as the State Government may permit it to receive and the funds received

and expenditure incurred by the Mission shall be operated through one or more accounts in scheduled Banks. The accounts of the Mission shall be audited in such manner and through such agency or agencies as may be decided by the Government. On the recommendation of the Empowered Committee and with the approval of the State Government, the Mission may engage or appoint on deputation, such number of Officers and staff on such terms as may be decided and considered necessary for the performance of the duties and responsibilities of the Mission. As the nature of the Mission will be mainly catalytic in creating an environment for the sustainable production and use of bamboo resources, it will adopt collaborative approach involving consultation with different stakeholders at different levels for policy decisions related to promotion and implementation of projects and programmes for bamboo sector development. The structure envisaged will be advisory in nature and would guide the activities of the mission.

There will be a Steering Committee and an Empowered Committee at the State level to provide an overall direction and take policy decisions required for achieving the goals of the Mission. It should also include a Screening committee for Grant of Licenses for Bamboo based Industries. An executive committee consisting of representatives of Departments of Environment & Forests, Industries, Finance, Trade & Commerce & Rural Development, and the Conservator of Forests Bamboo Resource Development wing will scrutinize the applications from entrepreneurs and recommend grant of licenses for various categories of units for final decision by the Bamboo Development Agency. The Screening Committee will verify the availability of raw material, financial position, investment source; and recommend grant of Industrial licenses on merit.

## **6. Financial Support**

Financial support to implement the various policy initiatives enunciated shall be provided from the funds of 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 sector shall be supported from plan funds of Agriculture, Horticulture, and Rural Development Departments and pertinent national and State level missions, such as NBM. Special projects for bamboo plantation in farm sector shall be prepared for institutional finance from NABARD and other similar financial institutes. Establishment of bamboo craft centers, training of artisans and craftsman and bamboo cottage and small and medium industries can be supported by government subsidies and institutional finance from industrial financing agencies and industrial investors and exporters. International financial, trade and technical support shall be solicited from ADB, IBRD, IFAD, GCF, GEF, UNIDO, UNDP and other international agencies and philanthropic foundations for supporting bamboo sector development, combating climate change, bamboo based poverty afflicted communities, SMEs and industries in the State.

## **7. ACTION PLAN**

The policy shall be implemented through appropriate strategic programmes, projects and action plan packages; and their implementation shall be regularly monitored for attaining desired results.

## **8. POLICY REVIEW**

The policy shall be reviewed periodically to evolve guidelines to achieve bamboo-based sustainable development goals and State level priorities and revenue generation.

### Annexure 11 Common facility centers/bamboo bazaar established under OBDA

Common Facility Centers (11a)				
Sl. No.	Name of the organization	Year of Establishment	Location	Products
1.	Maa Manasa SHG	2011	Bhalia, Baripada, Dist. Mayurbhanj	Bamboo Baskets, Decorative items
2.	Mahatma Gandhi Khadi and Gramodyog Samiti	2011	Arikam, Dist. Khurda	Bamboo Handicraft and Agrabatti
3.	Sunshine Multi Media Academy and Rural Development Action	2011	Rayagada, Dist. Rayagada	Bamboo roll sticks for Agarbatti
4.	India Network of Social Action & Formation	2011	Badamba Hata, Athgarh Dist. Cuttack	Bamboo mat, & other traditional products
5.	United Sport Association	2011	Dhalapathar Dist. Khurda	Bamboo Agrabatti & Handicraft
6.	Mayurbhanj Bamboo Artisan Cooperative Society	2011	Takhatpur, Baripada Dist. Mayurbhanj	Sophisticated bamboo craft and furniture
7.	Mighty Club	2011	Chhamauj Dist. Balasore	Agrabatti and other sticks and decorative items.
8.	Odisha Rural Products Marketing Federation	2012	Tendakura, atkurdea Dist. Kendarpada	Furniture and Agrbatti
9.	Bamboo Farmers Forum	2012	Sibatata Dist. Bolangir	Agrabatti sticks and bamboo craft
10.	Utkal Kiasn Vikas Parishad	2014	Gurujanguli Dist. Dhenkanal	Agrabatti sticks
11.	Sashiparva Handicraft	2014	Jamujhadi, Simulia Dist. Balasore	Agrabatti sticks and decorative items
12.	PAHAD,	2014	Sudurukumpa Dist. Kandhmal	Agrabatti sticks and decorative items
13.	Srujan SHG	2014	Kendupadar Dist. Kandhmal	Ttool kit for handicrafts
14.	SANSTHAPAN	2016	Palsipada Dist. Kalahandi	Treatment of bamboo
Bamboo Bazaar (11b)				
1	Development Action for Tribal Area	2011	Anlakuda, Baripada Dist. Mayurbhanj	Long and Piece bamboo, handicraft & household items
2	Mighty Club	2011	Chhamauj Dist. Balasore	Long and Piece bamboo, handicraft & raw Agarbatti stick items
3	Samrudhi Odisha	2011	Bhubaneswar Dist. Khurda	Bamboo Mat, Gabians, Long and Piece bamboo, handicraft & household items
4	SOWDESH	2014	Chowki, Bogarai Dist. Balasore	Bamboo Mat, Gabians, Long and Piece bamboo, handicraft & household items



## Annexure 12

# Legal provisions and regulations related to Bamboo

### Orissa Forest Act, 1972

Under the Orissa Forest Act, 1972 (OFA) bamboo is defined as "tree" (OFA Section 2(o)<sup>27</sup>), and "timber" (OFA Section 2(n)<sup>28</sup>) which is a "forest produce" whether found in, or brought from a forest or not (OFA Section 2(a)<sup>29</sup>). The OFA authorizes the State Government to make rules to regulate transit and possession of all timber and other forest produce (OFA Section (45)). The State Government notified the Orissa Timber and Other Forest Produce Transit Rules 1980 (Notification SRO No. 165/80 dated 1<sup>st</sup> February 1980).

OFA defines only timber, tree, and forest produce and does not define minor forest produce. Under the Orissa Timber and Other Forest Produce Transit Rules 1980 (called TT rules) "Minor Forest Produce means forest produce other than timber, firewood, charcoal and bamboos (Rule 2(1)(h))" and thus bamboo is not an MFP.

The TT rules provide that transport of all forest produce are to be covered by a transit/depot/coupe permit issued by a designated authority. However, under these rules inter alia no transit permit is required for transport of MFP within the district except lac, tassar, myrabolans, gums and resin, root or patalagaruda, sal seed, tamarind and hill brooms, subject to such limit of transport and storage without transit permit as may be notified by State Government in the Official Gazette for different items. The rules also have detailed procedure for obtaining permit for removal of trees/bamboos from privately owned areas (application to be made by the owner of the plot(s), joint verification by revenue and forest officials along with enumeration of trees/bamboos, preparation of conversion list, issue of transit permit mentioning destination, route, and vehicle number etc.). In respect of bamboo plantations raised in "Farm Forestry" and "Forest Farming for Rural Poor" under the Orissa Social Forestry Project, funded by Swedish International Development Agency (SIDA) and implemented between 1983-96, the concerned Range Officers have been authorized to issue transit permits. Through an amendment vide Gazette Notification No.10(TR)-18/91/16900/F&E dated Bhubaneswar 18<sup>th</sup> September 1991 exemption has been given for timber and firewood obtained from some tree/bamboo species. The exempted bamboo species were *Dendrocalamus strictus* in districts of Balasore -except Nilagiri sub-divisions, Cuttack -except Athgarh sub-division, Puri -except Nayagarh Sub-division and Balugaon range, Chatrapur sub-division of Ganjam District, and Mayurbhanj and Keonjhar districts (which are the areas in which forests do not have natural occurrence of bamboos). In a subsequent amendment in 1991, this exemption for bamboos was replaced exemption for three bamboo species namely *Bambusa nutans* (Sundar-Kani), *Bambusa vulgaris* (Badi-baunsa) and *Bambusa tulda* (Bolangi-Baunsa) for the whole State. Thus *D. strictus*, the main bamboo species in the forests, is not an exempted species under the TT rules. Some species of non-exempted bamboo species are also planted in private areas along with exempted species and it is not easy identify bamboo species after they are cut. Therefore, the private bamboo traders who purchase clumps or culms from individual bamboo growers prefer to get transit permits issued to avoid hassles at forest check gates during transportation of bamboo to paper mills and/or other places within or outside the State.

### Bamboo is one of the specified produce under the Orissa Forest Produce (Control of Trade) Act, 1981.

<sup>27</sup>OFA Section 2(o) "tree" includes palms, bamboos, stumps, brushwood and canes.

<sup>28</sup>FA Section 2(n) "Timber" includes trees fallen or felled and all wood cut-up or swan

<sup>29</sup>OFA Section 2(g) "forest" produce includes- (i) the following whether found in, or brought from a forest or not, that is to say- (a) timber, charcoal, catechu, wood- oil, resign, natural varnish, bark, Tussay Cocoon, lac, gums, roots of Patala Garuda, mohua flowers, mohua seeds, myrabolans, Kendu Leaves, sandalwood, tamarind, hill- broom, Siali leaves, Siali fibres, Sal seeds; and (c) such other produce as may be notified by the State Government.

### 73<sup>rd</sup> Constitution Amendment & PESA

73<sup>rd</sup> amendment to the Constitution (Anon. 1992) mandated that resources, responsibility and decision making be passed on from the Central Government to Panchayats at the appropriate levels (A three tier structure of local self- governance was envisaged under this amendment), with respect to (a) the preparation of plans for economic development and social justice; and (b) the implementation of schemes for economic and social development and social justice as may be entrusted to them including those in relation to the matters listed in the Eleventh schedule. Seventh entry in the eleventh schedule is **Minor Forest Produce**. Moreover, since the provisions do not automatically apply to the Scheduled Areas, PESA [Panchayats (Extension to the Scheduled Areas) Act, 1996] enacted in December 1996 extended the provisions of Panchayats to the tribal areas of nine states that have Fifth Schedule areas, including Odisha<sup>30</sup>. Amongst other provisions, PESA provides that a State Legislature shall ensure that the Panchayats at the appropriate level and the Gram Sabha are endowed specifically with the ownership of minor forest produce. Orissa Gram Panchayats (MFP Administration) Rules, 2002, among others also provides that the Gram Panchayat shall have the power to regulate - obtaining and trade of MFP (as specified in the schedule appended to these rules which does not include bamboo).

### Schedules Tribes and other Traditional Forest Dwellers (Recognition of Rights) Act, 2006

Under the Schedules Tribes and other Traditional Forest Dwellers (Recognition of Rights) Act, 2006 [known as the Forest Rights Act (FRA), with the Ministry of Tribal affairs GoI as the Nodal/Administrative Ministry] Minor Forest Produce includes all non-timber forest produce of plant origin including bamboo, brush wood, stumps, canes, tussar cocoon, honey, wax, lac, Tendu/Kendu leaves, medicinal plants, and herbs, roots, tubers, and the like.

The FRA provides for rights, with secure individual or community tenure or both, of ownership, access to collect, use and dispose of Minor forest produce which has been traditionally collected within or outside the village boundaries, on all forest lands as forest right to the scheduled tribes and other traditional forest dwelling communities (FRA Section 3(1) (c)). The recognition and vesting of these rights is "notwithstanding anything contained in any other law for the time being in force" (FRA Section 4(1)). The rights under FRA are subject to the condition that such tribes and other traditional forest dwelling communities had occupied forest land before 13<sup>th</sup> December 2005 (FRA Section 4(3)). Moreover, as per the Schedules Tribes and other Traditional Forest Dwellers (Recognition of Rights) Amendment Rules, 2012 notified on 6<sup>th</sup> September 2012, the rights related to MFP are community rights for which the FRA and the Rules made there under have detailed procedure for filing, determination, and verification of claims and authority for the same vests in the Gram Sabha. The September 2012 amendment also clarifies that "disposal of MFPs includes right to sell as well as individual or collective processing, storage, value addition, transportation within and outside forest area through appropriate means of transport for use of such produce or sale by gatherers or their cooperatives or federation for livelihood". It has also been explained that transit regime in relation to transportation of MFP shall be modified and given by the committee constituted under the rule 4 of FRA Rules or the person authorised by the Gram Sabha. Recognition of claims for community rights and CFR right requires prior delineation of boundaries of the CFR and preparation CFR map. The Act also provides that duties of the holders of any forest right, Gram Sabha and village level institutions in areas are to protect the wild life, forest and biodiversity, and protection of adjoining catchment areas, water sources and other ecological sensitive area. A recent instruction of Government of Odisha, vide letter dated 19<sup>th</sup> September 2015, quoting the observation of the Ministry of Tribal Affairs, GOI, it has been clarified that CFR under FRA may be conferred only to the Gram Sabha and not the VSS committees (constituted under JFM resolution discussed in following paras).

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<sup>30</sup>Scheduled Areas in Odisha include Mayurbhanj, Sundargarh, and Koraput districts and parts of Sambalpur, Keonjhar, Khandmal, Ganjam, Bhawanipatna, and Balasore districts -which cover sizable bamboo bearing areas. .

Odisha has been a frontal state in implementation of FRA and has till October 2015 approved 3055 community claim titles involving an area of 228825.44 acres (about 90,000 ha.) in addition to individual claims. A large number of these community claims are in areas with natural occurrence of bamboos. However, so far only one village, Jamguda in Bhawanipatna district has applied for and got the authority to issue transit permits for transportation of harvested bamboo from their community forest right area (123.5 acres) since 3<sup>rd</sup> March 2013. During last three and a quarter years the Gram Sabha has harvested and sold 30114 no. of bamboo with an income of Rs. 1.87 lakhs (Rs. 3.58 lakh total sale value minus (Rs. 1.28 lakh expenditure towards harvesting cost + Rs. 33,400/- spent for creation of fire lines + Rs. 10,000 for subsidiary silvi-culture operations) which works out to about Rs.6 per bamboo<sup>31</sup>.

### Joint Forest Management

Giving primacy to ecological security with a focus on meeting livelihood needs of the forest dependent communities, the 1988 National Forest Policy (NFP) brought in a paradigm shift in the management of forests from “regulatory” to “participatory”. An important outcome of 1988 NFP was the beginning of formal community participation in management of forests – through Joint Forest Management (JFM) - involvement of village communities in protection and development of degraded forests, and usufructory benefits initiated through a resolution of Gol in 1990. Gradually JFM became a nationwide movement with State Governments issuing their own JFM resolutions. JFM approach followed in India is a typical example of adaptive/incremental process since it has evolved over time and is still evolving towards the achievement of its goal (SFM). There are more than one lakh JFM Committees (involving 15 million families) in the country managing about 23 million ha. forest area (~30% of the total forest area of the country) of these 12,500 JFMCs are in Odisha involving an area of about 1.16 million ha. JFMCs are also major vehicles for execution of major forestry sector programs in the country including the Green India Mission (one of the eight missions under the National Action Plan on Climate Change), National Afforestation Program, and the Externally Aided Projects.

Odisha has been a pioneer in involvement/participation of local communities in forest protection and management and in fact brought out a Resolution in 1988 even before the guidelines issued by the Gol, Ministry of Environment and Forest in 1990. Since then People have played very important role in protection and regeneration of forests all over the State. The resolution for JFM has been revised to keep pace with the evolution of JFM concept and the aspirations of the communities. Latest resolution was notified in 2011<sup>32</sup> also takes into consideration the 73<sup>rd</sup> Amendment to the Constitution, PESA and FRA. The resolution provides for two types of committees namely first Vana Surakshya Samiti (VSS) in Reserved Forests, Protected forests, Village forests, Revenue forests etc. not covered under Protected Areas, and second Eco-development Committee (EDC) involving Protected Areas (National Park and Sanctuaries) excluding Core Areas and Mangrove Wetlands. While deciding the extent of area to be assigned the Panchayat shall consult Forest Range Officer concerned and take into account the area customarily being protected and used by the community, the number of adjacent villages, their claims, if any, and users’ regime. In case any change is required in the extent of forest area assigned to the existing VSS formed under the JFM Resolution, 2008, the same can be done in consultation with the village community and the local forest department officials not below the rank of a Forest Range Officer.

The resolution also provides that regarding protection and conservation of forest, wildlife and environment, the Executive Committee of VSS/EDC shall work as a Sub-Committee of Panchayat and thus seeks to establish a link between the VSS / EDC and the PRI in view of that fact that the 73<sup>rd</sup> Amendment of the Constitution has vested certain powers and responsibilities on PRIs. Regarding sharing of usufructs the resolution mentions that inter alia all intermediate yields in the shape of small wood, poles,

<sup>31</sup>Personal email communication from the concerned Divisional Forest Officer.

<sup>32</sup>The 1988 resolution introduced a Scheme of Protection of peripheral Reserve Forest areas with participation of the adjoining villagers by forming a Village Level Forest Protection Committee. The scope of this resolution was enlarged in 1990 to include the Protected Forests. To make the forest-people interface more effective, the Government of Orissa in Forest & Environment Department issued a Resolution dated in 1993 which dealt, in a fairly exhaustive manner, the involvement of all local communities in protection of adjoining forests, formation of Van Samrakshyana Samiti (VSS), duties and responsibilities of the V.S.S. and their Executive Committees and the role of Forest Department and Gram Panchayats, preparation of Joint Forest Management plans, usufruct benefits for the V.S.S. and provisions of MoU etc. The 2008 resolution extended the participatory approach to "Mangroves and Protected Areas" and thus covered all types of forests. Eco-development was adopted as a strategy in order to improve the livelihood of local people and thereby secure their support for conservation.

firewood etc as may be obtained as a result of silvicultural operations and bamboo harvested in VSS / EDC assigned area shall be made available to the VSS / EDC members in a manner as may be decided by EC. If sold at a price, the funds so obtained shall be deposited in the VSS/EDC Account. Although the forest cover in the assigned area is to be maintained perpetuity, if any major harvest or final felling occurs in the assigned forest, the same shall be taken up by the forest department as per the prescription of the working plan/ duly approved micro plan. The VSS/EDC will receive 50% share of the sale price after deduction of proportionate harvesting cost and this will be deposited in VSS/EDC account.

All forest produce requiring permits for transit as per provisions of Orissa Timber and Other Produce Transit Rules, 1980 shall be removed from the assigned forest area in accordance with a permit to be issued jointly by the President and the Secretary in the prescribed format and the permit shall be valid only within the limits of the area to which the VSS members belong. Thus, it is evident that in the areas assigned to VSS/EDC the EC is entitled to a share in bamboos harvested in accordance with approved micro/working plans.

### **Biological Diversity Act 2002**

The Biodiversity Act 2002 mandates all local bodies (including Panchayats) to setup Biodiversity Management Committees (BMCs) comprising of One Chairperson, Six Members: 1/3<sup>rd</sup> of nominated should be women, SC/ST reservation as per state demography. The functions of BMC include preservation and promotion of local biodiversity- breeds of birds, animals and plants, Preparation of People's Biodiversity Register (PBR) contain comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them, collection of fees for granting access to Biodiversity register to researchers and commercial companies. Progress under the act has been rather slow due to the fact that legal/IPR status of PBR is a grey area, leading to frivolous litigations, and reluctance by PRIs to form BMCs fearing erosion of their authority over MFPs.

### **Analysis**

Bamboo is defined as tree/timber under OFA 1972 and transportation(except for the three exempted species namely, *B. nutans*, *B. vulgaris* and *B. tulda*)requires transit permit to be issued by a forest/ designated officer. For harvesting/transportation of bamboo from privately owned lands due process of joint verification with revenue and forest department and issue of transit permit is to be followed. However, under FRA 2006 bamboo is defined as MFP with provision for community forest right to ownership, access to collect, use rights if it been traditionally collected within or outside the village boundaries and such rights are required to be claimed and admitted following the prescribed procedure. For transportation of MFPs the committee constituted under the rule 4 of FRA Rules or the person authorised by the Gram Sabha are to be authorised to issue permits by modifying the transit permit regime. However, this is applicable to areas where CFR have been admitted under FRA. This is not in conflict with the TT rules.

The provisions under FRA for granting CFR to Gram Sabha dilutes/modifies the facilitation under JFM resolution under which VSS President and Secretary have to jointly issue transit permits for removal of harvested forest produce from VSS areas within village boundary. However, since the latest JFM resolution of Odisha mentions that VSS-EC will function as sub-committee of Gram Sabha, the apparent confusion has been addressed.



## Annexure 13

### Short list of participants at the multi-stakeholder consultative workshop on 12<sup>th</sup> January 2016 at Bhubaneswar

Sl. No.	Name	Place	Category
1	Mr. Chandrakanta Pradhan	G.Udaigiri	Bamboo Farmer
2	Mr.Gobinda Mahapatra	Baripada	Bamboo Farmer
3	Mr. Brajabihari Pradhan	Subarnapur	Bamboo Farmer
4	Mr. Ekadashi Barik	Bhubaneswar	Artisan
5	Mr. Sankar Narayan Mohanty	Phulbani	Artisan
6	Mr. Pranab Pradhan	Subarnapur	Artisan
7	Mr. Premlal Pradhan	Binika, Subarnapur	Artisan
8	Mr. Ananda Mohanta	Baripada	Artisan
9	Mr. Kadambari Mallik	Angul	Artisan
10	Mr. Mayadhar Behera	Angul	Entrepreneur
11	Mr. Pratik Joshi	Bhawanipatna	Artisan
12	Mr. Bharat Bhusan Dhal	Bhubaneswar	Artisan
13	Mr. H.K.Sikka	Titilagarh	President AIHSS
14	Mr. Ashok Sharda	Bhubaneswar	Ex. Vice President JK Paper Mill
15	Mr. Abdul Hai	Bhubaneswar	FES, OBDA
16	Mr. S.S.Mishra	Koraput	FES, OBDA
17	Mr. Ratan Nayak	Bhawanipatna	FES, OBDA
18	Mr. S.K.Nayak	Sambalpur	FES, OBDA
19	Mr.S.S.Mohanty	Angul	FES, OBDA
20	Mr. R K Sutar	Phulbani	FES, OBDA
21	Mr. S.K.Pradhan	Rourkela	FES, OBDA
22	Mr. Chandra Sekhar pradhan	Bhubaneswar	OBDA, Bhubaneswar
	Mr. D. Dalapati	Bhubaneswar	OBDA, Bhubaneswar
23	Mr. Y Beriha	Bhubaneswar	Dy. PD OBDA
24	Mr. H.S.Upadhyay	Bhubaneswar	PD, PBDA



## Annexure 14 District-wise Waste lands & Degraded lands in Odisha

District	TGA	Open forest	Waste lands	Degraded and Wastelands <sup>33</sup>
Source	sq.km	ISFR, 2015 sq. km.	Wastelands Atlas MoRD, DoLR sq. km.	Degraded and Wastelands of India Status and Spatial Distribution, ICAR & NAAS sq. km.
Angul	6375	953	663.48	1180
Balesore	3806	202	110.78	50
Baragarh	5837	396	454.25	1270
Bhadrakh	2505	62	34.31	680
Bolangir	6575	676	540.28	1230
Boudh	3098	450	359.51	860
Cuttack	3932	496	337.98	550
Deogarh	2940	596	298.84	290
Dhenkanal	4452	815	356.62	430
Gajapati	4325	919	1082.08	3050
Ganjam	8206	847	1146.37	2120
Jagatsingpur	1668	128	41.16	260
Jajpur	2899	219	250.32	80
Jharsuguda	2081	170	224.6	390
Kalahandi	7920	1209	888.43	3130
Kendrapada	2644	116	64.55	600
Keonjhar	8303	1517	661.62	660
Khandhmal	8021	2106	1085.36	3300
Khorda	2813	248	471.9	410
Koraput	8807	1099	1212.85	4120
Malkangiri	5791	1452	1280.79	1940
Mayurbhanja	10418	988	463.78	1080
Nawapara	3852	671	517.48	980
Nabarangpur	5291	472	856.37	1970
Nayagarh	3890	527	955.78	790
Puri	3479	153	231.73	80
Rayagada	7073	1838	679.2	3340
Sambalpur	6657	1094	577.67	750
Sonepur	2337	133	273.95	110
Sundargarh	9712	1309	526.24	1520
<b>Total</b>	<b>155,707</b>	<b>21,861</b>	<b>16,648.28</b>	<b>37,220</b>

## Annexure 15 a

### A Case study of bamboo plantation in Ramanguda, District, Mayutbhanj



A Case study of bamboo plantation in Ramanguda, District, Mayutbhanj

Ramanaguda is one of the villages selected under the watershed project. Soil & Water conservation, water resource development, rehabilitation degraded wasteland are some of the interventions taken up under NRM component of the project.

Participatory situation analysis was undertaken with community participation to know the status of natural resources and identify the interventions required to manage the resources effectively. 11 hectares land was identified lying fallow since long suffering from soil erosion.

During Gram Sabha, it was proposed to taking up bamboo plantation in the above waste land leveraging funds from Mahatama Gandhi National Rural Employment Guaranty Scheme (MGNREGS). Ten Scheduled Tribe beneficiaries, who took interest to take up bamboo plantation with sabai grass as an intercrop, were selected.



Bamboo plantation was taken up during the year 2010-11 in the entire 11 ha. land with bamboo and sabai grass. 278 bamboo plants and 28000 sabai grass slips were planted per ha. Total cost of plantation with two-year maintenance was Rs 88,128.00 per ha. met with from the funds provided by the Government.

Sabai plantations started yielding from the 2<sup>nd</sup> year. 20 quintals of loose grass was collected, and sold @ Rs. 1300/- per quintal with a total income of Rs.26.000/- for 2011-12. In the 3<sup>rd</sup>& 4<sup>th</sup> year the yield of Sabai was 38 quintals and sold at @ Rs 1500/quintal (total sale value Rs 57000/- per year). In the 5<sup>th</sup>/6<sup>th</sup> year yield decreased to 30-35 quintals, and sold @Rs 2200/- per quintal (total sale value Rs 66,000/- to 77,000/-).

In 2015,9800 bamboo culms were harvested from the area and sold for Rs 652,000. The return is expected to increase to 4 culms/clump in 6<sup>th</sup> year, and 5-6culms/clump from 7<sup>th</sup> year onwards.



### Annexure 15 b Case study bamboo Plantation with intercrop in Maa Bhairbi watershed, Mayurbhanj district



In the course of participatory situation analysis undertaken with community participation in Maa Bhairbi micro water shed in Mayurbhanj district under the Integrated Watershed management Program an area of 15 hectare was identified that was lying fallow for many years due to low productivity and prominent soil erosion. The watershed comprises of five villages, namely Anlakuda, Dhangri, Pathara, Belirisole, Bhaduasole and Purunapani. The Gram Sabha decided to take up Bamboo Plantation with intercropping of Sabai Grass in this wasteland leveraging funds from Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). 13 beneficiaries belonging to other backward caste (OBC) category were involved in the plantation program.



Plantation of Bambusa tulda was taken up during 2013-14 in the area with intercropping of Sabai grass. The plant population of bamboo was 278 plants per hectare along with 28,000 Sabai slips. The cost of cultivation in the first two years was Rs 1, 12,600/- per hectare for bamboo and Rs 50, 800/- per hectare for Sabai grass met with from the funds provided by the Government.

Sabai plantations have started yielding from the 2<sup>nd</sup> year (2014-15). Loose grasses of 30 quintals was been collected and sold at Rs 2200/- per quintal giving a total income of Rs. 66,000/- in the second year itself. From third year onwards the yield of Sabai is expected to be about 50 quintals with an estimated sale value of Rs 1,10,000/- or Rs. 7,500 per ha. Moreover, traditionally the farmers grow Sabai grass in these areas and skilled enough to add value to Sabai grass by making ropes and handicrafts for which market exists. Thus there is an opportunity of value addition to Sabai grass by making ropes which are sold at Rs 3900/- per quintal, and also handicraft items sold at even higher rates.

Bamboo clumps are expected to start yielding from 5<sup>th</sup> year onwards (2017-18). 2 to 3 culms will be harvested from each clump. Considering 20% mortality, 445 - 667 culms are expected to be harvested with a sale value of Rs. 24,000 to 36,000 per ha (@ Rs 55/- per culm). Number of culms available for harvest is expected to be 4 per clump in 6<sup>th</sup> year, 5-6 per clump in the 7<sup>th</sup> year onwards giving an income of Rs. 85,000/- per ha. at current sale price.



## Annexure 16

### Cost Benefit Analysis Bamboo Plantation with Intercropping

cost per ha. In Rs.			Subsidy	intt @11% per annum	Re- payment	cumulative loan	Cost	income from intercrop	income from bamboo	total income	Repayment	cash flow
intercrop - Sabai grass etc.	bamboo	total										
	40000											
40000	60000	40,000	20,000	2,200		20,000	20,000			0		-20,000
10000	20000	1,00,000	50,000	7,700		70,000	50,000			0		-50,000
		30,000	15,000	9,350		85,000	15,000	10000		10000		-5,000
		15,000		12,029		1,09,350	15,000	10000		10000		-5,000
		15,000		15,002		1,36,379	15,000	10000		10000		-5,000
		15,000		12,248	40,032	1,11,348	15,000	10000	66720	76720	40,032	21,688
		15,000		7,724	53,376	70,220	15,000	10000	88960	98960	53,376	30,584
		15,000			70,220		15,000	10000	111200	121200	70,220	35,980
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440
		15,000					15,000		133440	133440		1,18,440

**IRR**                    **33%**  
**NVP**                   **Rs. 280,000**  
**BC Ratio**            **3.58**



The International Network for Bamboo and Rattan (INBAR) is an intergovernmental organisation established in 1997. INBAR is dedicated to improving the social, economic, and environmental benefits of bamboo and rattan. INBAR plays a unique role in finding and demonstrating innovative ways of using bamboo and rattan to protect environments and biodiversity, alleviate poverty, and facilitates fairer pro-poor trade. INBAR connects a global network of partners from the government, private, and not-for-profit sectors in over 50 countries to define and implement a global agenda for sustainable development through bamboo and rattan.

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