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Co-production of Sustainable Bamboo Management Solutions in Eastern Maharashtra

Final Report

Submitted to the Maharashtra Forest Department

(October 2019)

Livelihoods

Bamboo health

Governance

महाराष्ट्र वन विभाग

प्रगतेः मूलं प्रकृतिः

Maha CAMPA
FOREST DEPARTMENT
MAHARASHTRA

Prepared by the co-production working group anchored by the Indian Institute of Forest Management and Funded by Maha-CAMPA

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पूर्व महाराष्ट्रातील शाश्वत बांबू व्यवस्थापन साधनचे सहनिर्माण

फाइनल रिपोर्ट

आजीविका

बांबूचे आरोग्य

शासन

Prepared by the co-production working group anchored by the Indian Institute of Forest Management and Funded by Maha-CAMPA

Contents

Glossary of local terms

Marathi	English
बांबू	*Dendrocalamus strictus*
कटेन्ग बांबू	*Bamusa arundinacea*
रांझी	Clump
बांबू	Culm
एक वर्षाचा बांबू (करला)	0-1 year old culm
दोन वर्षाचा बांबू	1-2 year old culm
तीन वर्षाचा बांबू	2-3 year old culm
वास्ता	Edible new shoot
गुंथलेली रांझी	Congested clump
खडा	Node
दोन खड्यांच्या मधला पेरा	Internode
परिपक्व बांबू	Mature culm
शिपुट्या, झिनाट्या	Whippy culms
कंद	Rhizome
मुड्या	Fibrous roots

Local terms	Description
Bail bandi	Bullock cart
Beedi	Thin cigarette wrapped in Tendu leaf
Devrai	Sacred grove
Gram sabha	Village body
Gram panchayat	Village council
Kanji house	Cattle pound
Karla	0-1 year old culm
Kasai	Butcher
Kathiwadi	Migratory herders from Gujarat
Lavaris gai	Feral cattle
Malguzari system	Land revenue system where rulers dominated through their mercenaries
Mandi	Wholesale market
Nistar	Concessions granted to the local community on specified forest produce
Poha murmura	Flattened and puffed rice
Taluka	Block
Tendu patta	Leaf of *Dispyros melanoxylon* used for wrapping tobacco for making beedis
Tola	Habitation, hamlet

Abbreviations used

Abbreviation	Description
BHAU	Bamboo Handicraft and Art Units
BOWC	Bamboo Overlapping Working Circle
BRTC	Bamboo Research Training Center
C&I	Criteria and Indicators
CFR	Community Forest Resource Rights under FRA
CPR	Common Pool Resources
DBT	Direct Benefit Transfer
DTE	Down to Earth magazine
EWS	Early Warning System
FD	Maharashtra Forest Department
FDCM	Forest Development Corporation of Maharashtra
FGD	Focus Group Discussion
FRA	Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
GPS	Global Positioning System
IFR	Individual Forest Rights under FRA
LWE	Left Wing Extremism
MBDB	Maharashtra Bamboo Development Board

Abbreviation	Description
MFP	Minor Forest Produce
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MOEFCC	Ministry of Environment, Forest and Climate Change, Government of India
MOTA	Ministry of Tribal Affairs, Government of India
MORD	Ministry of Rural Development, Government of India
MSP	Minimum Support Price
PESA	Panchayat Extension to Scheduled Areas Act, 1996
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institutions
PWR	Participatory Wealth Ranking
SBM	Sustainable Bamboo Management
SFM	Sustainable Forest Management
SMC	Soil and Moisture Conservation
SOR	Schedule of Rates
TBL	Triple Bottom Line
TNA	Training Needs Assessment

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Figures

Acknowledgements

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The BILT paper industry with Shri Kunal Sekhar and Shri Sanjay Telharkar amazed us with their strong participation. Mr. Tehlarkar's knowledge about the bamboo resource and his social network in the region is seen to be believed. Shri. Pandurang Raut from the Tribal Department participated enthusiastically in exposure visit and inception workshop.

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The heroes of the study are the project staff - Shri Kailash Dahake (Special Project Associate) and field investigators - Shri Chandrakant Kichak, Shri Nilesh Desai and Shri Sahil Tekam, who translated the study design on the ground in difficult and at times trying conditions. The credibility of any research lies in the design of the scientific part, accuracy of data collection, sound data analysis and freedom to present the ground reality. All these aspects have been ensured, and the study truthfully reflects the ground reality. We hope that the study does not merely remain as a report, but results in positive change for nature and people both.

~ **IIFM Team**

Executive Summary

Background

The Indian forests were consolidated and nationalized in the late 19th century under the colonial rule and this tenurial regime lasted for more than hundred years. The last four decades have seen a radical change in the legal regime governing the management of forest resources. The national forest policy of 1988 advocated participatory forest management and also two new legislations were passed with an aim to decentralize and democratize forest management to the village level elected body. These two Acts, namely The Panchayats (Extension to the Scheduled Areas) Act, 1996 (PESA) and The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA) were enacted by the Indian parliament for this purpose. Maharashtra state is a forerunner in the country as far as implementation of these Acts is concerned.

The bamboo forests of Chandrapur and Gadchiroli have been managed under different tenurial regimes. Earlier managed under the *Zamindari/malguzari* system, they were then declared as reserve forests and nationalized. Following this, they were leased out to the BILT paper industry. Over the last decade, under the Community Forest Resource Rights under FRA (CFR) and PESA, these forests have been handed over to the local community. Of the total bamboo area of 4,749 sq. km. in the state, 71% (3,354 sq. km.) has been brought under CFR and PESA. Of this area under CFR and PESA, 94% (3153 sq. km.) is located in Gadchiroli district alone. This transition of ownership and management rights of forests has however not been without its trials and tribulations. There is a concern in the forest department that the local communities are not managing the bamboo sustainably and the health of the bamboo forests is deteriorating due to over exploitation. Accordingly, in December 2018, the Maharashtra Forest Department entrusted a study to the Indian Institute of Forest Management, Bhopal (IIFM). The objective of the study is to assess bamboo management by four institutions the forest department (traditional multi-tasking entity with a social role), the forest development corporation (government owned commercial entity), the PESA villages (with MFP ownership rights) and the CFR villages (with conservation and management rights) in eastern Maharashtra.

Approach

The uniqueness of this study is the co-production approach, wherein a working group was formed comprising of local community and experts, forest department officials, industry representatives, tribal department officials and IIFM faculty. This is amongst the first studies in the country that has adopted the co-production approach to get diverse stakeholders on the table to resolve a burning conservation issue. This diverse working group took charge of this study and prepared the study design and criteria and indicators for sustainable bamboo management. The study design was presented in an inception workshop held at Gadchiroli on 5th Feb, 2019 and finalized based on the feedback obtained.

Field data was collected during the months of March to June 2019. We sampled bamboo forests that had been harvested during 2016-17 and 2017-18. Of the total 33 CFR and PESA sites falling in this category, 25 were not accessible due to security reasons, and hence we sampled the remaining 8 sites (4 CFR and 4 PESA). We selected 4 FD and 4 FDCM sites

as well. These 16 selected sites were distributed across the institutional gradient with 4 each in CFR, PESA, FD and FDCM. Ten of these sites were in Gadchiroli and six in Chandrapur district. Following standard norms of the National Working Plan Code and the Forest Survey of India, the sampling intensity for the bamboo health component within a compartment was kept at 1%. Here, we laid square plots of 0.1 ha each and sampled every alternate clump. We laid a total of 150 plots and enumerated 1,174 clumps in Gadchiroli and Chandrapur districts. Adequacy of data collection within a site was confirmed by plotting the accumulation curves. Data on livelihood and management aspects was collected through focus group discussions with key community members and forest department officials and secondary records. The emerging findings and suggestions were discussed with stakeholders in Chandrapur from 27-30 May, 2019 before finalizing the report.

The study faced several challenges in the implementation phase like a changing and uncertain law and order situation in Gadchiroli district, sampling during peak summer months when the mercury was hovering at 45+ degrees, field work on-foot in tiger inhabited area in Chandrapur district and logistic issues when the government machinery got engaged in the election process. The study has limitations in terms of sampling from only those forests that were harvested during 2016-18 and not being able to access sites which had security concerns. Within a site, since the density gradient was not known, sample plots were laid purposively. In few sites, locations in the interior of the compartment could not be accessed due to security reasons.

Findings

We co-designed the indicators for measuring bamboo health as congestion, girth of the new culms and their percentage. We found that in Allapalli forest division in Gadchiroli district, several compartments irrespective of the institutional gradient (PESA, FD, FDCM) have been rendered nearly devoid of young culms. The young culms have been reduced to less than 1% while the district average is close to 15%. The cause we suspect is the growing practice of leaving un-productive cattle in the forests, which have now multiplied and turned feral (*lavaris gai*). Also, we found that the Gadchiroli bamboo compared to Chandrapur bamboo has a 74% higher culm spacing, new culms have 28% higher girth and are more than double in number as well. This difference may be attributed to locality factors such as higher rainfall, higher forest cover and lesser biotic pressure in Gadchiroli. Also the Gadchiroli bamboo showed lesser congestion, with no recorded history of gregarious flowering over large tracts. From the above discussion, we suggest that locality and biotic factors, are stronger determinants of bamboo health as compared to governance. Within biotic factors, the grazing of the young culms during monsoons is the main threat. Governance factors (institutional gradient) seem to weakly influence the health of bamboo forests, as sizeable initiatives to protect and augment the bamboo resource need to be put in place in the four institutions. On the marketing front, we found that broadly three supply chains are functional. The social supply chain meets the *bona fide* requirements of the forest fringe communities. The industrial supply chain mainly meets the requirements of the paper industry, thermal power plants and small scale industries. While in the commercial supply chain, bamboo is used as stakes and trellis in horticulture orchards (grapes, orange, tomato, pomegranate etc.), for making crafts and utility items by *burad* artisans and for making furniture.

We constructed a sustainability tool that integrates bamboo health, livelihoods and governance objectively to derive the sustainability score. We suggest that due to varied locality features, biotic factors and dissimilar bamboo health baselines, the sustainability index is more suited to measure bamboo health temporally within a compartment rather than spatially across compartments.

Is there rampant overharvesting being carried out in the CFR/PESA sites? Of the probable 417 bamboo bearing CFR villages in Chandrapur and Gadchiroli districts, while ideally one third (i.e. 139) should be harvesting bamboo every year, forest department records indicate that only 18 (13%) are harvesting. Also, in these 18 compartments, only about one third of the compartment area available is being harvested. Within this area harvested, we detected overharvesting in only 18% of clumps. This is comparable to the 16.5% overharvesting observed in FD/FDCM sites. Hence, we did not detect a significant threat to bamboo health due to rampant felling or over-harvesting in the CFR/PESA areas. We have also attempted to address vexed problems in bamboo management like clump congestion, convenience felling by the workers and ensuring clump clearing during harvesting.

We also studied the potential of the bamboo resource to drive forest based sustainable development. The CFR/PESA villages prioritized local households for bamboo harvesting and provided attractive piece rates (five to seven times more) compared to the FD/FDCM institutions who were bound by financial (SOR) norms. The biggest constraint in the marketing management of bamboo on the demand side was competition from bamboo of other localities (northeastern states, central and eastern states, private bamboo), substitution by other materials (plastic, metals, brick masonry etc.) and lack of an assured marketing channel for the local communities. While on the supply side, it was a lack of capacity building and empowerment of the local communities. Due to this demand and supply side constraints, we estimate 87% of the bamboo potential in eastern Maharashtra is being left unharvested. The few PESA institutions that have attempted to market their bamboo through traders have been duped. The low market demand, supply side bottlenecks and the looming naxalite threat are a big safeguard against rampant bamboo harvest in Gadchiroli district.

On the governance side, the study found bamboo resource augmentation largely missing in the agenda for all the four institutions managing bamboo. The financial efficiency of FDCM was the best as it minimizes harvesting costs while the CFR/PESA institutions aim to maximize wage payments to the local community. Refreshingly, the Pachgaon CFR village had adopted a middle path providing reasonable wages and with the resultant savings created a village development fund and was also actively protecting and managing the bamboo forests.

We found that most of the villages lacked skills related to business planning, market linkages, contract negotiations, basic accounting, record keeping etc. and this prevented these institutions from effectively managing their bamboo resource. The PESA and CFR institutions have the potential to usher community-based forest management, but have not received adequate support or nourishment they need for all round growth.

Suggestions

Based on these findings, the study came up with the following suggestions. Other than prescribing felling norms (input), we suggest an outcome focus by objectively measuring the criteria and indicators of health of the bamboo forest for each compartment to ascertain the sustainability of management. The present practice is to exclude congested clumps from harvesting plans. We need to address the problem of congested clumps head-on by prescribing special rates for opening them. This will not only make the bamboo forests more productive but also reduce fire hazard. The workers have a tendency to avoid clump cleaning as the piece rate is low or clubbed with harvesting. We suggest a two-round operation where the same labour gang first harvests the bamboo and then in the second round cleans the clumps on piece rate basis. The higher costs will be more than compensated by the higher productivity entailed. While elaborate description of felling rules dominates the prescription for the Bamboo Overlapping Working Circle (BOWC), ensuring its translation on the ground

is a vexed issue. The workers prefer convenience felling to maximize their gains. We suggest marking of the culms (to be felled and retained) before harvesting by trained and trusted staff so that deviations from the felling norms can be detected. Activities to protect and augment the bamboo resource such as protection of young culms from grazing during the monsoons, assisted natural regeneration, gap filling, soil moisture conservation works etc. need to be prioritized in compartments where the health needs improvement. Resources from MGNREGA national program can be sourced to fund many of these activities.

In order to have an objective basis to assess the performance of the CFR institution, a joint benchmarking exercise with boundary demarcation and digitization of compartment boundary (following a standard protocol) will help in making the gram sabhas accountable as unsustainable practices can be detected.

We also suggest doing away with purchasing un-certified bamboo seeds from traders of unknown provenance, and prioritizing local seeds from superior clumps. Also, certain ecological questions have not received adequate attention. Why does the Gadchiroli bamboo exhibit superior morphology, growth (girth, height) and behavior (non-congesting, sporadic flowering) compared to Chandrapur bamboo? Are these two populations separated by the Wainganga river, different phenotypes of the same variety or they are different genotypes? i.e. to what extent will the Gadchiroli bamboo retain its original characteristics if planted in Chandrapur and vice versa? What about the variation in bamboo crop characteristics within Chandrapur district? How does the bamboo crop which has an aerial seeding origin compare with the one which has regenerated from the erstwhile bamboo crop? These ecological studies are needed to inform policy making.

On the livelihood front, we are inclined to suggest that FDCM driven by a profit motive has demonstrated high financial efficiency. It may be a good idea to enhance the harvesting piece rates, so as to attract the local community instead of deploying outside labour. Engaging local community and providing them gainful wage employment will not only help in creating social capital but also develop a bond between the community and the resource. This investment will come in handy while protecting the bamboo forests from fire, grazing and other threats.

There is a need to develop trusted marketing channels for the CFR/PESA villages and not leave them at the mercy of crafty traders. Initiatives such as offer a Minimum Support Price (MSP) for bamboo, organizing buyer's sellers meet, developing model agreements (MOU) and Standard Operating Procedures (SOPs), empaneling the traders, developing bamboo *mandi* near city areas can go a long way in this regard. With 71% of the bamboo area of the state handed over to CFR and PESA institutions, FDCM can rediscover itself as a specialized marketing agency by sourcing raw material from these villages, promoting primary and secondary processing at the local level, value addition and marketing.

A Training Needs Assessment (TNA) is needed for the CFR and PESA institutions to gauge the data, knowledge and skills gaps for community-based sustainable bamboo planning and management. Pachgaon village in Chandarpur has developed good governance practices and can be developed as a model resource center on sustainable forest management for training other community based institutions. The target should be to develop a network of such model resource centers, for training and hand holding other community based institutions. A cadre of local, young professionals needs to be developed with skills on sustainable forest management. The Mumbai University diploma course that employs innovative pedagogy to train local youth from Gadchiroli is a step in this direction. The new Chandrapur Forest Academy can also develop a School

of CFR/PESA studies and provide special trainings to village youth of these areas. The curriculum of these courses needs to be aligned with the findings of the Training Needs Assessment.

Is obtaining CFR right an end in itself, or is it a milestone in the journey towards self-rule, democratic decentralization and promoting forest centric sustainable development. Where do we see these CFR villages ten years from now? Can these CFR villages evolve as institutions of excellence in sustainable forest management meeting global quality standards? The challenge before the CFR initiative over the next decade, is scaling up of the sporadic success stories. The few gram sabhas that have been able to realize the real potential, have been supported by civil society groups and people's movements. The challenge is who is going to support the thousands of CFR villages who have received CFR rights and now need to manage their forests. The civil society and activists through their efforts have demonstrated the proof of concept that CFR works. But in the deprived swathes of Indian hinterland, to expect them to drive the scaling-up across thousands of villages would be expecting too much. Are CFR/PESA federations possible within the existing legal framework who could drive this forward.

What role do forest departments envisage for themselves? Do they remain indifferent and reluctant to engage with the CFR regime or they adapt to the post FRA reality and function as mentors, hand-holding these fledging organizations. Can civil society, academia, forest departments, businesses and the CFR institutions join hands? This appears to be the only scalable model to co-produce sustainable forest management solutions that work both for nature and people. After obtaining CFR rights to conserve and manage their forests, is it time for a new paradigm?

Chapter 1

Background

1. Background

Earlier managed under the Zamindari/malguzari system, the forests of the country were nationalized during the colonial regime and managed strictly as per the provision of the Indian Forest Act, 1927 (IFA). Section 28 of the IFA has a provision of assigning reserve forests to communities by designating them as village forests, but this provision was seldom used. Only with the National Forest Policy of 1988, participatory governance was ushered in and the Joint Forest Management programme was launched. Over the last three decades, two more legislations were enacted, namely The Panchayats (Extension to the Scheduled Areas) Act, 1996 (PESA) and The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA). PESA accords statutory status to the gram sabhas in Schedule V areas with wide ranging powers and authority. The Act recognizes the prevailing traditional practices and customary laws and also provides ownership to the gram sabha over Minor Forest Produce (MFP). Maharashtra is the leading state in the country in taking innovative steps to implement the provisions of this Act.

The Forest Rights Act, 2006 grants rights to forest-dwelling communities to land and other resources, denied to them over decades as a result of the continuance of colonial forest laws in India. The FRA provides title rights, use rights, relief and development rights and forest management rights. These rights fall in two categories: (i) Sec 3.1 - title of CFR rights, use *nistar* rights, relief and development rights, ownership rights on minor forest produce and

Figure 1: The Forest Rights Act, 2016 aims to undo a 'historical injustice' by providing forest dwellers rights over land and other resources denied to them over decades *(Photo credit: CSE 2017)*

forest management rights and (ii) Sec 3.2 provide for diversion of forest land for development facilities up to one hectare and felling of trees not exceeding seventy-five trees per hectare. The most debated have been the Community Forest Rights (CFR) that the Act provides to the local communities to collective conserve, sustainably utilize and manage their forest resources.

Over the last ten years under FRA, more than 1.8 million individual land titles (Figure 1) and 70,164 community claims have been granted covering 5.69 million ha countrywide. Community forest

rights have been distributed over 4.04 million ha (includes those under Sec 3.1 and 3.2 as well) and individual rights over 1.66 million ha (Ministry of Tribal Affairs 2018). Maharashtra is the leading state in the country in taking innovative steps to implement the provisions of this Act. Of the total community forest rights granted in the country, 1.75 million ha (43%) has been provided in Maharashtra alone (Ministry of Tribal Affairs 2018). In 2011, bamboo was freed and CFR gram sabhas were authorized to sell the bamboo of their community forest area and issue passes so that it could be legally transported (Figure 2).

Figure 2: In 2011, Shri Jairam Ramesh union minister of state for environment handed over transit passbooks for bamboo to the gram sabha in Mendha Lekha village, Gadchiroli *(Photo credit: CSE 2011)*

The large scale implementation of PESA and FRA in Maharashtra and the change in forest tenurial regimes that it brought about, was not without its share of concerns and controversies. The Maharashtra Forest Department has voiced its concern over the over-extraction of bamboo resource in the PESA/CFR areas in Eastern Maharashtra. Civil society organizations and local communities on the other hand argue that the decentralized community-based bamboo management not only conserves the bamboo resource but also provides significant economic gains to the local community leading to empowerment. The viewpoints of the stakeholders differ as indicated below:

- **Forest Department**

  There is a growing perception in the forest department that the local communities are over-harvesting resulting in deterioration in the health of the bamboo forests due to over exploitation. The department has a long history of bamboo management using standard practices codified in the working plan.

- **Local community**

  Look at bamboo as an important renewable resource to earn income and diversify livelihoods. There is a sense of prosperity brought about by bamboo harvests in CFR/PESA areas. They have traditional knowledge and are skilled in bamboo harvesting.

- **Academicians**

  They are of the view that the traditional practices of harvesting bamboo are scientific and sustainable. They also doubt the scientific management practices of the forest department, as the resource data is not readily accessible and in public domain. But no studies could be accessed online on sustainable bamboo management in Gadchiroli, so this appears to be a research gap.

- **Activists / NGOs**
  Are of the belief that this "rights based approach" of handing over management of forests to the local community is the way forward. They equate success of this initiative to the extent of forest areas brought under the CFR regime and with decentralized governance and empowerment.

Natural resource management problems are often multi-disciplinary and complex, with several dimensions such as ecological, social, economic and political. Also, the nature of natural resource management problems is typically wicked i.e. stakeholders do not agree, there is no clear measure of success and the construct is socially complex (Rittel & Weber 1973). It is difficult for one organization to understand and respond to these problems fully, as there is often disagreement on the causes of the problem and the best way to tackle them (Figure 3). The linear approach to multi-dimensional problems creates a barrier in the uptake of science for policy making. Hence, to address this, while addressing key natural resource management challenges, interaction between the scientist, policy makers and practitioner is required.

This issue of sustainable bamboo management falls into the construct of a "wicked problem" as the key stakeholders namely the local community, state forest department, activists and NGOs and academicians are in disagreement. There is a growing perception in the forest department that the local communities are not managing the bamboo sustainably and the health of the bamboo forests is deteriorating due to over exploitation. Thus a need was felt to take up a systematic, trans-disciplinary study to address this wicked problem and provide sustainability solutions jointly through co-production process involving all the stakeholders. Accordingly, the

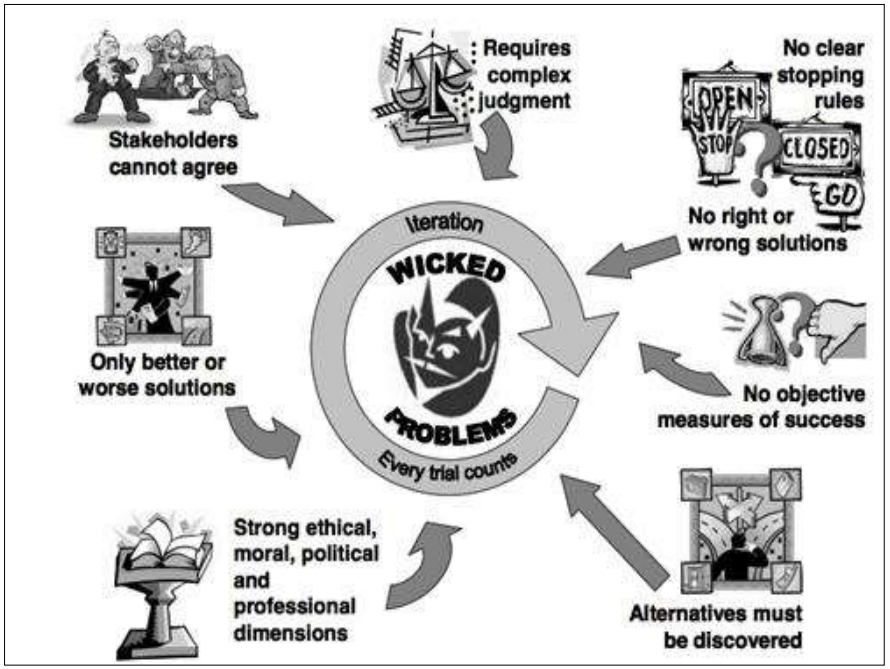


Figure 3: Characteristics of wicked problems which cannot be addressed using simple, linear approaches (Source: Rittel & Weber 1973)

Maharashtra Forest Department offered IIFM to take up a study to assess the sustainability of bamboo harvesting across different institutional arrangements. Subsequently, a study proposal was prepared by IIFM and finalized based on mutual consultations.

Chapter 2

Aims and Objectives

2. Aims and objectives

2.1 Study objective

Analyze bamboo management systems across the institutional gradient of PESA, CFR, Forest Development Corporation Limited (FDCM) and State Forest Department (FD) using the three-pronged criteria of sustaining bamboo health, providing livelihood benefits and participatory governance - to synthesize sustainability solutions.

2.2 Study scope

What the study will not do

- Evaluate management of bamboo (*Dendrocalamus strictus*) across PESA, CFR, FDCM and FD institutions
- Being an in-depth (vertical) and not an extensive study (horizontal) it cannot be generalized to pass value judgements on the performance of PESA, CFR, FDCM or FD institutions

What the study will cover

Prepare a tool that can be used to objectively assess the sustainability of bamboo management systems covering bamboo health, associated livelihoods and governance. Scientific and participatory approaches will be used to construct this tool.

The population of the study kept evolving as more clarity emerged. The characteristics of the population were not known i.e. how many PESA/CFR sites were harvested in 2016-17 and 2017-18. Also, some sites selected could not be assessed due to security reasons. Initially we were under the impression that the population size is large, and hence decided to take up only purposive sampling of good and bad villages. However, reliable information to differentiate good and bad sites too was not available. Later it came to light that the number of sites harvested under CFR/PESA during 2016-17 and 2017-18 was small and the bigger strata was the unharvested sites.

2.3 Research questions

The key research questions that the study attempts to answer across the institutional gradient of PESA, CFR, FDCM and FD in Eastern Maharashtra are:

1. What are the sustainable and unsustainable management practices in bamboo management in Eastern Maharashtra?
2. What are the criteria and indicators for sustainable harvest of bamboo?
3. What is the status of access, benefit sharing and equity in the value chain of bamboo?
4. What are the tradeoffs between sustaining bamboo health and livelihood benefits to the local people?

This study is unique in the terms of the process if followed. It is amongst the first studies in the country to adopt the coproduction process to address and try to resolve a “place based” wicked problem. Diverse stakeholders with different motivations, positions and stakes were involved right through the inception phase, data collection, data analysis and report writing. Using the framework of

sustainable forest management, the study has been able to create for the first time a sustainability framework for bamboo management. The principles, criteria, indicators and verifiers for sustainable bamboo management were developed possibly for the first time globally.

In this study firstly, we show that the health of the bamboo clumps can be assessed by measuring clump congestion, size of the new culms and their percentage. We also developed indicators for assessing bamboo based livelihoods and governance components. Secondly, we show that while overharvesting does have an adverse impact on bamboo health, the principal drivers are locality factors and protection of young culms from grazing. Thirdly, we show that while the potential of bamboo forests to diversify rural livelihoods and address unemployment are significant, the biggest limitation is the weak market demand due to substitution by other materials (plastic, metals, brick masonry etc.), competition from bamboo of other localities, lack of assured marketing channel and supply side constraints such as lack of empowerment of the local communities who have been handed over large tracts of bamboo forests without adequate skill development and enablement. Due to the weak demand and supply side constraints, we estimate that only 13% of the potential area is being harvested. Several PESA villages have been duped while attempting marketing bamboo through these wily traders. Finally, we suggest steps to strengthen sustainable bamboo management in eastern Maharashtra.

2.4 Study area

The study area for the project is eastern Maharashtra comprising of Gadchiroli and Chandrapur districts (Figure 4).

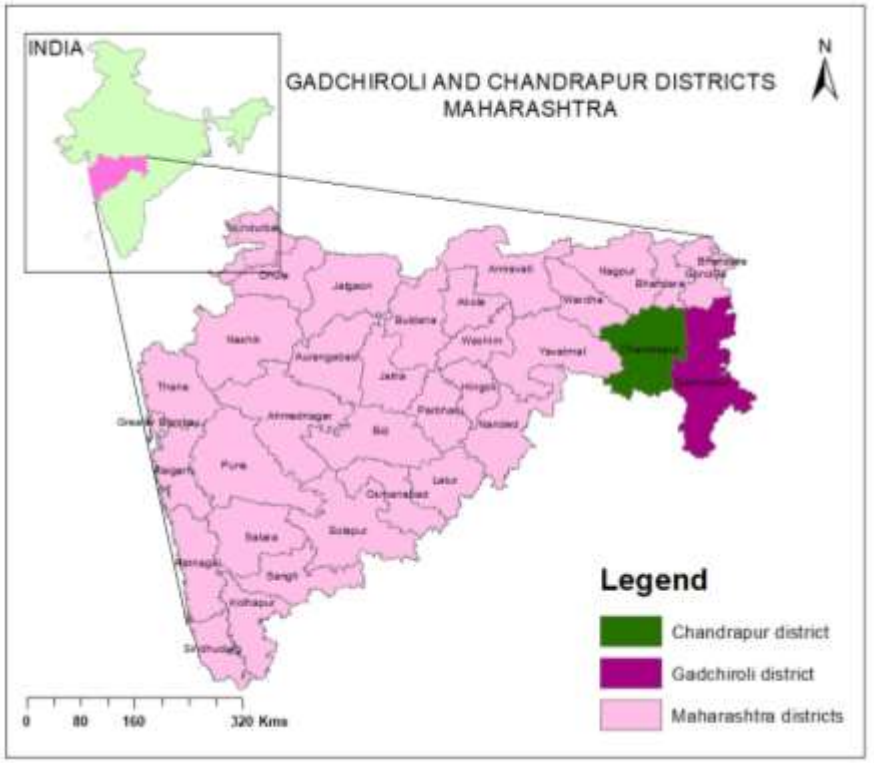


Figure 4: Map of study area showing the location of Chandrapur and Gadchiroli districts in Maharashtra state

The region is at the junction of Madhya Pradesh, Chhattisgarh and Telangana. These districts fall in the catchment of the Godavari river with Wardha, Wainganga, Pranhita and Indravati rivers draining this

region. The average annual rainfall decreases from 1,493 mm to 1,280 mm as we move from the south eastern to north western part of this region. The forest wealth comprises of tropical dry deciduous and tropical moist deciduous forests comprising mainly of teak and its associates with bamboo in the middle storey (Champion and Seth, 1968). A key characteristic of this region is non-diversified economies that are solely primary sector based. Agriculture, sometimes supplemented with mining or forestry, is the mainstay of the economy, which is often unable to support rapid increases in population. Madia Gonds are the endogamous Gond tribes inhabiting this region. They have been granted the status of Particularly Vulnerable Tribal Group (PVTG) by the Government of India.

2.4.1 Why eastern Maharashtra?

The total bamboo area in Maharashtra state is 4749.16 sq. km., of which 83.76% is located in Gadchiroli (69.61%) and Chandrapur (14.15%) districts alone. Also, 71% (3353.65 sq. km.) of this total bamboo area of the state has been brought under CFR and PESA (Forest department 2017). Of this area under CFR and PESA, 94% (3153.11 sq. km.) is located in Gadchiroli district alone (Forest department 2017). Of the total 1,813 CFR villages in Chandrapur and Gadchiroli, 23% (425) are in Chandrapur and 76% (1,388) in Gadchiroli (TRTI 2019). Also, of the total area of 5,205.38 sq. km handed over under CFR in these two districts, 9% (489.51 sq. km.) is in Chandrapur and 91% (4,715.87 sq. km.) in Gadchiroli (TRTI 2019). There are a total of 1,567 PESA villages in these two districts.

2.4.2 Chandrapur district

Chandrapur district falls under the Nagpur Division of Maharashtra. The district was formerly known as Chanda District, and was renamed in 1964. Chandrapur was the largest district in India until in 1982 the Gadchiroli and Sironcha tehsils were split into a separate Gadchiroli district. In 2011, the district population was 2.195 million. The district is known for its super thermal power plant, and its vast reserves of coal in Wardha Valley Coalfield. The district also has limestone mines for cement manufacturing. In 1956, the Ballarpur Industries Limited paper mill was setup in the district. Within the district is the Chandrapur ferroalloy plant, a Public Sector Unit (PSU) engaged in the production of manganese based ferro-alloys. The Tadoba National Park one of India's fifty Project Tiger reserves is located near Chandrapur city. The 2015 census of tigers found that 120 of Maharashtra's 170 tigers were located in Chandrapur district (“Chandrapur”, n.d.).

The district has a total geographical area 11,443 sq.km., of which forest cover is 4,087 sq.km. which corresponds to 35.72% (ISFR 2017). There are three divisions in Chandrapur circle, Central Chanda, Chandrapur and Bramhapuri having a total of 19 ranges. Central Chanda has 8 ranges of which 4 are bamboo bearing ranges (Pombhurna, Kothari, Ballarshah, Wirur). Chandrapur division has 5

ranges of which 3 ranges (Bhadravati, Chichpalli, Chandrapur) are bamboo bearing. Bramhapuri division has a total of 6 ranges, none of which are bamboo bearing. Bamboo is found as the middle storey in teak forests, with very few pure bamboo stands. Of the total forest area of 4822.63 sq. km the district, the area under bamboo working circle is 1001.48 sq. km., and the area under bamboo is 672.14 sq. km (Forest Department 2016). Chandrapur circle has 14.15% of the total area under bamboo of the state. There are a total of 847 gram panchayats and 1,792 villages spread across 15 talukas. A total of 425 villages have been granted CFR under FRA and 489.51 sq. km. of forest land has been handed over to them (TRTI 2019). A total of 194 villages have been granted PESA, and many of them have CFR as well.

2.4.3 Gadchiroli district

Gadchiroli district is situated in the southeastern corner of Maharashtra, and is bounded by Chandrapur district to the west, Gondia district to the north, Chhattisgarh state to the east, and Telangana state to the south and southwest. Gadchiroli district was created in 1982 by the separation of Gadchiroli and Sironcha tehsils from Chandrapur district. As of 2011, it is the second-least-populous district of Maharashtra. It is categorized as a tribal and undeveloped district and most of the land is covered with forest and hills. The eastern part of the district bordering Chhattisgarh is particularly hilly. This district is famous for bamboo and tendu leaves. Paddy is the main agriculture produce in this district and the main profession of the people is farming. The district is currently a part of the Red Corridor affected by Left Wing Extremism ("Gadchiroli", n.d.).

Gadchiroli forest circle comprises of five divisions namely - Allapalli, Bhamragarh, Sironcha, Gadchiroli and Wadsa having a total of 31 ranges. Gadchiroli district has a geographical area of 14,412 sq.km., out of which forest cover is 10,004 sq.km., which corresponds to 69.41% of the geographical area (ISFR 2017). Of the total forest area of 12,833.33 sq. km. in the district, the area under bamboo working circle is 5235.69 sq. km., and the area under bamboo is 3305.80 sq. km (Forest Department 2016). Gadchiroli circle has 69.61% of the total area under bamboo of the state. A total of 95.38% of the total bamboo area of Gadchiroli district has been handed over to CFR and PESA villages. There are a total of 467 gram panchayats and 1,688 revenue villages spread across 12 talukas. A total of 1,388 villages have been granted CFR under FRA and 4,715.87 sq.km. of forest land has been handed over to them (TRTI 2019) while villages have been granted PESA. A total of 1,373 villages have been granted PESA, and many of them have CFR as well.

2.4.4 Bamboo resource

Bamboo is the fastest growing, perennial plant of the world with 1,500 versatile livelihood and ecological benefits (Desalegn and Tadesse 2014). Bamboo provides a variety of ecosystem services, supports biodiversity conservation and sustains rural livelihoods. Of the total 1,600 bamboo species in the world, 125 species are

reported from India. In India, bamboos occupy 15.69 million ha of forest area and constitute 30 percent of the global bamboo resource (ISFR 2017; Lobovikov et al. 2007). *Dendrocalamus strictus* a clumping, tropical bamboo is widely distributed and comprises about half of the bamboo growing stock of the country (Pandey and Pandey 2007). Maharashtra state has the second- highest bamboo bearing area in the country with the resource comprising mainly of *Dendrocalamus strictus* concentrated in the central Indian part (ISFR 2017). This bamboo is monocarpic and most vulnerable after gregarious flowering when it seeks to re-establish itself. Protection of the seedlings from grazing and fire for six to seven years after flowering is essential for the survival of these forests (Dwivedi 1988). Bamboo forests in central India have been shrinking after gregarious flowering due to rising biotic factors impacting the natural regeneration (Prasad & Chadhar 1988).

Chapter 3

Study Approach

3. Study approach

While studying "sustainable bamboo management", We realized that we were addressing a wicked problem, as there was trust deficit between the stakeholders, communication channels were broken and strong perceptions had been formed. Sustainability is the classic 'wicked' problem, characterized by poorly defined requirements, unclear boundaries and contested causes that no single agency or discipline is able to address (Brown et al. 2005). One of the key ingredients to solving wicked problems is working across the boundary of internal and external organizations and engaging multiple stakeholders in decision making (Australian Public Service Commission 2012). Evidence suggests that when people are closely involved in knowledge production, they are more likely to view the resulting knowledge as credible, salient, and legitimate and to adopt such knowledge for implementation (Cash et al. 2003). Credibility refers to the scientific robustness of the arguments and outputs, salience deals with relevance to user needs, and legitimacy represents the extent to which the information is perceived as fair, unbiased, and respectful of all stakeholders (Figure 5). This generates an enriched picture of an issue of concern, which serves as a legitimate starting point for multiple stakeholders to participate in producing further knowledge (Nel et al. 2016).

One of the real world approaches bridging this science policy practice divide is the co-production of actionable science. In co-

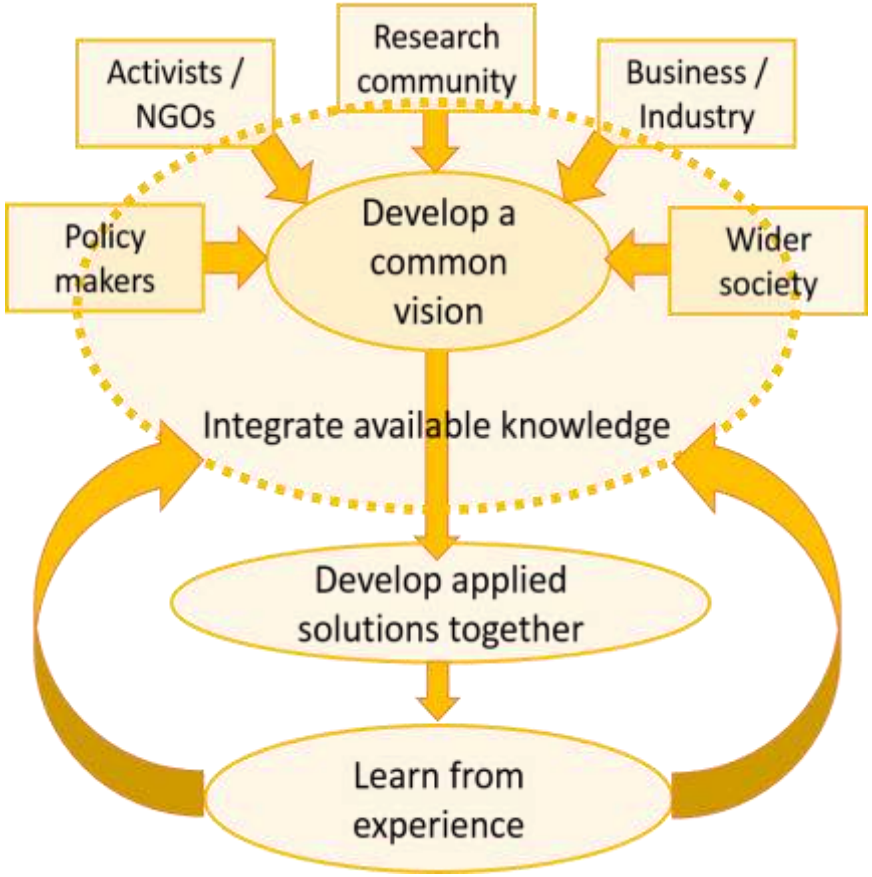


Figure 5: Co-production approach to develop applied solutions together (Adapted from FutureEarth research (2015**)**

production, a team of multi-disciplinary experts comprising of scientists, policy makers and practitioners convene around a specific problem at the intersection of conservation and human well-being (SNAPPshot 2018). Managers, policy makers, scientists, industry experts and other stakeholders, first identify specific decisions to be

informed by science, and then jointly define the scope and context of the problem, research questions, methods, and outputs, make scientific inferences, and develop strategies for the appropriate use of science (Beier et al. 2017).

Role of IIFM

IIFM is a unique organization in the country housing experts in social sciences, economics, environment and management with expertise in natural resource management under one roof. The institute is supported by the Ministry of Environment, Forest and Climate Change, Government of India and enjoys autonomy in academic decision making. These competencies enable IIFM to function as a boundary organization (neutral and independent) to coproduce sustainability solutions by synthesizing knowledge from various scientific and management areas by working with a diverse range of stakeholders. Being perceived as a neutral agency enables it to function as a science steward.

If IIFM had adopted the traditional approach and taken up a stand-alone study, the knowledge created may not be perceived as credible, salient and legitimate by the other stakeholders (Cash et al. 2003). Hence, the approach adopted for this study was "co-production" wherein representatives from the key stakeholders namely the Maharashtra forest department, Tribal department and the local community/civil society, industry and IIFM faculty were coopted into a working group. This working group steered this study and was anchored by IIFM. IIFM with the funding support from Maharashtra Forest Department, in partnership with other stakeholders, has attempted this unique approach to coproduce sustainable bamboo management solutions in Eastern Maharashtra.

The study has adhered to the two principles of loyalty to science (credibility) and respect for diverse stakeholders and their view points (legitimacy). Credibility refers to the perception that the information is scientifically adequate and the sources are authoritative and trustworthy. Legitimacy refers to the information development process, which should be unbiased and respectful of divergent stakeholder beliefs and values (Cash et al., 2003).

The following steps were taken to ensure that the credibility and legitimacy of the study is enhanced:

a) Credibility of the study

- Open and questioning mindset, free of any bias or leanings
- Methods used are scientifically acceptable
- Ensured that data collection is authentic and honest
- Ensured that data collectors are acceptable to all the stakeholders and their recruitment is done in consultation with them
- Strengthened repeatability
  - Marked and photographed the clumps whose observations were taken
  - Recorded GPS points and google earth images of sampling sites
  - Recorded contact details of participants who were consulted

b) Legitimacy of the study

- Respect diverse knowledge sources
- Methods jointly agreed upon
- Open science – study design, field data collected, open data sources and summary tables are shared with the members of the working group
- Ensured that data collection is joint with all stakeholders who are part of the working group

Chapter 4

Frameworks Used

4. Frameworks used

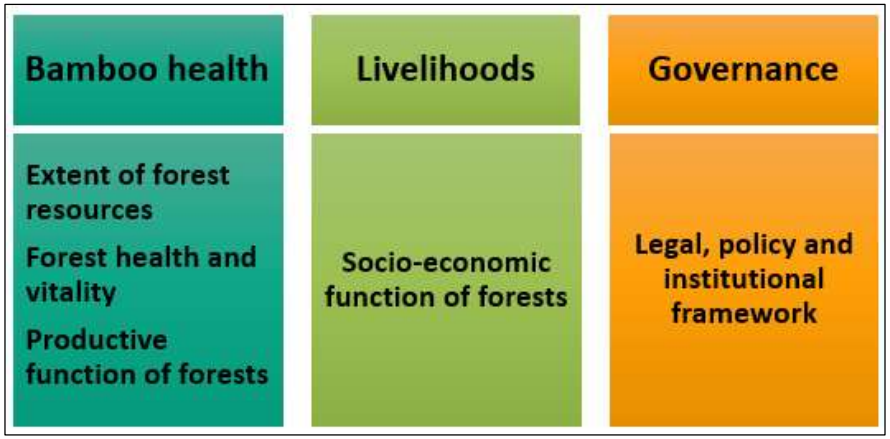
The frameworks on which the study stands on are Sustainable Forest Management (SFM), Triple Bottom Line (TBL) and Ostrom's principles for governing the Common Poor Resources (CPR) (IPF 1997; UNFF 2001; FAO, 2001; Slaper and Hall 2011; Ostrom 2015).

4.1 Sustainable Forest Management (SFM)

Over the last two decades, a range of concepts and terms has been used to operationalize sustainable forest management. Criteria and indicators are tools used to define, guide, monitor and assess progress towards sustainable forest management in a given context. Since the United Nations Conference on Environment and Development (UNCED) of Rio 1992, several different international processes and initiatives have developed criteria and indicators as a framework for SFM. C&I provide a framework that characterizes the essential components of SFM, and recognize forests as ecosystems that provide a wide range of environmental, economic and social benefits to society.

The seven thematic elements of sustainable forest management, as acknowledged by the United Nations Forum on Forests (UN 2008): extent of forest resources; forest biological diversity; forest health and vitality; productive functions of forest resources; protective functions of forest resources; socio-economic functions of forests; and legal, policy and institutional framework. Out of these seven, elements the present study builds on five elements and does not include "forest biological diversity" element as the focus is on single species *Dendrocalamus strictus* and on "protective functions of forest resources" element as we are not assessing the role of bamboo forests in moderating soil, hydrological and aquatic systems, maintaining clean water and reducing the risks of natural calamities (Figure 6).

Figure 6: Sustainability of bamboo management assessed by building on five of the seven thematic elements of Sustainable Forest Management (SFM)



4.2 Triple Bottom Line (TBL)

The triple bottom line comprises of social equity, economic, and environmental factors. The phrase, "people, planet, and profit" is used to describe the triple bottom line and the goal of sustainability (Figure 7).

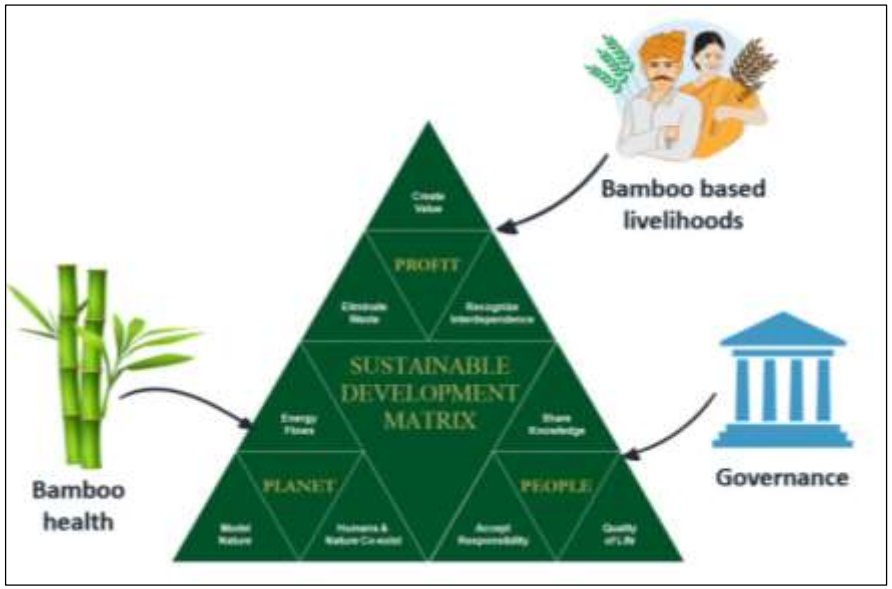


Figure 7: Sustainability of bamboo management would need assessment of triple bottom line (TBL) - bamboo health, livelihood benefits and governance

Building on this framework, the study in order to assess sustainability of bamboo management unravels the social, economic and ecological aspects. Bamboo management by each of the four institutions (FD, FDCM, PESA, CFR) is assessed using these three lenses (social, economic and ecological) and the best practices and areas needing improvement collated.

4.3 Governing the commons

Elinor Ostrom shared the Nobel Prize in Economics in 2009 for her lifetime of scholarly work investigating how communities succeed or fail at managing common pool (finite) resources such as grazing land, forests and irrigation waters. Ostrom's achievement effectively answers popular theories about the "Tragedy of the Commons",

Figure 8: Ostrom's eight design principles for governing the Common Pool Resources (CPR)

CPR institutions

1. Clearly defined boundaries
   Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined, as must the boundaries of the CPR itself.
2. Congruence between appropriation and provision rules and local conditions
   Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and/or money.
3. Collective-choice arrangements
   Most individuals affected by the operational rules can participate in modifying the operational rules.
4. Monitoring
   Monitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators.
5. Graduated sanctions
   Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, by officials accountable to these appropriators, or by both.
6. Conflict-resolution mechanisms
   Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7. Minimal recognition of rights to organize
   The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

For CPRs that are parts of larger systems:

8. Nested enterprises
   Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

which has been interpreted to mean that private property is the only means of protecting finite resources from ruin or depletion. She has documented in many places around the world how communities devise ways to govern the commons to assure its survival for their needs and future generations. She is the first woman to be awarded the Nobel in Economics. Based on her extensive work, Ostrom offers eight principles for how commons can be governed sustainably and equitably in a community (Figure 8). In the CFR areas, the bamboo forests are a Common Pool Resource (CPR). The governance of these institutions can be compared with the eight Ostrom's principles to assess the depth of governance by the community.

Chapter 5

Sampling, Methods and Tools

5. Sampling, methods and tools

5.1 Sampling strategy

The study area spans across the two districts of Gadchiroli and Chandrapur in Eastern Maharashtra across the institutional gradient of PESA, CFR, FDCM and FD. During the inception workshop It was decided to cover about 12 villages across the institutional gradient in these two districts. The number of CFR/PESA sites where the bamboo forests had been harvested in 2017-18 were only 17 (15 in Gadchiroli and 2 in Chandrapur). Hence, it was decided to cover villages where harvesting had taken place in 2016-17 as well. During 2016-17 and 2017-18, a total of 33 sites had been harvested under CFR and PESA in Gadchiroli and Chandrapur districts. Of these 33 sites, 25 were not accessible due to security reasons and hence we covered the remaining 8 sites (4 CFR + 4 PESA) resulting in a sampling intensity of 24%. Similarly, we selected 4 FD and 4 FDCM sites where harvesting had taken place in 2016-17 and 2017-18 in a manner to cover all the divisions where harvesting had taken place. Of the total 16 sites sampled, 10 were in Gadchiroli district and 6 in Chandrapur. Out of the total 8 forest divisions in the study area (5 in Gadchiroli and 3 in Chandrapur), 7 are bamboo bearing and in 6 of them bamboo harvesting had taken place during 2016-17 or 2017-18. The 16 sites sampled, were distributed across 5 of these 6 forest divisions of these two districts and hence had extensive coverage of the study area. We laid a total of 150 plots and enumerated 1,174 clumps in Gadchiroli and Chandrapur districts (Table 1). The location of the villages sampled is mapped in Figure 9. Field data was collected during the months of March to June 2019.

Table 1: List of 16 sites (compartments) sampled in Gadchiroli and Chandrapur districts

No.	District	Forest division	Institution
1	Gadchiroli	Allapalli	FDCM
2	Gadchiroli	Allapalli	FDCM
3	Gadchiroli	Gadchiroli	CFR
4	Gadchiroli	Gadchiroli	CFR
5	Gadchiroli	Gadchiroli	CFR
6	Gadchiroli	Bhamragarh	PESA
7	Chandrapur	Central Chanda	CFR
8	Chandrapur	Central Chanda	FDCM
9	Chandrapur	Central Chanda	FD
10	Chandrapur	Chandrapur	FD
11	Chandrapur	Central Chanda	PESA
12	Chandrapur	Brahmapuri	FDCM
13	Gadchiroli	Allapalli	PESA
14	Gadchiroli	Allapalli	PESA
15	Gadchiroli	Allapalli	FD
16	Gadchiroli	Allapalli	FD

5.2 Market study

For the market supply chain study, interactions were held with various stakeholders from producer till consumer in the supply chain

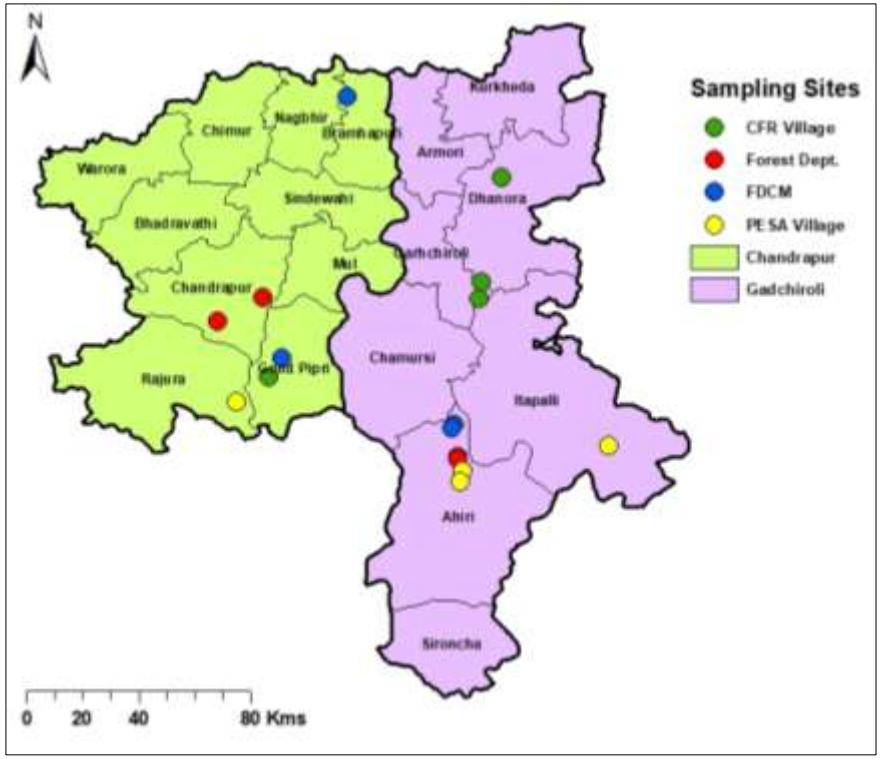


Figure 9: Location of sampling sites in Gadchiroli and Chandrapur districts during March-June 2019

of bamboo. The primary data was collected from forest department officials, FDCM officials, traders, merchants, paper mill officials, farmers, artisans, plantation experts and the communities through the process of personal interviews, informal interactions, field study, focused group discussions and telephonic interactions. The secondary data was collated from reports, forest department working plans, BILT procurement report, FDCM annual report and documents available with the communities.

5.3 Mixed methods

The study used mixed methods in which both qualitative and quantitative data was combined. Qualitative data was collected using participatory approaches. In developing a mixed method approach, Creswell (2014) defines three basic approaches convergent parallel, explanatory sequential and exploratory sequential. In convergent parallel approach both qualitative and quantitative data is collected at the same time and used to triangulate the findings. In explanatory sequential, qualitative data provide context and explanations for the quantitative results, to develop systematic explanations of the trends found in the quantitative results. In exploratory sequential, we use focus groups, listings, interviews with key informants, and other qualitative approaches to develop hypotheses and to clarify research questions. In this study, a combination of exploratory sequential and explanatory sequential methods was used. During the exploratory phase of the study, exposure visits and focus group discussions were carried out to frame the criteria and indicators for sustainable bamboo management. This was followed by field data collection in which quantitative data was collected and explanatory sequential approach was used with focus group discussions and key informant interviews to be able to explain the quantitative findings (Figure 10, 11).

Figure 10: Focus group discussion held in the village helped to ascertain the livelihood benefits and governance aspects of bamboo management. It also provided a platform to discuss vexed issues such as congested clumps, convenience harvesting, gregarious flowering, mortality of young culms, marketing fraud by traders etc.

Figure 11: quantitative field data collection underway to assess bamboo health and harvesting practices by laying sample plots of 0.1 ha area

5.4 Data collection

Data collection covered both primary and secondary sources. The secondary data was collected from the Maharashtra State Forest Department, local community and from other sources. The methodology is elaborated below in Table 2.

Table 2: Methods and tools used for collecting primary data

Method	Tools	Output
Primary data		
Field data collection	Measurement in the field site using basic tools like GPS, tape, camera etc. for quantitative enumeration	Assess the health of bamboo forest using indicators like congestion, clump age structure, shoot growth characteristics etc.
Participatory Rural Appraisal (PRA)	Using PRA tools such as focus group discussions (FGD), Participatory Wealth Ranking (PWR), oral histories, case studies and others to explore stakeholder perceptions, sustainable and un-sustainable practices	Measuring livelihood benefits and management aspects from the stakeholders Interaction with the stakeholders involved in the bamboo supply chain
Photos	Good resolution photos to document the process along with field parameters	Taking photographs of all the stages of the study, all the clumps assessed and key field findings
Secondary data		
Literature review	Bamboo ecology, bamboo management, co-production approaches, sustainable forest management, criteria and indicators	Assess the parameters used to assess bamboo health, management practices prescribed and co-production approach
State and Circle level from Forest	Details of bamboo management practices, working plan documents,	Assess the management practices, stocking

department and others	enumeration and harvest figures etc.	levels and livelihood benefits for the local community Bamboo management norms, trends in revenue generated, bamboo bearing areas etc.
Village level	Harvest figures, benefits provided, bamboo management practices	Assess the bamboo harvest, income generated, local management practices

5.5 Assessing bamboo health

Bamboo health was assessed in the compartments where bamboo was harvested in 2016-17 or 2017-18 by collecting primary data. Sample plots of 0.1ha of 31.62m x 31.62m were laid using purposive sampling with density class as the gradient. The sampling intensity followed was 1% of the geographical area and every 4th clump was enumerated within this plot as per the process and formats laid out in the National Working Plan Code (2014) and Forest Survey of India (2002). The sampling intensity was subsequently enhanced to every 2nd clump within the sample plot to enhance the ability to capture variability within a plot. Within a clump, the culm congestion, girth of all the green sound culms, number of dry sound culms and problematic culms (green and dry) were counted. Adherence to harvesting rules was measured by assessing the quality of the harvesting cut (slanting cut, height of the cut and clean cut) and whether a portion of the clump was left unharvested or problematic culms were removed or not.

5.6 Data analysis

Data analysis was carried out by aggregating the data of the sampled sites using pivot table function in Microsoft excel spreadsheet. The data was aggregated sampling site wise, institution wise and district wise to discern the patterns. The following summary tables were generated for the three components of bamboo health, livelihoods and governance:

- Indicators of bamboo health along with an aggregated health index value
- Bamboo based livelihoods and markets along with an aggregated livelihood index value
- Bamboo governance along with an aggregated governance index value

Values for each component was obtained by normalization i.e. (X – Xmin) / (Xmax – Xmin) of the indicator values. Normalization helps to rescale the values of all the indicators in the range of 0-1. These three component level indices for bamboo health, livelihoods and governance were then aggregated to develop a composite sustainable bamboo management index. Amongst the three indicators of bamboo health namely culm spacing, girth of the new culms and their percentage, since, the percentage of new culms would determine the future of these forests, it was decided to give it a higher weightage. These three indicators were aggregated in the ratio of 20:20:60 to arrive at the bamboo health score. The extent of overharvesting was measured as the percentage of overharvested clumps to the total harvested clumps. The overharvested clumps

were identified as those clumps that had been harvested and had less than 8 culms retained during harvesting.

5.7 Sampling adequacy within a site

The sampling adequacy test was carried out by plotting the 0-1-year-old culm girth at plot level cumulatively with sampling effort. We found that the sampling intensity was adequate for all the 16 sites.

5.8 Limitations of the study

- Bamboo forests harvested in 2016-17 and 2017-18 were taken up for the study. Other bamboo forests were not covered.
- While laying sample plots, the plots were laid purposively, as prior knowledge of the density gradient was not available.
- Sites in Wadsa forest division as advised by forest personnel were not accessible due to security reasons and hence were not covered. Also, in a few sites in Gadchiroli district which were sampled, it was unsafe to venture too deep inside the compartment for the same reasons.

5.9 Challenges faced

In terms of co-production, the study faced several challenges specially during the initial phases - starting from getting diverse stakeholders on board, facilitating them to work together, bridging the trust deficit, and in ensuring credibility and legitimacy of the study (Figure 12).

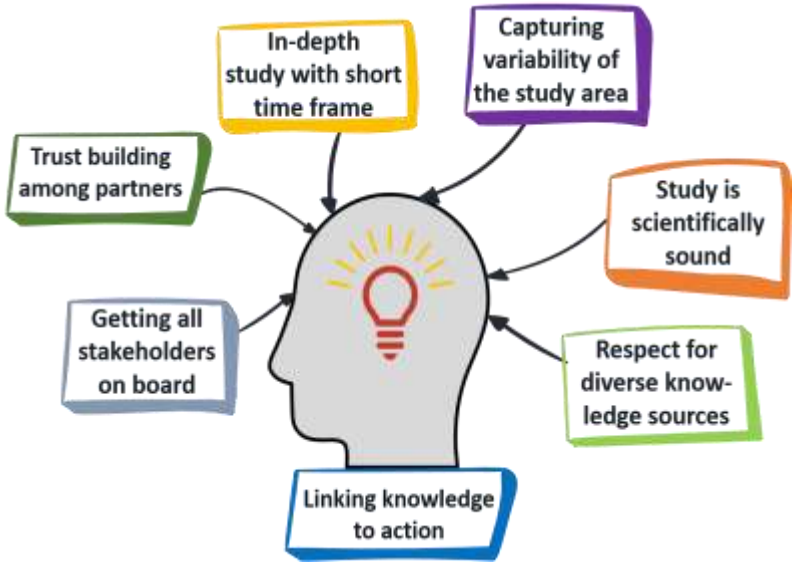


Figure 12: Challenges faced in linking knowledge to action in the co-production approach

The other risks, challenges and difficulties the study faced were adapting to a changing security situation in Gadchiroli district which flared up during election events, field work on foot in tiger inhabited area in Chandrapur district, overlap with the *lok sabha* elections and carrying out data collection during peak summer in April-May. The study was able to provide the deliverables on schedule primarily due to the strong support from the forest department, other stakeholders and the hard work of the field team.

Chapter 6

Process Followed

6. Process followed

This 8-month study was initiated in Dec 2018 and completed by July 2019. The steps followed are shown in Figure 13 and also listed below.

Figure 13: Steps followed in the 8-month duration research study

a) **Oct 2018:** Presentation of concept note of the research study to Maharashtra Forest Department on 22nd Oct, 2018. The Forest Department asked to include portions of Chandrapur district as well to the study area. Also, they appreciated the proposed co-production approach and asked IIFM to coordinate with the local community, Tribal development department, Rural development department and BILT paper industry.

b) **Nov 2018:** Study design and MoU prepared and jointly signed by IIFM and Maharashtra Forest Department on 28th Nov, 2018. Meeting with Mr. U. Prakasam, PCCF production, Madhya Pradesh forest department held on 28th Nov, 2018 to understand the bamboo management systems in Madhya Pradesh. He informed that Balaghat is the best district to study the bamboo management in the state.

c) **Dec 2018:** Study commences, literature review carried out. Invitations sent out to all prospective working group members including local community, Activists, NGOs, tribal development department, rural development department, BILT paper industry and others. A field visit to Seoni Malwa Range, Hoshangabad division was also organized on 10th Dec, 2018 to assess the bamboo management first hand. A meeting was also held with Shri. B. B. Singh, Managing Director of the Bamboo Development Board to understand the status of bamboo management.

d) **Jan 2019:** Other than Rural development department, confirmation was obtained from all other stakeholders. An exposure visit was organized from 29th Jan to 3rd Feb, 2019

wherein the working group members participated whole heartedly to understand the bamboo management in Balaghat, Madhya Pradesh and Chandrapur and Gadchiroli districts in Maharashtra across the gradient of PESA, CFR and JFM. A total of 14 working group members comprising of local community and experts, Activists and NGOs, IIFM faculty, BILT paper industry, representatives of tribal department and forest department participated in this exposure visit.

e) **29th Jan 2019 Balaghat:** The team got together in Balaghat on an exposure visit to study the bamboo management practices in Balaghat, Chandrapur and Gadchiroli. In Nagpur, the team also met Dr. S. H. Patil, PCCF and provided him with an update on the progress.

f) **30th Jan 2019 Balaghat:** In Balaghat the team studied the bamboo harvesting practices at Kanha tola, the staking and grading practice at Ukwa bamboo depot and also visited Baihar common facility center (CFC) were local youth were being trained in value addition of bamboo. An interaction with the bamboo merchants of Balaghat was also organized in the evening to understand the end use and trends in bamboo demand.

g) **31st Jan, 2019 Balaghat:** The working group started the discussion on developing the criteria and indicators of sustainable bamboo management and unsustainable bamboo management.

h) **1st Feb, 2019 Chandrapur:** The working group visited the Karwa beat, Ballarshah range and carried out pilot testing of the

bamboo plot enumeration form. In the evening the team visited Annur PESA village under the Antargao gram panchayat where due to a communication gap bamboo harvest was yet to begin.

i) **2nd Feb, 2019 Chandrapur:** An interaction was held with the Pachgaon gram sabha in Kothari range who narrated their struggle to obtain CFR and their bamboo management practices. CCF(T) Chandrapur – Shri S. V. Ramarao also accompanied the team and observed the bamboo harvesting practices, depot management and marketing strategy. In the afternoon the team visited another compartment in Ballarpur Range where bamboo was harvested last year. Observation and discussion were done on problem of congested bamboo clumps left un-harvested.

j) **3rd and 4th Feb, 2019 Gadchiroli:** The team was based in Gadchiroli and co-designed the criteria and indictors for bamboo health, associated livelihoods and management practices. DCF Working Plan Shri Umesh Verma and CCF Gadchiroli – Shri W.I. Yatbon also contributed in designing these indicators. The sampling strategy was also finalized and the draft inception report was prepared.

k) **5th Feb, 2019 Inception Workshop in Gadchiroli:** The Maharashtra Forest Department organized the Study Inception Workshop in the office of the CCF (T) Gadchiroli and invited several stakeholders. The draft study inception report was presented and a total of 30 participants contributed actively followed by intense discussions in which the following decisions were taken:

- **Rephrasing the first research question:** The first research question read as **–** "what are the best practices and failures in bamboo management in Eastern Maharashtra?" It was decided to rephrase this research question as – "what are the sustainable and unsustainable practices in bamboo management in Eastern Maharashtra", as it was felt that both best practices and failures where extreme situations, which would be too few in number. Instead it would be better to capture the sustainable and unsustainable practices, that would cover the best and failure scenarios as well.
- **Expanding and sharpening the Institutional gradient:** The study objective presently includes PESA, CFR and JFM as the institutional gradient. It was decided to modify this to PESA, CFR, Forest Development Corporation of Maharashtra (FDCM) and State Forest Department (FD). Also, it was proposed to drop JFM, since this is similar to the State Forest Department institution and not separate from it.
- **Which bamboo forests to sample:** While initially it was proposed to assess bamboo health in forests where harvesting was carried out in 2018-19, the house decided to sample bamboo forests which had been harvested in 2017-18. As the physical and financial records of these locations would be available. Locations harvested during 2018-19, may not have complete financial records available. Also, while sampling the sites harvested in 2017-18, the new shoots emerged in 2018-19 could prove to be a useful indicator on the effectiveness of the harvesting operation.
- **Identifying the villages to be sampled using purposive sampling:** Initially it was planned that all the stakeholders would provide the list of villages with sustainable and unsustainable management practices as purposive sampling. In the presentation made by CCF (T) Gadchiroli during the inception workshop, he showed that harvesting in PESA/CFR villages was taking place in a small scale and in an irregular manner, and in most of the PESA/CFR villages no harvesting has taken place over the last few years. Hence, it was decided to cover about 12 villages where harvesting had taken place in 2016-17 or 2017-18 across the 4 institutions namely PESA, CFR, FDCM and FD in both Gadchiroli and Chandrapur districts. Also, it was decided to include the PESA/CFR villages where no harvesting has taken place in the sample as well.

- **Non-disclosure of sample sites:** It was also decided not to disclose the village names, as it would vitiate the process of trust building and in eliciting authentic information. It would also protect field managers in these sites from punitive action (if any). The report would indicate these villages as Village 1 (CFR), Village 2 (FDCM) etc.
- **Felling cycle:** The pros and cons of a three year versus a one year felling cycle were discussed. Representatives from the local community highlighted the benefits of the one year felling cycle as regular cleaning, reducing fire hazard, regular incomes etc. The felling rules followed in both the cycles would be the same as prescribed in the working plan, hence issues of over-harvesting do not arise. Reference to scientific studies was also provided which highlight the benefits of the one year felling cycle over the three year one. The choice of a three year or one year felling cycle is related to logistics and tradeoff between benefits and convenience, which should be a left to the judgement of the institution managing the resource.
- **Co-designing the criteria and indicators:** The first draft of the criteria and indicators for all the three components namely bamboo health, livelihoods and management were presented and jointly approved (Figure 14). In the livelihoods and markets components, it was decided that if the wage payments were released to workers who were not resident of the nearby villages, then this benefit would not receive a score, as it did not result in any direct benefits for the local community. It was also decided that these criteria and indicators would be sharpened and calibrated based on field testing as the study progresses and a better shared understanding emerges.

- **Strengthening the participation of forest department in the working group:** Based on the experience gained in the exposure visit, it was decided to request the Maharashtra Forest Department to include General Manager – FDCM (Shri. Rishikesh Ranjan), CCF(T) Chandrapur (Shri. S. V. Ramarao) and CCF(T)

Figure 14: Co-designing criteria and indicators for sustainable bamboo management

Gadchiroli in the working group. Also, Shri. T.S.K. Reddy, MD MBDB may be requested to advise/mentor this working group. It was also decided to request Shri. Pandurang M. Raut (Tribal Development Dept.) to kindly coordinate with the Rural Development Department for their participation in the study.

These inputs were incorporated to prepare the study inception report.

l) Finalizing Study Inception Report

The study inception report was finalized in mid Feb 2019 and submitted to the Maharashtra Forest Department vide letter dated 19th Feb, 2019.

m) Hiring field staff and joint data collection: The hiring of field investigators was carried out in Feb 2019. They were hired in partnership with the local community and experts and represented both Chandrapur and Gadchiroli districts. The local forest field staff were also involved in data collection. This strategy helped in getting buy in from all the stakeholders and developed trust in the data collected. For the value chain and marketing part, two IIFM students who had just passed out were engaged as project interns for a few weeks, and they conducted a market survey and submitted the report.

n) Field data collection: Once the methods were finalized, the data collection was initiated from March 2019. The data collection in the first few sites was supervised by Dr. Anup P. Upadhyay and Dr. Advait Edgaonkar (IIFM faculty) in the FDCM sites in Gadchiroli from 1st – 5th March, 2019. Based on this field visit, the sampling intensity of the clumps within a plot was doubled from every fourth to every second clump. This was done to make the data collection more intensive so as to capture the variation within a site adequately.

From 12th – 15th April, 2019, a joint team of Dr. Suprava Patnaik, Dr. Sandeep Tambe, Shri. Mohan Hirabai Hiralal, Shri. Devaji Tofa, Dr. Vijay Edlabadkar and Shri. Sanjay Telharkar visited Chandrapur, Gadchiroli, Bhamragarh and Allapalli to supervise the data collection. This visit helped to make the data collection more scientific specially on measurement of clump congestion and indicators for marketing management. This visit also helped the team to gain qualitative insights and helped to answer the

why question. i.e. why is the bamboo health or livelihoods good or bad in a particular site?

o) Market survey: IIFM PGDFM students Shri Abhishek Gawande and Shri Pratik Surkar were engaged for the bamboo market study. They covered the various stakeholders, supply chain and price trends by interacting with various stakeholders from producer till consumer in the supply chain of bamboo. They also interacted with the BILT personnel at their procurement depot as well as with the *burad* community artisans.

p) 27th – 30th May, 2019: Co-production consultation was organized at Chandrapur wherein the data gaps, data analysis, sharing of emerging findings, analysis of the co-production process and preparation of draft report was carried out. The meeting had representation of most of the working group members, and forest department officials. Shri Rishikesh Ranjan GM FDCM along with his team, Dr. Kishor Mankar, DCF (RU), Shri Mohan Hirabai Hiralal Vrikshamitra NGO, Shri Kunal Sekhar DGM BGPPL, Shri Sanjay Telharkar Manager BGPPL, Shri Devaji Tofa Mendha Lekha gram sabha, Shri Vijay Dethe Paryavaran Mitra NGO, Dr. Vijay Edlabadkar along with the IIFM Team comprising of Dr. Rekha Singhal, Dr. Suprava Patnaik, Dr. Sandeep Tambe, Dr. Advait Edgaonkar and Dr. Anup P. Upadhyay and representatives of the forest department participated.

q) May – June, 2019: Data analysis, preparation of draft report and submission

r) July 2019: Submission of draft report to Maharashtra Forest Department on 2nd July 2019. Presentation of draft report to

senior officials of the Maharashtra Forest Department in Van Bhawan on 25th July 2019 at Nagpur in a meeting chaired by Shri Praveen Srivastava PCCF (P&M).

s) **Sept 2019:** One-day workshop organized by the Maharashtra Forest Department which had participation from working group members in Harisingh, Van Sabhagruh, Seminary Hills, Nagpur on 9th Sept 2019 at Nagpur and chaired by Shri Praveen Srivastava PCCF (P&M). The final report was presented in this workshop and suggestions were received from all participants followed by deliberations on the way forward.

Chapter 7

Co-designing Criteria and Indicators

7. Co-designing criteria and indicators

The study tries to capture the variation in bamboo health and related livelihood benefits across the institutional gradient of community managed (CFR), community owned (PESA), forest corporation (FDCM) and forest department (FD) managed bamboo. The study has three main components, bamboo health, livelihoods and governance. These criteria and indicators were co-designed in a participatory manner jointly by the working group (Figure 15).

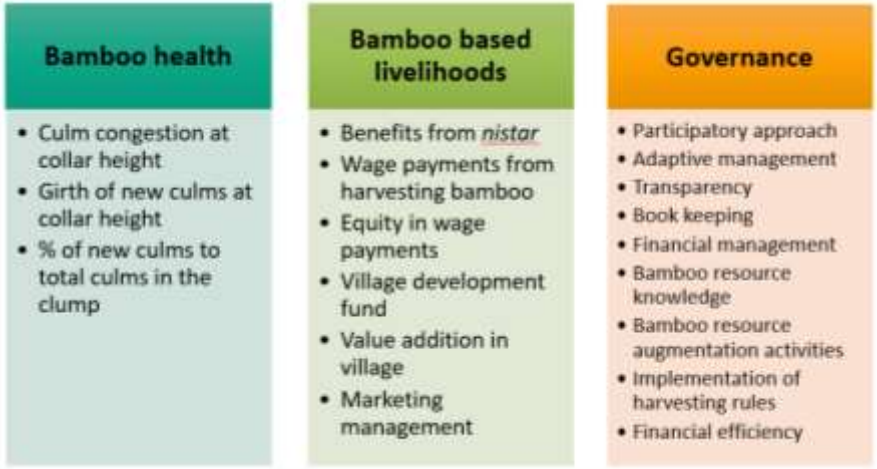


Figure 15: Co-designing the criteria to assess bamboo health, livelihoods and governance

7.1 Bamboo health

Bamboo health was assessed in the compartments where bamboo was harvested in 2016-17 or 2017-18. Bamboo health was derived using three main indicators namely clump congestion, average girth of 0-1-year-old culms at collar height and percentage of 0-1-year-old culms to total culms (Table 3).

Table 3: Co-designing the criteria, indicators and verifiers to assess bamboo health

Criteria	Indicators	Value	Verifier
Culm congestion	Culm congestion at collar height of 80% of the culms 1 finger width = 2 cm	< 1 finger	Field data
		1 finger	
		2 finger	
		>= 3 finger	
Girth of new culms	Average culm girth of new culms (0-1 year) at collar height	>15 cm	Field data
		12.1-15 cm	
		9-12 cm	
		< 9 cm	
% of new culms	Percentage of new culms (0-1 year culms) to total number of culms in the clump)	> 30%	Field data
		15.1-30%	
		0.1-15%	
		0%	

7.2 Livelihoods

Livelihoods component covered access and adequacy of *nistar*, quantum of wage payments received per household, piece rate for bamboo harvesting, percentage employment received by poor households, value addition of bamboo at the village and contribution

to the village development fund (Table 4). Bike ownership was used as an indicator for poverty at the household level, as it is a publicly owned asset and cannot be hidden. The proportion of non-bike owning households amongst the bamboo wage earners was compared with the overall non-bike owning households in the village to arrive at the equity of wage payments. This difference was used as a measure of equity or pro-poor nature of the wage payments. i.e if the poverty % of bamboo harvesting households is 60% and that of the village is 50 % then the equity in wage payments would be positive at 10% (60-50).

Table 4: Co-designing the criteria, indicators and verifiers to assess bamboo based livelihoods and markets

Criteria	Indicators	Value	Verifier
Nistar	Access to Nistar bamboo for last 3 years	0 times	Focus group discussion with villagers and forest staff
		1 time	
		2 times	
		3 times	
	Adequacy of Nistar quantity over last 3 years	Good	Records
		Moderate	
		Inadequate	
Wage payments	Average wage payment received (by local households) from bamboo harvesting during last year (total wage payment made, total local households employed, average wage payment received)		Records
	Piece rate received (by local households) from bamboo harvesting during last year (long bamboo, bamboo bundles)		Records
Equity in wage payments	Difference in percentage of poor households engaged in harvesting bamboo from village poverty percentage	> 20%	FGD with local community and forest staff
		11-20%	
		1-10%	
		-10- 0%	
Village development fund	% contribution of bamboo turnover to Village Development Fund (Total turnover, expenditure incurred, contribution to VDF)	>50%	Records
		25.1-50%	
		10.1-25%	
		0-10%	
Value addition in village	% of persons engaged in value addition (handicrafts, treatment and others) of long bamboo or bamboo bundles	>20%	FGD with local community and forest staff
		10.1-20%	
		5.1-10%	
		0-5%	
Marketing management	Average rate at which long bamboo and bundles were sold, was the total bamboo lifted by the trader, was the total payment received from the trader and whether it was received in the bank account or not		Records

7.3 Governance

The governance component covered participatory governance, adaptive management, transparency, book keeping, bamboo resource knowledge and plough back, implementation of harvesting rules and financial efficiency (Table 5).

Table 5: Co-designing the criteria, indicators and verifiers to assess bamboo governance

Criteria	Indicators	Values	Verifiers
Participatory approach	Participation of all local people in governance (felling rules, piece rate, felling series, supervision during felling, felling period, patrolling, penalty, nistar rules, sale process, pre-harvesting preparations)	8-10 6-7 4-5 0-3	FGD with local community and forest staff
Adaptive management	Monitoring mechanism, feedback mechanism, evidence of incorporating for process improvement	> 3 years 1-3 year < 1 year	FGD with local community and forest staff
Transparency	Knowledge of bamboo outturn cost estimation, harvest, expenditure, sale process	Public disclosure Provide on demand Not providing	FGD with local community and forest staff
Book keeping	Sample plot enumeration, harvesting estimate, stock register, expenditure record, sale record	All 5 records as per SOP All 5 records available < 5 records available	Records
Financial management	Timely release of wage payments	> 2 months 1-2 months 15-30 days < 15 days	Records
Bamboo resource knowledge	Knowledge of boundary, knowledge of extent, bamboo species present, bamboo resource maps, felling series demarcation, bamboo stock density knowledge, bamboo flowering pattern, bamboo productivity knowledge, knowledge of threats (pest, disease, theft, fire, grazing)	8-10 6-7 4-5 0-3	FGD with local community and forest staff and map
Bamboo resource augmentation activities	Trenching, mounding, fire protection, grazing protection, plantation in blank areas, pests and disease, nursery for artificial regeneration, debris removal, bamboo gregarious flowering contingency activity	8-10 6-7 4-5 0-3	FGD with local community and forest staff
Implementation of felling rules	% of clumps where problematic culms are retained	> 50% 30.1-50% 10.1-30% <10%	Field data
		> 50% 30.1-50%	

	% of clumps where improper felling cut (height, clean, slanting)	10.1-30%	
		<10%	
	% of clumps which have not been worked in difficult areas (hilly, distant, across a stream etc.) due to inconvenience	> 50%	
		30.1-50%	
		10.1-30%	
		<10%	
Financial efficiency	Benefit cost ratio (Benefit is from sales, while cost includes only harvesting costs)	> 2	Records
		1.6-2.0	
		1.1-1.5	
		0-1.0	

After assessing the bamboo health, associated livelihoods, and governance, the explanatory sequential approach was used to ascertain the drivers by assessing the management practices, locality and biotic factors etc. These criteria and indicators evolved as the study progressed and were fine-tuned towards the end of the study after field testing. Finally, each of the indicators was normalized and aggregated to arrive at a single score for each component e.g. bamboo health, livelihoods and governance.

Chapter 8

Findings

8. FINDINGS

8.1 Bamboo health

The initial hypothesis of the study was that bamboo health could be primarily attributed to extraction or harvest, and that over-harvesting was resulting in a decline in the bamboo crop. There are several drivers of bamboo health which can be aggregated into three broad heads namely locality factors (edaphic, climatic, topographic etc.), biotic factors (grazing, fire, invasive species, over-extraction etc.) and governance (grazing protection, fire protection, soil moisture conservation, harvesting methods, resource augmentation etc.). The objective of the study is to assess bamboo health in Chandrapur and Gadchiroli districts across the institutional gradient (governance) of CFR, PESA, FD and FDCM. In the real world, it is not possible to find counterfactual sites that are exactly same in locality and biotic factors and differ only in governance. While the health of the bamboo crop can be measured using criteria and indicators, its attribution to locality factors, biotic factors or governance is the challenging part. Hence, we analyzed select scenarios to better understand the cause and effect relationship.

8.1.1 Bamboo health across institutional gradient

How does bamboo health vary across the institutional gradient of PESA, CFR, FD and FDCM when the locality and biotic factors are broadly the same? Allapalli division provides this interesting comparative scenario, as there are compartments managed by PESA (Option II), FD as well as FDCM in close proximity that were harvested in 2016-17 and 2017-18. These six sites are located 20 km apart and provide a unique control for us to assess the impact of the institutional gradient. The criteria and indicators of bamboo health are listed in Table 6.

Table 6: Variation in bamboo health parameters across the institutional gradient of PESA, FD and FDCM in Allapalli forest division

Institutional gradient	Average culm spacing (cm)	Average girth of 0-1 year old green sound culm (cm)	% of 0-1 year green sound culms to total culms	% of 1-2 year green sound culms to total culms	% of >2 year green sound culms to total culms	Average clump height (feet)
PESA	8.00	14.60	1.41%	8.96%	61.94%	30.87
FD	8.19	13.89	0.57%	5.37%	49.26%	36.72
FDCM	9.56	11.13	0.39%	10.51%	56.92%	25.72
Allapalli division	**8.58**	**13.20**	**0.79%**	**8.28%**	**56.04%**	**31.10**
Gadchiroli district	**9.95**	**15.59**	**14.80%**	**24.40%**	**37.14%**	**29.00**

Source: Primary data

We observed that across the three institutions of PESA, FD and FDCM, the 0-1-year-old culms (*karla*) have almost disappeared from the Allapalli bamboo forests and constitute less than 1% of the total culms, while the district average in other locations is several times more at 14.80%. The 1-2-year-old culms in other parts of the district are also nearly three times (24%) more. Consequently, the percentage of greater than 2-year-old culms is higher at 56% compared to 37% in other parts of Gadchiroli district. So what changed suddenly over the last two years that resulted in the disappearance of young culms in Allapalli forest division (Box item 1). Field observation and focus group discussion point towards a recent trend of the local households of leaving their unproductive cattle in the forests. These feral cows over the past few years have started residing permanently and selectively browse these nutritious bamboo culms. The culms are very tender during the growing stage (Chaturvedi 1988). The few culms that are lucky to survive are those protected by older culms on all sides (Figure 16). These six sites differ in their governance systems, but had not taken adequate grazing control measures, as they had not detected the disappearance of the *karlas*. Hence, we found governance to be a weak driver of bamboo health as sizeable initiatives to protect and augment the bamboo resource need to be put in place.

Box item 1. The mystery of the disappearing *karlas* in Allapalli forest division, Gadchiroli district

Karlas (new culms) have all but disappeared from our bamboo forests, and their density has come down to one in seven clumps. They have not disappeared all of a sudden, but have been reducing over the last 4-5 years. There is no problem of migratory herders (*Kathiwadi*) camping here. The problem is the growing tendency of the villagers to leave their unproductive cattle in the forests. Earlier the cattle used to be left in the forests only during summer, in monsoon and winter they used to be in the farm. These cattle now stay in the jungle round the year and have become *lavaris gai* (feral cattle). Earlier I had five cows, after leaving them in the forest only one came back. I do not know how many they have become now. In the past unproductive cattle would be sold to the butcher (*kasai*) for the slaughter industry. *Kasai* used to come to our village to buy these unviable cattle. Now with a ban on cow slaughter, the farmers are left with no option but to abandon these cattle. These cattle have taken to the forests, turned feral and multiplied. The succulent bamboo shoots are sought by these hordes of cattle and being borne towards the clump periphery they stand no chance. Even the bamboo shoots inside the clump are selectively devoured. The policy to ban slaughter of cattle including bulls has had an unintended consequence. Remedial measures like *kanji* house, cow shelters for abandoned cattle etc. are not showing any impact. These feral cattle are impacting paddy farming as well, as a six-foot fence is also not a deterrent for them. The bamboo clump now has only parents and grandparents left (in bamboo the generations are one year apart), as no new culms have been able to survive. Our bamboo forests have become childless; we need to protect the young culms during the ensuing monsoons as the parent culms will soon cross the reproductive age. We run the risk of losing the entire bamboo forest unless urgent steps are taken to control the *lavaris gai*.

Source: FGD at Ramy Yapetha village, near Elchil village, Allapalli forest division

Figure 16: New culms have become rare in the Allapalli forest division, and their density has come down to one in seven clumps. The few culms that are lucky to survive the onslaught of the feral cattle (highlighted in red) are those protected by a cage of older culms on all sides

8.1.2 Bamboo health across the biotic gradient

We studied the effect of the biotic gradient of grazing across PESA village sites which were located 50 km apart, but had similar locality factors and governance. In this scenario, while one site (PESA village 1) had low grazing pressure, the other site (PESA village 2) had high grazing pressure with resident cattle (Table 7).

Table 7: Variation in bamboo health parameters across the gradient of biotic pressure in Gadchiroli circle

Biotic gradient	Grazing pressure	Average culm spacing (cm)	Average girth of 0-1 year old green sound culm (cm)	% of 0-1 year green sound culms to total culms	% of 1-2 year green sound culms to total culms	% of >2 year green sound culms to total culms	Average clump height (feet)
PESA village 1	Low	8.50	15.92	20.41%	32.65%	31.55%	29.95
PESA village 2	High	8.06	14.56	2.37%	8.71%	62.32%	30.29

Source: Primary data

We found that the biotic pressure in the form of resident cattle has had a disastrous effect on young green sound culms (Figure 17). The number of 0-2-year green sound culms had reduced five times from 53% to 11%. The grazed sites had a predominance of older culms in the clump thereby putting the very future of these forests at risk. Hence, we found that the bamboo forests are sensitive to grazing pressure specially in the monsoons.

8.1.3 Bamboo health at district level across locality factors

We then compared bamboo health across the Chandrapur and Gadchiroli districts by aggregating the health indicators district wise. We excluded the six sites of Allapalli where the bamboo health had been impacted by recent, resident cattle grazing. On aggregating the bamboo health parameters across various institutional systems at district level, we found that Gadchiroli bamboo has a culm spacing of 9.95 cm (74% higher), the average girth of 0-1-year-old culm is 15.59 cm (28% higher) and comprises of 14.80% of the total culms in the clump (113% more) (Table 8). Hence, we found that a bamboo clump in Chandrapur shows higher congestion, lesser girth of new culms and is comprised of older culms.

Figure 17: There is a growing tendency to leave unproductive cattle in the forests. These cattle have turned feral and devastated the young bamboo culms in Allapalli forest division, Gadchiroli district, putting a question mark on the very future of these forests

Table 8: Comparative analysis of bamboo health parameters aggregated across Chandrapur and Gadchiroli districts (excluding the 6 sites in Allapalli forest division)

District	Average culm spacing (cm)	Average girth of 0-1 year old culm (cm)	% of 0-1 year green sound culms to total culms	% of 1-2 year green sound culms to total culms	% of > 2 year green sound culms to total culms	Average clump height (feet)
Chandrapur	5.73	12.18	6.96%	16.94%	35.71%	25.00
Gadchiroli	9.95	15.59	14.80%	24.40%	37.14%	27.72
% difference	73.66%	28.04	112.58%	44.06%	4.00%	10.91%

Source: Primary data

This variation in bamboo health can be attributed to locality factors, governance or biotic factors? Gadchiroli district has a higher rainfall, higher forest cover, better soil conditions and lesser biotic pressure as compared to Chandrapur district (Chaturvedi 1988). Also, during the focus group discussions with village elders at various sites across Gadchiroli district, they could not recall the last gregarious bamboo flowering event unlike the Chandrapur bamboo where the current crop has established after the gregarious flowering in early 1980s. Also, Gadchiroli bamboo across large tracts does not exhibit congestion (Figure 18). This raises a question whether the *Dendrocalamus strictus* in Gadchiroli is a different ecotype compared to the *Dendrocalamus strictus* in Chandrapur, considering that it shows differences in congestion behaviour, culm size, percentage of new culms, flowering pattern, height etc. This suggests that we would be mistaken if we attributed the lower health of bamboo in Chandrapur district (as compared to Gadchiroli district) to governance. Also, comparing bamboo health of sites across Chandrapur and Gadchiroli districts and attributing it to governance or biotic factors can be misleading as the effect of locality factors come into play.

8.1.4 Within district level across governance and biotic gradient

We then aggregated the bamboo health parameters for the 16 sites institution wise separately within the two districts (Table 9,10). The Gadchiroli CFR sites showed the best bamboo health characteristics while the Chandarpur CFR showed the lowest. This should not make us conclude that the CFR institutions in Gadchiroli are significantly better in bamboo governance than Chandrapur, as, the locality factors in these two districts are significantly different. What is evident is the drastic decline in the number of young culms in the sites managed by FD, FDCM and PESA in Allapalli forest division of Gadchiroli district (discussed above).

Figure 18: Some of the best bamboo forests were found in Bhamragarh division of Gadchiroli district. The morphology, growth and behaviour of Gadchiroli district bamboo is superior to Chandrapur bamboo, also it does not display congestion or gregarious flowering over large tracts

The study found that the health of the bamboo forest can be objectively measured using three indicators namely culm congestion, girth of new culms and percentage of new culms. Since, the percentage of new culms would determine the future of these forests, it was decided to give it a higher weightage and these three indicators were aggregated in the ratio of 20:20:60 while constructing the bamboo health score.

Table 9: Comparative analysis of bamboo health parameters in Gadchiroli district across the institutional gradient of CFR, FD, FDCM and PESA

Health parameters	Average culm spacing (cm)	Average girth of 0-1 year old culm (cm)	% of 0-1 year green sound culms to total culms	Normalized scores			
				Culm spacing	Girth of new culm	% of new culms	Health score
Weightage				**20**	**20**	**60**	
CFR	10.10	15.67	13.14%	1.0	1.0	1.0	**1.00**
FD	8.19	13.89	0.57%	0.1	0.6	0.0	**0.14**
FDCM	9.56	11.13	0.39%	0.7	0.0	0.0	**0.15**
PESA	8.06	15.24	3.77%	0.0	0.9	0.3	**0.34**
Gadchiroli	**8.98**	**13.98**	**4.47%**	**0.45**	**0.63**	**0.32**	**0.41**

The FD, FDCM and two of the PESA sites are located in Allapalli forest division and have a lower relative health score as these sites have been impacted by high culm mortality. The drivers of bamboo health impacting these three health indicators are biotic factors and governance (Figure 19). Of these, protection and harvesting are within our control while locality factors (like soil, rainfall etc.) cannot be normally altered for a given site. Protection of the young culms from mortality will improve the health of the bamboo forests in Allapalli forest division. Both the FD and FDCM sites are located in Allapalli forest division, while the CFR sites are located in Gadchiroli forest division. Hence we cannot attribute the better health of the bamboo forests in the CFR sites of Gadchiroli to governance since the biotic factors are different.

Figure 19: The drivers adversely affecting bamboo health are visible in this photograph from Chandrapur district. Poor site quality, cattle grazing, forest fire and ill-treatment of the clumps during harvesting - resulting in congestion of the clumps

Table 10: Comparative analysis of bamboo health parameters in Chandrapur district across the institutional gradient of CFR, FD, FDCM and PESA

Health parameters	Average culm spacing (cm)	Average girth of 0-1 year old culm (cm)	% of 0-1 year green sound culms to total culms	Normalized scores			
				Culm spacing	Girth of new culm	% of new culms	Health score
Weightage				**20**	**20**	**80**	
CFR	4.88	11.04	5.61%	0.0	0.0	0.0	**0.00**
FD	5.98	11.74	6.39%	1.0	0.2	0.2	**0.37**
FDCM	5.53	12.76	7.05%	0.6	0.6	0.4	**0.47**
PESA	5.83	13.84	9.42%	0.9	1.0	1.0	**0.97**
Chandrapur	**5.56**	**12.35**	**7.12%**	**0.62**	**0.47**	**0.40**	**0.45**

Since, there was only one CFR site and one PESA (option 1) site harvested in 2016-17 and 2017-18, the sample size could not have been increased. Using the same reasoning as above, it would be erroneous to conclude that due to weak governance in the CFR site, their health score is low. This is due to the absence of benchmarking when the bamboo forest was handed over to the CFR village. If this was available, then we could have compared the present health of the bamboo forest with this baseline to ascertain the trend. Without the baseline, we cannot detect whether the forests were in poorer health earlier and are improving now, or they were in better health earlier and are declining now. While we can assess the present status of the bamboo forests, whether there is an uptrend or a downtrend cannot be discerned.

This analysis of bamboo health across Chandrapur and Gadchiroli districts also brings home the point that comparing bamboo health across compartments may give erroneous results i.e. CFR is best in Gadchiroli and worst in Chandrapur. Instead it would be accurate, if we monitor the health of the bamboo forests longitudinally within a compartment. This temporal study can give us an accurate picture of the status and trend of bamboo health within a compartment and can also help us attribute reasons for the same.

8.1.4 Estimating the extent of non-harvest

There are a total of 425 CFR villages in Chandrapur and 1,388 CFR villages in Gadchiroli. Of these villages, how many are bamboo bearing is not known. We estimated this figure by using the proportion of the bamboo bearing area to the total forest area of the district. In Gadchiroli district,

the total forest area is 12,833.33 sq. km. while the area under bamboo is 3305.80 sq. km., which amounts to 26% (Forest Department 2016; Government of Maharashtra 2017). Using this measure, we estimated the number of bamboo bearing CFR villages in Gadchiroli district to be around 358 (26% of 1,388). Similarly, Chandrapur district has a total forest area of 4,822.63 sq. km and the area under bamboo is 672.14 sq. km., which amounts to 14% (Forest Department 2016; Government of Maharashtra 2017). Using this measure, we estimated the number of bamboo bearing CFR villages in Chandrapur district to be around 59 (14% of 425). Forest department records show that in 2016-17 and 2017-18, only one CFR village is harvesting bamboo in Chandrapur district, and only 17 in Gadchiroli district (Watbon 2019). Of the probable 417 bamboo bearing CFR villages in Chandrapur and Gadchiroli districts, while ideally one third (i.e. 139) should be harvesting bamboo every year, only 18 (or 13%) are harvesting annually.

Also, within these 13% of the compartments that are harvested, we found that only one third of the area of the compartment is being harvested (Table 11). Of the 307 ha area of an average compartment due for harvest, only 102 ha is being harvested i.e. 33%. The remaining 66% is being left unharvested.

Table 11: Assessment of area harvested in harvested compartments across the institutional gradient

Institution	Average area of compartment (ha)	Average area harvested per compartment (ha)	Percentage of area harvested
CFR	333	96	29%
FD	305	113	37%
FDCM	321	81	25%
PESA	269	120	45%
Average	**307**	**102**	**33%**

Source: Primary data

8.1.5 Extent of overharvesting in the harvested sites

We then assessed the extent of over-harvesting across the institutional gradient. Over harvesting was defined as retaining less than 8 culms during harvesting and was measured at the clump level (Table 12).

Table 12: Assessment of overharvesting in the harvested sites across the institutional gradient

Institution	Chandrapur	Gadchiroli
CFR	15%	0%
FD	48%	16%
FDCM	17%	12%
PESA	21%	28%

Source: Primary data

Since the sample size was small, we used median to assess the central tendency of the dataset. We found that the extent of overharvesting for the CFR/PESA sites was 18% while that of FD/FDCM was 16.5%. Hence, we could not find evidence of large scale overharvesting in the CFR/PESA sites.

8.1.6 Will lack of harvest result in congestion?

This leads us to the next question that in the 87% CFR/PESA villages, if bamboo is not harvested regularly, then will it result in congestion? Are the unharvested compartments getting congested? Since, baselines on the status of the bamboo health while handing over the bamboo bearing compartments to CFR/PESA villages are not available, this question cannot be answered easily (Box item 2). Scientific studies point that congestion is a response of the bamboo clump to culm mortality at the periphery due to felling of the culms, grazing and harvesting (Lovegrove 1910; Rebsch 1910; Gupta 1964; Chaturvedi 1988). This creates a ring of dead rhizomes at the periphery, forcing the new culms to turn backwards. In congested clumps, lack of working causes further congestion of culms within the clump and the number of dry bamboos are considerably increased (Mohan 1931).

Favorable locality and biotic factors in Gadchiroli have resulted in luxuriant bamboo growth as compared to Chandrapur. Consequently, Gadchiroli bamboo showed better health compared to Chandrapur bamboo irrespective of the management institutions (but for Allapalli forest division). Large scale mortality of young culms in Allapalli is a matter of serious concern. From the above discussion, we suggest that locality and biotic factors, are stronger determinants of bamboo health as compared to governance. Within biotic factors, the grazing of the young culms during monsoons is the main threat. Governance factors seem to weakly influence the health of bamboo forests, as sizeable initiatives to protect and augment the bamboo resource need to be put in place by the four institutions. Only 13% of the area due for harvesting is being harvested

every year. Also, within these harvested compartments, only one third of the area is being harvested. Within these harvested compartments, overharvesting was detected in only 16-18% of the clumps. Hence, we did not detect a significant threat to bamboo health due to rampant felling or over-harvesting in the CFR/PESA areas.

Box item 2: What causes congestion in bamboo? ill-treatment or non-working

Lovegrove (1910) while studying *Dendrocalamus strictus* clumps in the Ganges division of the United Provinces found that growth had a bearing on the correct method of exploiting bamboos at that period. He noted that after a seedling has established itself, growth takes place from the center forming thicker and better culms as the plant as a whole gathers strength. As age advances a tendency was noticed for the clump to advance in certain parts of the periphery of a clump more than in other. He concluded that a clump should be encouraged to advance in the directions chosen by itself, as confirmed from the position of the youngest culms, the bamboos should not be cut over the whole periphery of a clump and that care should be taken not to clean out too large areas in a clump. He attributed the congestion of bamboos to ill treatment, such as unrestricted cutting of bamboos round the periphery, resulting in the death of the outer rim of rhizomes and forcing of the growing culms to turn backwards. These observations were also supported by Rebsch (1910). Gupta (1964), ascribed three reasons to clump congestion in *Dendrocalamus strictus* – cutting of bamboos by villagers on the periphery of clumps, non-observance of cutting rules by forest contractors by never removing interior culms and damage to periphery culms by cattle. Damage by man is probably one of the main causes of congestion in bamboos (Chaturvedi 1988). The villagers invariably fell the bamboos from the periphery of the clumps as it is easier than to fell bamboos from the interior of the clumps. Forest contractors or labour also do not follow the harvesting rules as it is often uneconomical for them to do so. Also, bamboo is worked under the overlapping working circle with large annual coupes and its fencing is prohibitively costly. Consequently, the new culms that appear at the periphery of the clumps after felling are damaged by cattle and those which appear in the interior escape such damage. As a result of these factors, often after harvesting instead of having been cleared of congestion, a clump is left all the more congested (Gupta 1964).

Source: Lovegrove (1910); Rebsch (1910); Gupta (1964) and Chaturvedi (1988)

8.2 Livelihoods and markets

8.2.1 Livelihoods

We assessed the potential of the forest bamboo resource to drive sustainable livelihood development in the village. Livelihood benefits were gaged by measuring the *nistar* benefits, piece rate offered, wage payments, local persons engaged and equity (Table 13). Regarding *nistar* to the local community (for bona fide use), we observed that in all sites (except Pachgaon CFR) the villagers extract the bamboo needed directly from the forest. Only in Pachgaon CFR village, local rule-making was visible as a best practice, with the gram sabha setting an upper limit of 100 pieces per household per year which can be extracted only after due approval. In the forest, extraction for *nistar* purpose can be differentiated from regular harvesting by the higher height of the felling cut (3-4 feet height instead of less than 1 feet). In terms of livelihood benefits, we found that CFR/PESA villages offered an attractive harvesting piece rate of Rs 27 for long bamboo and Rs 65-75 for bamboo bundle which was three to seven times the piece rate offered by FD/FDCM. Also, the rates offered by FD were significantly higher (1.7 to 1.9 times more) than the FDCM rates. In PESA/CFR sites, sizeable number of local households are engaged in harvesting and they directly benefit from wage employment. In sites operated by FD/FDCM, at times labour from outside the state are engaged by setting up labour camps. In terms of wage benefits, we found that CFR performed the best as it provided Rs 11,264 per capita wages to 259 households per site. While FD and FDCM also provided a sizeable Rs 10,029 – 11,516 per capita wages, but on an average only 19-40 local households benefitted per site as labourers from outside the state were engaged. While PESA also benefitted 226 persons per site, however the wage payment was low. The reason was that in one of the sites (PESA Option 1), the harvesting and disposal was by the forest department and labourers from outside were engaged. In the other two PESA sites, the trader cheated the villagers and did not release the promised wage payment after harvesting. In terms of equity, we found that there is no significant pro-poor focus in employment provided by the institutions, as the focus is more on equality rather than equity. Hence, from the above discussion we summarize that the livelihood benefits to the local community are significantly higher in CFR sites. An aggregate livelihood indicator which can be used to integrate the piece rate, area harvested, average per capita wages and local persons engaged per site can be the “average wages received per person per ha harvested”.

The data was also normalized and is presented in Table 14. The livelihoods score was higher for the CFR and PESA institutions due to the higher wage rates and prioritizing local persons.

Table 13: Comparative analysis of livelihood parameters across the institutional gradient of CFR, FD, FDCM and PESA

Institution	Availability of nistar bamboo for the households	Piece rate offered for one long bamboo (Rs.)	Piece rate offered for one bamboo bundle (Rs.)	Average area harvested (ha)	Average per capita wages (Rs.)	Local persons engaged per site	Proportion of poor households engaged
CFR	1.00	27.33	65.00	96	11,264	259	-0.02%
FD	1.00	8.68	21.42	113	11,516	19	0.03%
FDCM	1.00	4.53	12.39	81	10,029	40	-0.02%
PESA	1.00	27.06	74.54	120	6390	226	0.01%
Average	**1.00**	**16.90**	**43.33**	**103**	**9,800**	**136**	**0.01**

Source: Primary data

Table 14: Normalized values of livelihood parameters across the institutional gradient of CFR, FD, FDCM and PESA

Institution	Availability of nistar bamboo	Piece rate offered for long bamboo	Piece rate offered for bamboo bundle	Average area harvested	Average per capita wages	Local persons engaged per site	Proportion of poor households engaged	Livelihoods score
CFR	1.0	1.0	0.8	0.4	1.0	1.0	0.2	0.76
FD	1.0	0.2	0.1	0.8	1.0	0.0	1.0	0.59
FDCM	1.0	0.0	0.0	0.0	0.7	0.1	0.0	0.26
PESA	1.0	1.0	1.0	1.0	0.0	0.9	0.6	0.73
Average	**1.0**	**0.5**	**0.5**	**0.6**	**0.7**	**0.5**	**0.4**	**0.59**

8.2.2 Markets

8.2.2.1 Marketing management

We found that the CFR villages were able to provide higher piece rates for harvesting to the local households as they were passing on the total benefits to the households akin a Direct Benefit Transfer (DBT) (Table 15). The data was also normalized and is presented in Table 16. Also we found that while the CFR villages had been successful in selling their long bamboo and bamboo bundles, the PESA villages but for one site which was facilitated by the forest department, are unable to market their long bamboo and are selling only bamboo bundles. The PESA villages face one major hurdle in the sustainable management of bamboo. The hurdle is in being able to market the bamboo through credible bamboo traders

who can be trusted. Though the PESA villages signed formal agreements with these traders, this has not helped them to hold the trader accountable when he defaulted. The PESA villages have been duped by these traders who have either not lifted the total bamboo, or made only part payment after lifting the total bamboo. The modus operandi of these traders is to initially offer lucrative rates and promise to lift large quantities, but once the bamboo is harvested, they either do not lift the total quantity or make only partial payments. Formal agreements signed are not honored, and the villagers have no mechanism for seeking timely relief. The PESA villagers have burnt their fingers and these broken deals with unfulfilled promises have left a trail of unpaid wage payments, rotting bamboo stacks in the forests and conflicts behind them (Box item 3).

Table 15: Comparative analysis of market parameters across the institutional gradient of CFR, FD, FDCM and PESA

Institution	Selling Price of long bamboo	Selling Price of bamboo bundle	Was the total bamboo lifted by the trader	Was the total payment received from sale	Was the payment received in bank account
CFR	42	78	1.00	1.00	1.00
FD	36	49	1.00	1.00	1.00
FDCM	29	69	1.00	1.00	1.00
PESA	41	93	0.50	0.50	0.25
Average	**36**	**72**	**0.88**	**0.88**	**0.81**

Source: Primary data

Table 16: Normalized values of market parameters across the institutional gradient of CFR, FD, FDCM and PESA

Institution	Selling Price of long bamboo	Selling Price of bamboo bundle	Was the total bamboo lifted by the trader	Was the total payment received from sale	Was the payment received in bank account
CFR	1.0	0.8	1.0	1.0	1.0
FD	0.5	0.0	1.0	1.0	1.0
FDCM	0.0	0.6	1.0	1.0	1.0
PESA	0.9	1.0	0.0	0.0	0.0
Average	**0.6**	**0.6**	**0.8**	**0.8**	**0.8**

Box item 3: Duped, deceived and devastated – the story of Mirkal PESA village in Allapalli forest division in Gadchiroli district

Mirkal is a PESA village in Allaplli forest division inhabited by 45 households of predominantly Gond community. In 2016-17, 600 villagers from this village and 26 adjacent villages got busy harvesting bamboo over 224 ha in compartments 36, 37 and 38. A trader – Mr. Jitendra Behare (alias bunty) from Nandgaon, Chhattisgarh had promised lucrative rates. He offered to purchase 96,250 bundles (2m long) at Rs 120 each, 35,585 long bamboo at Rs 55 each and 34,726 short bamboo at Rs 40 each. The gram sabha settled to this deal worth Rs 148.96 lakh and the agreement was signed and notarized. The bamboo trader made payments of Rs 60.64 lakh in cash in installments and this went on till half of the material was lifted. He then wanted to lift the balance material and was stopped and asked to first make the full payment. Few villagers pressurized saying that unless the material is lifted and sold, how will the trader release the payments to us. The trader sold the bamboo at Nagpur, Chandrapur and the bundles to BILT. But he never came back or made the balance payment. The village requested the police to retrieve the balance money and give them justice but not to arrest him. As if he was arrested, they would never get their money back. Balance payment of Rs 88.32 lakh of 600 people belonging to 26 villages is pending. As wage payments were not made as promised the people are disheartened. The villagers also tried to nab two of his trucks from another village, but he got wind of the plan and did not turn up. The villagers are desperate now. The additional greed of Rs 20 resulted in this situation (Rs 120 per bundle offered by the trader as compared to Rs 100 by BILT). BILT is an assured market with 30-40 years of relationship with the village. BILT staff had advised the villagers not to sell to Bunty as he would deceive them. Selling bundles to BILT, would have also improved the health of bamboo, as they would have cleaned the clump. With the royalty money they could have carried out mounding of the clump. The villagers have burnt their fingers now, and this is like a lifelong curse. Shri Rama Pandu Talandi, Panchayat President, Mirkal village informs that, “It is now three years, since the transaction took place and I am unable to sleep. The pressure of wage payments of 600 persons is on my head. I cannot leave the village or travel freely as I am continuously hounded by them. My life is destroyed.” Surely the proponents of PESA would never have desired this unintended consequence – leaving the simple and gullible Adivasi to fend with wily traders without any external support or guidance. What villagers of adjacent Talwada village had to say, “मिरकल गाव सारखे पैशाच्या प्रलोभनाला बळी पडुन जास्त पैशांमध्ये बांबू चुकीच्या व्यापाऱ्याला विकण्यापेक्षा सूरक्षित पद्धतीने कमी पैशांमध्ये चांगल्या व्यापाऱ्याला बांबू विकणे केव्हाही चांगले आहे I i.e. Like Mirkal village for greed sake instead of selling bamboo for more money to a wrong trader, it is better to sell bamboo at a lower price in a secure manner to a good trader”. Now we feel we need better marketing and negotiation skills to deal with crafty traders.

Source: As told by Shri Rama Pandu Talandi, Panchayat President, Mirkal village, Allapalli forest division, Gadchiroli district

Of the estimated 417 bamboo bearing CFR villages in Chandrapur and Gadchiroli districts (Refer 9.1.2), only about 15-20 are harvesting annually. The main reason behind this is the declining demand for forest bamboo due to substitution by other materials (plastic, metals, brick masonry etc.) and emerging competition from bamboo grown in other localities like northeast, Gujarat, Konkan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal etc. This lack of strong market pull for this forest bamboo may be a boon in disguise, as strong institutional systems are

yet to evolve. This weak market demand, supply side constraints and the looming naxalite threat has prevented the large scale harvest of bamboo. In the business as usual scenario, we forecast that these sporadic harvests will continue in few locations based on demand from traders and the paper industry. The Gadchiroli bamboo is non-clumping in nature and hence will not be significantly impacted by non-harvest.

As we can observe, CFR and PESA institutions maximize livelihood benefits for the local households (Table 17). PESA institutions have however not been successful in marketing the bamboo and hence not been able to convert the harvest into livelihood benefits.

Table 17: Normalized values of livelihood component across the institutional gradient of CFR, FD, FDCM and PESA

Institution	Normalized livelihood sub-component	Normalized marketing sub-component	Livelihood score
CFR	0.76	0.96	0.86
FD	0.59	0.70	0.65
FDCM	0.26	0.72	0.49
PESA	0.73	0.38	0.56
Average	**0.59**	**0.69**	**0.64**

8.2.2.2 Bamboo supply chain

Bamboo market survey was conducted to identify the various stakeholders/actors of the supply chain and their roles as elaborated below:

a. **Forest bamboo resource:** The main forest bamboo resource found in Chandrapur and Gadchiroli districts is *Dendrocalamus strictus*, which occurs in the middle storey of the teak forests. The total bamboo area in these two districts is 3,978 sq. km. Due to favourable locality and biotic factors, the Gadchiroli bamboo is more luxuriant in growth and displays larger girth and height compared to the Chandrapur bamboo.
b. **Producers:** There are primarily four producer organizations namely FDCM, FD, PESA and CFR. Out of these, FD and FDCM sell their produce through the process of auction through government depots. Whereas the CFR and PESA (option II) villages harvest their bamboo after receiving a demand from the trader. Pachgaon CFR village is the only exception, where the gram sabha maintains a bamboo depot and conducts regular auctions.
c. **Traders:** Various primary and secondary traders are involved in the supply chain of bamboo. Primary traders are located in and around Chandrapur, who sell their produce to the secondary traders located in Nashik, Jalgaon, Amravati, Bhawani mandi in Rajasthan etc. The

primary traders procure the bamboo from the producers. After procuring the material, they transport it to their depot for grading into different sizes as per the requirement in horticulture sector and industries.

d. **Enablers/Facilitators:** The Bamboo Research Training Center (BRTC) set up by the Maharashtra Bamboo Development Board (MBDB) acts as the enabler for promoting bamboo based livelihoods, enterprises and products. It has launched several courses such as diploma in bamboo technology (2 years), certificate course in turning (70 days), certificate course in basketry (70 days), certificate course in furniture (70 days) and certificate course in construction (70 days). BRTC has also setup the localized Bamboo Handicraft and Art Units (BHAU), agarbatti and toothpicks production units. Currently, such BHAU units are functional at Chandrapur, Pombhurna, Mul, Visapur and Chimur.
e. **Processors:** The industrial processing of the bamboo is done by the BILT paper mill and the quantum of their usage is to the magnitude of 1.5 lakh tonne per annum. BILT uses 10% bamboo in their paper production process in order to provide shine and brightness to the paper. Apart from this, small scale industries such as *agarbatti* (incense stick) industry, toothpick industry, thermal power plants and *poha-murmura* industry also use bamboo in their production processes. The *Burad* community are traditionally involved in the making of bamboo based crafts and utility items. Bamboo is also processed by furniture units for making furniture for homes, hotels and restaurants.
f. **Wholesalers and retailers:** The wholesalers procure long bamboo and bamboo bundles from the traders and sell it to horticulture retailers, paper industry and others. The *burad* community sells bamboo crafts and utility items to retailers in Chandrapur. Apart from this, the Maharashtra Bamboo Development Board (MBDB) has started retail outlets named "Bamboo Shop" in Nagpur and Chandrapur.
g. **Consumers:** The primary consumers of bamboo are the forest fringe communities, who use it for making fences, roofs, temporary shades, house construction etc. Industrial consumers include paper industry, thermal power plants and *poha-murmura* industry. Other consumers include farmers in Nagpur, Amaravati, Nashik, Sangamner etc. who utilize the bamboo in orchards for making stakes, supports and trellis. Bamboo crafts and utility items are purchased by the city folks. Some high-end consumers make use of bamboo furniture in homes, hotels and restaurants.

We found that broadly three supply chains are present for forest bamboo resource namely social, industrial and commercial (Figure 20). In the social supply chain, the forest fringe communities access forest bamboo as *nistar* to meet their bona fide needs such as fencing, roofing, shade, housing, utility items etc. (Figure 21). The industrial supply chain mainly meets the requirements of the paper industry, thermal power plants and several small scale industries such as *poha-murmura* etc. (Figure 22). While the commercial supply chain supports the horticulture orchards (grapes, orange, tomato, pomegranate etc.), *burad* artisans for making bamboo crafts and the furniture units (Figure 23, 24).

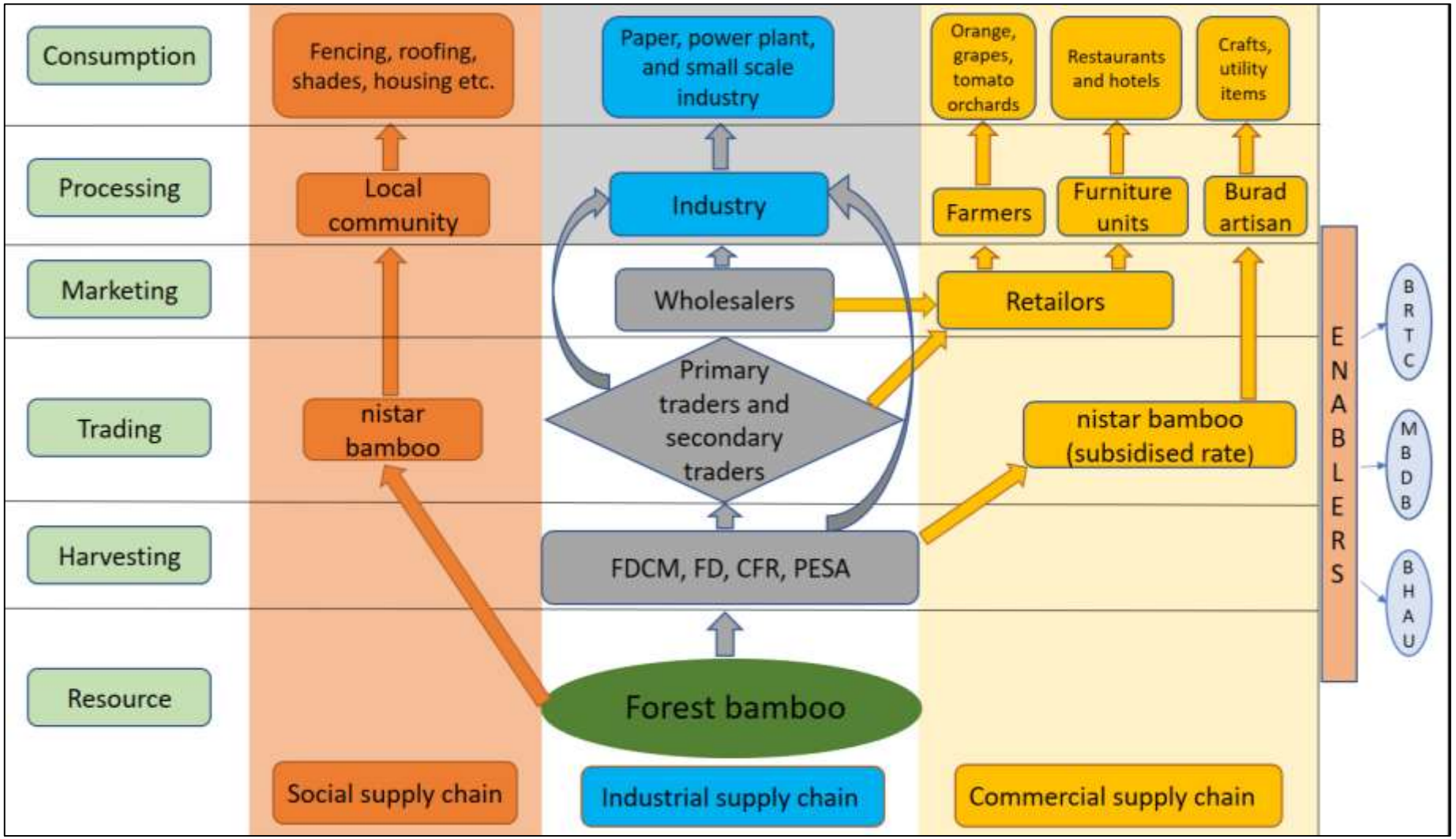


Figure 20: Schematic representation of the three bamboo supply chains in eastern Maharashtra. The social value chain helps in meeting the bona fide requirements of the forest fringe communities, the industrial value chain meets the requirements of the paper and other industries and the commercial value chain supports horticulture orchards, *burad* artisans in making bamboo crafts and the furniture units

Figure 21: In the social supply chain, the forest fringe communities access forest bamboo as *nistar* to meet their bona fide needs such as fencing, roofing, shade, housing, utility items etc. Aspiration for *pucca* houses and promotion of brick masonry houses in government housing schemes has reduced the demand for bamboo in the housing sector

Figure 22: Procurement depot of BILT paper industry at Ballarshah (industrial supply chain). Forest bamboo of eastern Maharashtra now faces stiff competition from bamboo from other states and also from bamboo grown in farmer's fields

Figure 23: The commercial supply chain for horticulture is supported by traders who bundle the bamboo for sale to horticulture farmers (orange, grape, tomato, pomegranate) of Vidarbha, Nashik and other areas. However, droughts in Maharashtra have resulted in a decline in the demand for bamboo in the horticulture sector

Figure 24: Retailers selling bamboo products made by the *Burad* local artisans in Gandhi market, Chandrapur (commercial supply chain). The use of bamboo products has gone down over the years due to substitution by other materials like plastic, metals, brick masonry etc.

8.3 Governance

8.3.1 The legal framework

Over the last four decades, the legal regime governing the management of forest resources in the country has seen radical changes. In 1992, parliament passed the 73rd constitutional amendment according the Panchayats a constitutional status as institutions of local self-governance for rural India. Minor Forest Produce (MFP) was one of the 29 subjects devolved to the local government level. In 1995, the Bhuria committee, recommended adapting the PRI to tribal areas so that it would integrate with tribal culture and customs. Accordingly, the parliament enacted the Provisions of the Panchayats (Extension to the Scheduled Areas) (PESA) Act, 1996 for its applicability to fifth schedule areas. In 2006, the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights Act), 2006 (hereafter Forest Rights Act or FRA), came into force. It aspires to undo the "historic injustice" meted out to forest dependent communities by recognizing and vesting in them the rights to use, manage and conserve forest resources and to legally hold forest lands that they have been residing on and cultivating. The FRA recognizes a number of rights of forest dependent communities. Particularly empowering are provisions under Sec 3(1) of the Act which recognize the community forest rights (CFR) of the Gram Sabhas (GS) of forest dwelling communities. The right to protect, regenerate, conserve or manage any community forest resource (CFR) which they have been traditionally protecting and conserving for sustainable use, under Sec 3(1)(i). This Section along with the above mentioned rights of the Act has the potential to change the top-down centralized style of governance of forests to enable greater site-specific management by communities, and provide collective livelihood security to communities, particularly when read with other provisions of the Act (Tatpati 2015). The comparative analysis of the key features and operational issues in the design and implementation of PESA and CFR under FRA is provided in Table 18.

Table 18: Comparative analysis of key features and operational issues in design and implementation of PESA and CFR under FRA

Key features	PESA	CFR under FRA
Nodal ministry	Ministry of Panchayati Raj	Ministry of Tribals Affairs
Nodal department at state level	Rural Development and Panchayati Raj Department	Department of Tribal Development
Purpose	Strengthen local self- governance in tribal areas by providing more autonomy	Undo historical injustice during nationalization of forests and settlement of claims
Applicability	Only in scheduled areas	All forests traditionally managed by local communities, not restricted to schedule areas
Institutional unit	Gram Sabha at Gram Panchayat level, new rules permit at village level but process is complicated	Gram Sabha at habitation level (hamlet or *tola*) not at gram panchayat level
Process of claim	No claim process	Claim process prescribed
Boundary demarcation	Not there	Prescribed
Title of the area	Not there	Clear title is provided
Right over natural resources	Only for minor forest produce	For all forest resources
Ownership right	Provided only for MFP	For all forest resources
Management right	Not provided, prescriptions of working plan will prevail	Provided to gram sabha
Conservation right	Not provided	Provided to gram sabha
Ownership of bamboo resource	Depends on interpretation in state rules	Included under definition of MFP

Operational issues	• Gram sabha has dual meaning – either gram panchayat gram sabha or village gram sabha. This results in confusion as to which gram sabha has the right over the MFP and has resulted in inter and intra village conflicts. • No clear boundary demarcation or title is awarded, no claim process. Hence this has led to inter village, intra village and forest department conflicts. • Only ownership right, no right for conservation or management. • Earlier confusion regarding whether bamboo and *tendu patta* are part of MFP, hence was excluded. A list was prepared which excluded these two resources from MFPs. This issue was sorted out only after FRA was enacted in 2006 and MFP was defined. • Does not have any enablers like supporting collective decision making, working capital for harvesting wage payments, training on harvesting rules, preparing business plan, market linkages etc. The absence of this enablement, creates fertile ground for contractors to function as middle men in connivance with gram panchayat level officials.	• Both MoTA and MoEFCC feel that they have primary jurisdiction over forests and tribals. MoEFCC feels that this is their subject area. • Lack of clarity regarding Section 3.1 and 3.2 (development right) of FRA. All these are clubbed in MOTA monitoring with Section 3.1(i) which are the management rights (CFR). Hence, not able to delineate the extent of CFR rights provided. Only clubbed information on CFR is provided. Drill down feature up to district, block and village level is needed. This will enable overlap with resource maps of forest department. • Many gram sabhas are not aware about CFR rights, as enablement is not provided from a government agency. • No technical support agency for training on resource estimation, sustained yield, felling rules, business planning, marketing, contract negotiation, record keeping etc. • No role provided to forest department under the Act (Figure 25).

Source: Adapted from conversation with Shri Mohan Hirabai Hiralal, Vrikshamitra NGO

Figure 25: Shri S.V. Ramarao, CCF (T) Chandrapur providing technical inputs on bamboo management to the CFR village at Pachgaon, Chandrapur. The FRA does not envisage the need of a technical support agency for training CFR villages on resource estimation, sustained yield, felling rules, business planning, marketing, contract negotiation, accounting, record keeping, reporting etc. Consequently, no significant role has been provided to the state forest departments under the Act

8.3.2 Translating the Acts into Action

We found that CFR and PESA institutions are better in participatory approach and in maintaining transparency, while the FD institution is better in terms of bamboo resource knowledge (Table 19). All the four institutions need to contribute towards bamboo resource augmentation. The financial efficiency of FDCM (2.41) was the best as it minimizes the harvesting costs, while the CFR and PESA institutions aims to maximize the wage payments to the local community. The FD institution, exhibited a middle path approach balancing financial profits with social benefits, by providing reasonable piece rates to the community while also exhibiting a modest financial efficiency of 1.80. Only one CFR village i.e. Pachgaon is able to create a sizeable village development fund using bamboo sale proceeds. in terms of implementation of harvesting rules, the PESA villages were found to be relatively better. This data was normalized and is provided in Table 20.

We examined the CFR and PESA village institutions on governance parameters and found mixed results. We ascertained the levels of participatory approach, transparency, accountability, adaptive management, book keeping and equity. We found that most of the villages lacked skills related to project management, business planning, working capital, market linkages, contract negotiations, conflict resolution, basic accounting, record keeping or reporting. Lack of these administrative, technical and financial skills prevented these institutions from effectively managing their bamboo resources. Villages with strong collective leadership and external support from NGOs performed better. Also, only 13% of the total bamboo bearing CFR villages in the study area are harvesting bamboo. In other villages, communities are not receiving any substantial livelihood benefits from bamboo.

Table 19: Comparative analysis of governance parameters across the institutional gradient of CFR, FD, FDCM and PESA

	Participatory approach	Transparency	Adaptive management	Book keeping	Bamboo resource knowledge	Bamboo resource augmentation
Target	**10**	**4**	**1**	**5**	**8**	**9**
CFR	7.75	3.00	0.25	4.00	5.50	1.25
FD	0.00	0.00	0.00	5.00	7.00	2.25
FDCM	0.00	0.00	0.00	4.00	5.75	0.75
PESA	6.00	2.50	0.00	4.25	5.75	1.00
Average	**3.93**	**1.57**	**0.06**	**4.31**	**5.86**	**1.31**

Contd..	Financial efficiency	Village development fund	Implementation of harvesting rules
		1	1
CFR	1.47	0.24	0.10
FD	1.80	0.00	0.39
FDCM	2.41	0.00	0.00
PESA	1.76	0.00	1.00
Average	**1.64**	**0.07**	**0.37**

Source: Primary data

Table 20: Normalized values of governance parameters across the institutional gradient of CFR, FD, FDCM and PESA

	Participatory approach	Transparency	Adaptive management	Book keeping	Bamboo resource knowledge	Bamboo resource augmentation
CFR	1.0	1.0	1.0	0.0	0.0	0.4
FD	0.0	0.0	0.0	1.0	1.0	1.0
FDCM	0.0	0.0	0.0	0.0	0.2	0.0
PESA	0.8	0.8	0.0	0.3	0.2	0.2
Average	**0.44**	**0.46**	**0.25**	**0.31**	**0.33**	**0.40**

Contd..	Financial efficiency	Village development fund	Implementation of harvesting rules	Governance score
CFR	1.0	0.3	0.1	**0.50**
FD	0.0	0.0	0.4	**0.42**
FDCM	0.0	1.0	0.0	**0.13**
PESA	0.0	0.3	1.0	**0.35**
Average	**0.25**	**0.40**	**0.37**	**0.35**

8.4 Sustainable bamboo management tool

The study aims to develop an objective standard to assess the bamboo forests of Eastern Maharashtra. It is based on the principles, criteria, indicators and verifiers for each of the three components namely bamboo health, livelihoods and governance. As elucidated in the health component, locality factors and biotic factors play a major role in determining the bamboo health. Hence, we suggest that instead of comparing bamboo health across compartments which have different locality and biotic factors and baselines, it may be appropriate to compare bamboo health temporally within a compartment. Also, baseline values need to be known, to understand the trend. For indicative purpose, the bamboo health, livelihood and governance components have been normalized to create the sustainable bamboo management matrix (Table 21). This matrix has been created for demonstrative purposes only, to assess Sustainable Bamboo Management (SBM) in a compartment on a temporal scale. As we can see Compartment 1 and 2 have the same health score in 2019, however Compartment 1 is showing an uptrend while Compartment 2 is showing a deteriorating trend. To be able to assess sustainable bamboo management comprehensively, it would be ideal if we created a benchmark and then used it to monitor the progress. This matrix could be adapted and included as a part of the compartment history form for the bamboo bearing compartments which can be monitored annually.

Table 21: Indicative matrix showing trend in sustainable bamboo management temporally

Row Labels	Year	Health score	Livelihoods score	Governance score	Sustainability score
Compartment 1	2016	0.5	0.6	0.5	0.5
	2019	0.7	0.5	0.7	0.6
Compartment 2	2016	0.9	0.6	0.7	0.7
	2019	0.7	0.5	0.4	0.6
Average		**0.5**	**0.6**	**0.4**	**0.5**

In terms of the Triple Bottom Line (TBL) framework, we found that the FDCM generated the highest financial capital with a benefit cost ratio of 2.41. The social capital in the CFR institutions was the highest as they have initiated participatory governance and engage local households for harvesting and provide them attractive piece rates. The ecological capital is more a function of the locality factors and protection of the young culms.

8.5 Summary of key issues identified

The study identified nine key issues (Figure 26) that need to be addressed for promoting sustainable bamboo management in eastern Maharashtra.

Figure 26: Key issues that need to be addressed for promoting sustainable bamboo management in eastern Maharashtra

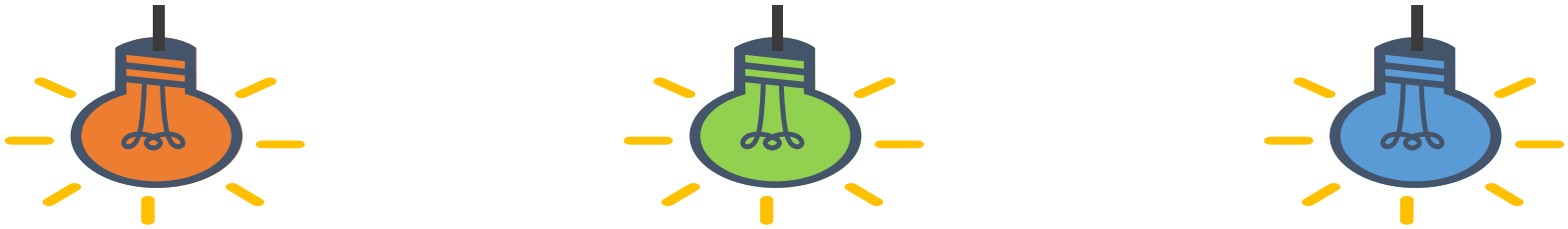
Chapter 9

Suggestions

9. SUGGESTIONS

Sustainable bamboo management will require three types of interventions in the social, ecological and economic realms as listed in Figure 27.

Figure 27: Summary of key suggestions to strengthen the triple bottom line of sustainable bamboo management in eastern Maharashtra



Social

- Trust building of forest department with gram sabha of CFR/PESA institutions
- FD and FDCM engage local community for harvesting bamboo
- Training Needs Assessment (TNA) of CFR institutions for Sustainable Bamboo Management (SBM)
- Skilling of local community for sustainable bamboo management
- Develop network of live SBM model resource centers
- Ensure empowerment and accountability of CFR institutions

Ecological

- Monitor bamboo health at compartment level using objective criteria and indicators
- Benchmark forest health before handing over to CFR institutions
- Protect young culms from grazing specially during monsoons
- Mark culms to be felled and retained before felling
- Open up congested clumps and ensure cleaning during harvesting
- Ensure resource augmentation and plough back of the bamboo revenue
- Take up ecological studies on bamboo

Economic

- Provide attractive harvesting piece rate to locals to ensure gainful wage employment
- Provide higher piece rate for decongesting bamboo clumps
- Delink harvesting from cleaning with differential rates
- Enable assured marketing channels for CFR/PESA villages

9.1 Bamboo health

9.1.1 Puzzling high culm mortality in the bamboo forests of Allapalli forest division, Gadchiroli district

One of the new symptoms that has emerged over the last few years and has the potential to wipe out the bamboo forests in the region is the surprising absence of young culms in the clumps (Figure 28). Production of young culms in *Dendrocalamus strictus* is triggered by timely monsoon rainfall and is also impacted by over harvesting. So the absence of young culms can be attributed either to unfavorable rainfall pattern or over-harvesting during the last felling cycle or mortality after production. Sites in the adjacent divisions of Gadchiroli and Bhamragarh showed a healthy 15% new culms, so if rainfall was the cause then these sites would also have been impacted. In terms of over-harvesting, local labourers had been engaged and less than 50 percent of the estimated quantity had been harvested. This points to the likelihood that *karlas* were produced, but faced drastic mortality levels. We suspect the problem to be the growing practice of leaving unproductive cattle in the forests. We came across hordes of cattle which had now made the forests their home and had turned feral. These cattle feed on the nutritious bamboo shoots when they emerge during the monsoons, and consequently large tracts of bamboo forests have now no culms in the 0-1 age group. Earlier cattle grazing in the forests was restricted to summer and winter, and the bamboo forests were cattle free during monsoons. With paddy planted in large tracts, households tended to their cattle lest they damage the agricultural crop. The bamboo culms thereby got a protective monsoon window of 3-4 months, in which they zoomed up 15-20 feet thereby escaping grazing mortality. Feral cattle are alleged to have caused hundred percent mortality to the young bamboo shoots, effectively blocking new recruitment in the bamboo clump.

Prasad (1985) studied the impact of grazing on *Dendrocalamus strictus* in Karnataka forests. He found that grazing significantly depresses the survival of seedlings and the recruitment of new culms in the clump. Herbivory on the new shoots was ascertained by the way in which the shoot was destroyed and by the spoor of the causative animal. Cattle and water buffalo were found to break the entire above-ground shoot (length ranging from 20-100 cm). So the worrying portend in Allapalli is that when the existing green culms become old, there will be no green culms left in the clump to support the recruitment of new culms. If this situation continues unabated, then over the next 2-3 years, bamboo forests will have only dry bamboo with no green culms to support vegetative propagation through shoots. In Allapalli, whether it is PESA forests, FDCM forests or State forest department forests, the story is the same. The age structure of these bamboo forests has been altered with very few new shoots surviving. The existing bamboo culms in the clump are aging, and in a few years will not be able to produce new culms. Unless urgent steps are taken, locations with resident feral cattle population will face repeated morality of the young culms, thereby putting the very future of these bamboo forests at risk.

Figure 28: The percentage of 0-1-year-old culms has been reduced to less than 1% in the bamboo forests of Allapalli forest division, Gadchiroli district

9.1.2 Outcome focus by measuring health of bamboo forest

The Working Plan prescriptions for bamboo management focus on felling rules, which culms to retain, which to cut, how to cut, felling series etc., but do not prescribe criteria and indicators for measuring the health of bamboo forests. Without measuring these indicators, it is difficult to ascertain whether the management is within sustainable limits or not. The harvesting methods are but inputs, and the working plan needs to articulate the outcome of sustainable bamboo management as well. The outcome is bamboo health to be measured using criteria and indicators (C&I) such as clump congestion, girth of the 0-1-year-old culm and the percentage of 0-1-year-old culms in the clump. During the estimation process before harvesting, these indicators need to be measured to assess the health of the bamboo forest in the compartment and compiled as a part of the compartment history records. Identifying and tracking these objectively verifiable indicators (OVI) would assist in accurately monitoring whether bamboo management in the compartment is sustainable or not. Periodic measurement of these indicators will serve as Early Warning Systems (EWS) to detect deterioration of the crop health and enable us take corrective action in a timely manner e.g. mortality of young culms in Allapalli forest division, Gadchiroli district.

9.1.3 Making congested clumps visible in harvesting plans and having a differential piece rate for opening them

Congestion is a critical indicator of bamboo health. There is a common perception that clumps if are not regularly harvested, will get congested. Studies by Lovegrove (1910) and Rebsch (1910) on *Dendrocalamus strictus* in the Ganges division attribute the congestion of bamboos to ill treatment such as unrestricted cutting of bamboos round the periphery, caused by the death of the outer rim of rhizomes forcing the culm to grow inwards. Gupta (1964), ascribed three reasons to clump congestion in *Dendrocalamus strictus* – cutting of bamboos by villagers on the periphery of clumps, non-observance of cutting rules by forest contractors by never removing interior culms and damage to periphery culms by cattle. The status of congestion needs to be measured in every compartment as it not only reduces the production of new culms but also escalates the fire hazard and turns the clump un-harvestable for future rotations. The practice observed during estimation is to exclude congested clumps from harvesting plans, anticipating that the workers will not harvest the congested clumps. During stock mapping and estimation, the percentage of congested clumps in a compartment need to be identified. The National Working Plan Code 2014 also needs to include congestion as an important indicator, and accordingly update the formats used for assessing bamboo crop. Only when the extent of congestion is known, prescriptions can be made to reduce it. Congested clumps need to be harvested by making a horse-shoe shaped opening in the clump from the side opposite to where the maximum production of new culms is noticed Gupta (1964) (Figure 29). In no case should congested clumps be clear-felled as they generally degenerate to bushy form (Chaturvedi 1988) (Figure 30). The piece rate for opening up congested clumps needs to be assessed separately and made attractive compared to the regular harvesting and cleaning operations.

9.1.4 Ensuring clump cleaning during harvesting

Bamboo harvesting rates are on piece rate basis with standard rates prescribed for harvesting a long bamboo, short bamboo and a bamboo bundle. The rates for clump cleaning which involves removing the dead, broken and twisted culms and decayed stumps is very low to the tune of 5 mandays/ha or at times clubbed with the harvesting piece rate. Since the piece rate for bamboo harvesting is better, hence the workers using convenience harvesting selectively fell only the long bamboo and avoid taking the effort for cleaning. Also, congested clumps are avoided. These practices result in over harvesting from accessible clumps, and increase congestion in the other clumps. This cleaning of the clump helps in decongesting it and creates space for the new culms to spread and also reduces fire hazard. However, the labourers do not invest in clump cleaning as the piece rate is linked to harvesting. There is a need to delink harvesting from cleaning. bamboo. In order to make cleaning of the clump happen, it is suggested that harvesting operations be done in two steps using the same labour gang. In the first round, labourers focus on harvesting bamboo culms based on the piece rate of bamboo harvest. This is followed by a second round in which the same gang is paid a piece rate on the basis of the number of clumps they clean. Engaging the same group of labourers in two rounds will help avoid any blame game amongst them. This 2-round operation of harvesting and cleaning will require additional investment, but the improvement in health of bamboo clump and its higher productivity by preventing congestion will more than make up the additional cost involved.

9.1.5 Ensuring the implementation of felling rules

How do we ensure that the felling rules prescribed in the working plan regarding which culms to harvest, which to retain etc. are strictly followed by the workers? The harvesting job is offered on piece rate basis, and hence, the workers opt for convenience felling, harvesting culms which are easy to harvest, and retaining culms which require more effort. Earlier, bamboo harvesting was supervised closely and there was abundant labour supply. Labourers who did not follow he felling rules were asked to discontinue and sent home. Consequently, culms on the periphery and those which are accessible are over harvested, while the culms in the interior of the clumps or congested clumps are left unharvested. This ill-treatment of bamboo clump accelerates congestion and reduces future bamboo yield. This convenience felling appears to be not a result of a knowledge gap or a lack of skills which can be corrected with capacity building, but a deliberate strategy on the part of the

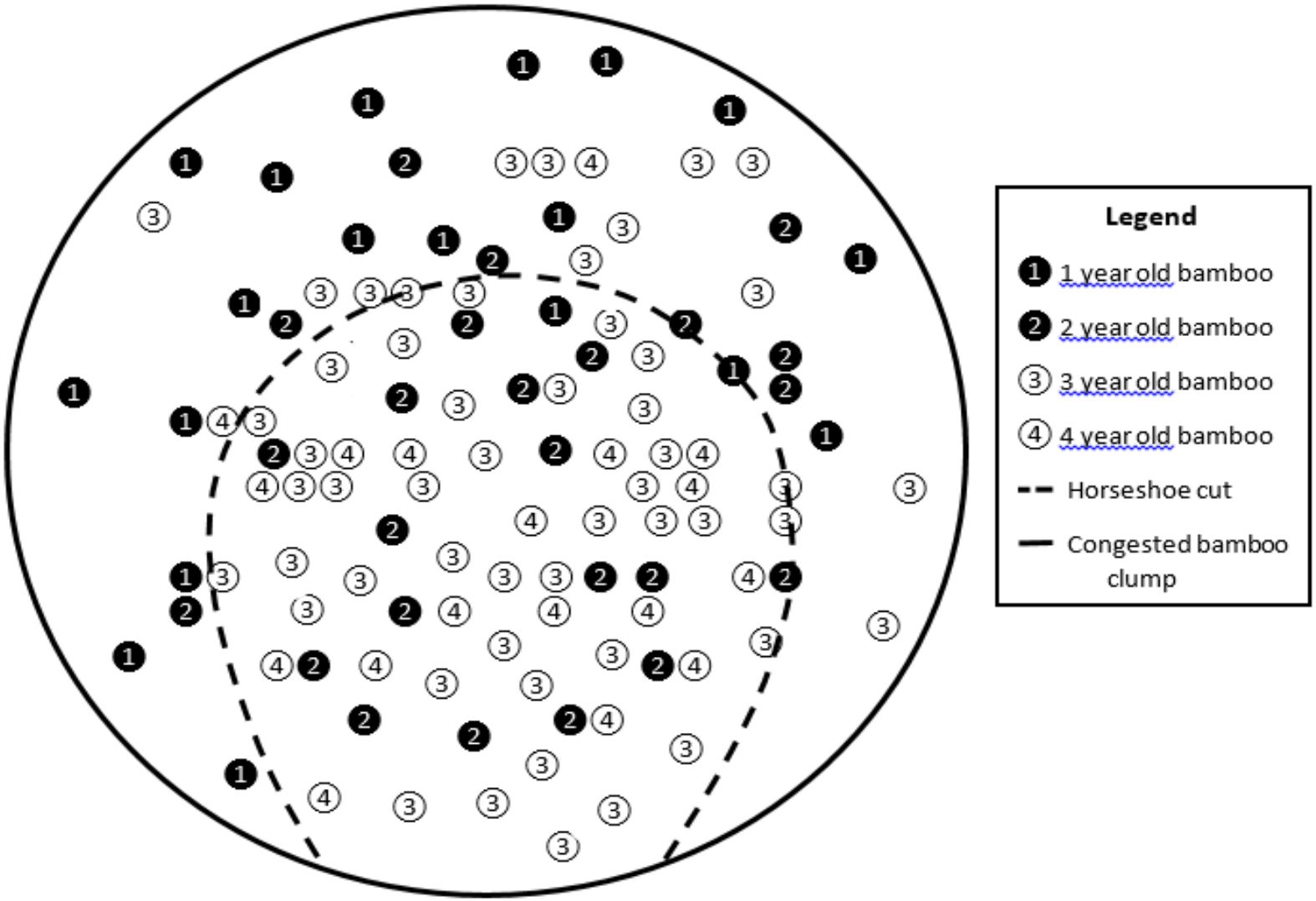


Figure 29: Congested clumps should be harvested by making a horseshoe opening from the side opposite to where maximum production of new culms is noticed. Clear felling should not be done as it results in clump degenerating to bushy form (Adapted from Rabik and brown (n.d.)

Figure 30: Clear felled bamboo clumps give rise to whippy culms that turn bushy. Overharvesting by workers as a result of convenience felling, profit motive and weak supervision in Chandrapur district

workers to maximize their earnings (Table 22). One initiative piloted at Mendha Lekha CFR village in Gadchiroli deserves mention here. Instead of harvesting and felling, the communication to the workers about the task is "clump management" i.e. they have been tasked with managing the clump and not felling it. Clump management includes marking, cleaning, harvesting and trenching/mounding. These activities are carried out in convergence with Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) wage employment programme. One supervisor is appointed for every 20 workers and monitoring is done after every two days. The point to be noted is that the culms to be felled are marked before felling. This marking is done at breast height by a trusted and trained staff using paint, and the workers are instructed to fell only the culms which are marked. Also, the number of culms to be retained in a clump can be painted in a prominent reserved culm of the clump (Prasad 1988). In this manner we can detect both if culms not available silviculturally are harvested or those that are silvicultural available are retained. This seems to be a practical approach to address the age-old problem of over harvesting in bamboo forests and needs to be piloted and adopted.

Table 22: Supervision during bamboo harvesting – then and now

Parameter	Earlier	Now
Supervision during harvesting	Earlier there used to be close and strict supervision by the officials. All clumps were inspected and badly harvested clumps was not tolerated, felling rules were strictly followed.	Now officials don't come often and harvesting is largely managed by the workers and few supervisors
Penalty for not felling as per rules	Workers were taken to the road and asked to return	Overharvesting and convenience felling needs to be controlled. Workers are in short supply now, they know the rules but deliberately harvest at the periphery – felling the young and retaining the old
Arranging for the labourers	Local labourers were engaged directly by the forest department	The transportation contractor (*bail bandi contractor*) arranges for workers to harvest and fill his cart. Workers not directly engaged by the department.

Source: FGD at Ramy Yapetha village, near Elchil village, Allapalli forest division, Gadchiroli district

9.1.6 Protecting and augmenting the bamboo resource by ploughing back revenue

Due to its high resilience and productivity, bamboo is still managed as a grass or as a weed, though the returns it gives is significant. Across the institutional gradients, we did not come across evidence of plough back of profits to enhance the health of these bamboo forests. Augmenting the bamboo resource needs to be prioritized by taking up soil moisture conservation works like trenching, loosening the earth around the clump, establishing nursery with local seeds, gap filling, assisted natural regeneration etc. This needs to be prescribed in the working plan as well specially for compartments where the bamboo health needs improvement. Resources from MGNREGA can be sourced to fund many of these augmentation activities. The young bamboo culms are most sensitive during the monsoon season and need protection from grazing to survive.

9.1.7 Managing unharvested compartments

If for some reason, a compartment due for harvesting gets left out, then its turn for harvesting comes only during next rotation i.e. after another three years. This results in the presence of large number of dry culms resulting in a loss in revenue. Unharvested compartments need to be taken up for harvesting in the following year. There should be a general clause in the working plan to allow unharvested compartments to be harvested in the next year by automatically shifting them to the next year's felling series.

9.1.8 Benchmarking forest health before handing over

While handing over forest compartments to CFR villages, there is a need for a joint benchmarking exercise of the forest resource. Boundary demarcation and digitization of the compartment boundary also needs to be done. This will ensure that an authentic baseline is available that can be used to assess the state of the forestry resources in future. Without this baseline, scientific assessment of forest health will be difficult in future. This exercise will also assist in making the gram sabhas more accountable as unsustainable practices can be detected during monitoring. A standard protocol for benchmarking forest health can be developed and followed before handing over the compartments to the CFR villages. For existing CFR villages, where baselines are not available, this exercise can be taken up *post facto* by taking the gram sabha into confidence. Involvement of an independent, neutral agency will help in strengthening the credibility of this exercise. This benchmarking will help in moving away from perception based assessment and moving towards an objective assessment of forest health.

Figure 31: Forest nursery at Bhamragarh division. Bamboo seedlings raised from uncertified seeds supplied by firms need to be discouraged and local seeds from superior clumps promoted

9.1.9 Bamboo nurseries with non-native seeds to be discouraged

In some locations, it was observed that forest staff prefer treated bamboo seeds as they show higher germination percentage (Figure 31). The seeds purchased from traders have unknown provenance (origin) and the seedlings developed are used to supplement the natural regeneration in forest areas. The Gadchiroli ecotype both in its morphology and growth is far superior to other *Dendrocalamus strictus* varieties and needs to be prioritized in forest nurseries and in afforestation projects in Gadchiroli district. Also, being sporadic flowering in nature, its seeds are readily available every year. The use of un-certified seeds procured from outside the district from traders needs to be discouraged, and seeds of local origin from superior clumps encouraged.

9.1.10 Need for ecological studies on bamboo of Eastern Maharashtra

The two bamboo populations in Gadchiroli and Chandrapur districts separated by the Wainganga river, are both recorded as *Dendrocalamus strictus*, but are morphologically dissimilar and exhibit different growth characteristics and behaviour. The Gadchiroli bamboo ecotype shows more luxuriant growth, with culms attaining higher girth and height, and having larger percentage of young culms. Also, it displayed lesser congestion with no record of gregarious flowering over large tracts, while the Chandrapur bamboo has a tendency to congest and a documented life span of 40 years. Studies by Dwivedi (1998) on gregarious flowering of *Dendrocalamus strictus* in Shahdol district show that locations with good site quality and low biotic pressure, delays or decreases the extent of gregarious flowering. This inherent, visible difference in the morphology, growth and behaviour of the Chandrapur and Gadchiroli bamboo brings us to the question as to why they are so different? What do we attribute the better growth characteristics of Gadchiroli bamboo to? Are the drivers genetic, edaphic, climatic, biotic or governance related, or a combination of these? On introducing Gadchiroli bamboo to other districts of Eastern Maharashtra, to what extent will it retain its superior characteristics? Are locality factors at play, or are these populations genetically separate? If we plant Gadchiroli bamboo in Chandrapur, will it start resembling Chandrapur bamboo which is thinner, shorter, has a tendency to congest and displays gregarious flowering or will it retain its original form and characteristics, and if so then to what extent (Box item 4)? In other words, is the genotype of these two populations similar, and the phenotypes differ due to environmental factors? These local races have not received adequate attention and ecological studies need to be taken up to aid evidence based policy making (Mohan 1931).

The other ecological puzzle, is the general feeling amongst various stakeholders in Chandrapur that the present bamboo crop which has established after aerial seeding is inferior to the erstwhile bamboo crop prior to the gregarious flowering in the 1980s. If will be interesting to assess the variation in the health of the bamboo crop across Chandrapur district to ascertain whether pockets of the erstwhile bamboo crop have survived

and compare its morphology and growth characteristics. Locations with superior bamboo crop can be identified for sourcing bamboo seed for artificial regeneration initiatives.

9.2 Bamboo based livelihoods and markets

9.2.1 Providing gainful wage employment to local community from bamboo harvest

At times when the compartment is deep inside the forest or when the local community is unwilling to harvest, the FD and FDCM institutions engage labourers from outside the state usually from Balaghat district. These labourers camp inside the forest and hence can start the operations early and work in mission mode. These labourers are faster, more efficient and complete the task in a time bound manner. The target for FDCM each year is to start harvesting operations by October, so that the material starts reaching the market by December and to ensure that the total harvested material is lifted from the forests before *Holi* festival. Engaging Balaghati labourers helps in meeting these targets in a predictable manner. The FDCM operations have highest financial efficiency as it minimizes the harvesting costs (Table 23, Box item 4).

Box item 4: Bamboo forests – green gold and bountiful harvests

Champion (1926) describes the extraordinary bamboo bounty of *Dendrocalamus strictus*. Its life is 40 years and it is mature for harvest after 16 years. Assuming a conservative rotation of 4 years, it will provide 6 yields (16^{th}, 20^{th}, 24^{th}, 28^{th}, 32^{nd}, 36^{th} year) after which it will seed and regenerate itself naturally. Let's assume that the average rotation of *sal* (*Shorea robusta*) or teak (*Tectona grandis*) is 120 years, or three lifecycles of bamboo during which it will provide 18 yields. In eastern Maharashtra, a typical 100 ha compartment will yield 0.5 to 1 lakh bamboo poles. Assuming a conservative harvest of 0.75 lakh bamboo, the harvesting cost is Rs 4.71 per bamboo, dragging Rs 2.70 per bamboo from site to jungle depot, demarcation is half man day per ha, 3-4 km roads need to be made for 100 ha, transportation is needed from jungle depot to sale depot, there racking is carried out length wise and girth class wise. The expenses work out to Rs 13-14 per bamboo, add another Rs 7-8 per bamboo as establishment costs, bringing the total cost to Rs 20-22 per bamboo. The selling prices is Rs 30-45 per bamboo provided there is timely harvest that starts by early October and ends before *holi* festival. Hence, there is a profit to be made of Rs 15 per bamboo or Rs 11.25 lakh per 100 ha. Over a 120-year duration (rotation for sal or teak forest), the 100 ha bamboo forest will provide 18 yields with a profit of about Rs 202 lakhs.

Sustainability is assessed along three dimensions, and includes social and ecological dimensions as well along with financial. The FDCM may like to strengthen its Triple Bottom Line (TBL) by providing gainful wage employment to the local community. Local rule making at Pachgaon village caps the upper limit of bamboo harvest per head at 55 long bamboos and 5 bundles per day. At the piece rate of Rs 7 per bamboo and Rs 20 per

bundle, this translates to a daily wage of Rs 473/day. Only local households are employed. This is an attractive wage rate and helps in creating meaningful employment opportunities within the village. In Pachgaon CFR village, employment is available for 5-6 months in a year at this rate, and has helped in curbing out-migration by sustainable bamboo management.

Table 23: Comparative analysis of piece rate offered for harvesting bamboo across institutions

Piece rate for harvesting bamboo	FDCM rate	Pachgaon CFR village rate	Other CFR villages rate	FD rate
Bamboo bundle	Rs. 13.40	Rs. 20.00	Rs. 80.00	Rs. 21.42
Long bamboo (> 10 cm girth)	Rs. 4.71	Rs. 7.00	Rs. 37.50	Rs. 8.68
Chapati bamboo (8-10 cm girth)	Rs. 1.97	Rs. 7.00	Rs. 37.50	Rs. 8.68

There is an opportunity for FDCM to demonstrate social responsibility by offering better harvesting piece rates to the workers which in-turn will help in attracting local villagers and avoid engagement of labourers from outside the state. When the local community is engaged in harvesting, and they earn sizeable wage employment, it in turn creates a bond between them and the bamboo forests. This social capital created will come in handy when seeking community support to protect the bamboo resource from grazing and fire. The Balaghati labourers have no incentive to preserve the resource, and this wage income instead if provided to the local community can create a positive incentive to protect the bamboo forest by creating a stake in the resource. The piece rate needs to be accordingly enhanced to create an incentive for the local villagers to opt for this employment opportunity. Payments also need to be released within a month of harvesting. This enhanced piece rate needs to be looked upon not as an added expenditure but as an investment in social capital to safeguard the bamboo resource with people's support. This will help FDCM to strengthen its Triple Bottom Line (TBL), from the current emphasis on financial efficiency.

9.2.2 Developing trusted marketing channels in PESA/CFR areas

The *Dendrocalamus strictus* bamboo of Eastern Maharashtra has a higher wall thickness, lower moisture content and consequently a higher shelf life. It is a blessing in disguise, that the demand for bamboo is not regular or assured, else the very survival of these forests would have been at risk. Also, in the few locations where harvesting is taking place, the local community has been misled by bamboo traders. They have been deceived by the specification of girth and length, or in terms of the installments, not lifting the total harvested bamboo or in not making full payment.

Presently, there is no external support, handholding or government aided marketing facilitation for these communities who are left to fend for themselves and have been left at the mercy of unscrupulous traders. In order to address this imperfect market, some initiatives that are needed are offer a Minimum Support Price (MSP) for bamboo, organize regular buyer's sellers meet, develop a model agreement between gram sabha and the buyer, establish a bamboo *mandi* near city areas to reduce the risk of traders, empanel traders who can buy bamboo in CFR/PESA areas etc. Also, a Standard Operating Procedure (SOP) for planning, estimating, harvesting, storing, marketing, record keeping, accounting, monitoring and reporting needs to be developed to ensure that certain standard best practices are adopted in CFR villages. These can be developed as a visual, illustrated handbook in local language to make them readily understandable to the local community. A USAID publication titled, "Towards Resilient Bamboo Forestry" on community managed forestry in Indonesia can be referred to for guidance (Rabik, A. & Brown, B., n.d.) and is available at <http://elti.fesprojects.net/RESOURCES/bamboo_forestry.pdf>.

9.2.3 FDCM can rediscover itself as a specialized marketing agency

Over the last decade, 71% of the total 4,749.16 sq. km. area of the total bamboo area of the state has been handed over under CFR and PESA. Of this area under CFR and PESA, which amounts to 3,353. 64 sq. km., 94% (3153.11 sq. km.) is located in Gadchiroli district alone. In this new scenario, where the production and harvesting functions have been largely transferred to the villages, FDCM can rediscover its role as a specialized marketing agency of forest produce. It can also enable primary and secondary processing at the village level, value addition of the bamboo resource and also explore possibilities of direct marketing by shortening the value chain. This will also enable it to provide an attractive buying price to the villagers. Based on the market demand, it can enter into agreements with the CFR/PESA villages to source raw material from them and also promote primary and secondary processing. The biggest challenge faced by CFR/PESA villages is the lack of an assured marketing channel, a gap that FDCM may well attempt to bridge.

9.3 Bamboo governance

9.3.1 Adequate enabling activities missing in CFR areas

While large tracts of forests have been handed over the local communities, adequate enabling and hand holding activities are missing to ground community-based forest management in the CFR areas. The main barriers in community not being able to harvest bamboo are lack of technical

know-how to prepare business plan for harvest, absence of working capital for wage payments, lack of assured marketing linkages and lack of strong institutions. Support mechanisms are needed in the initial years to enable business plan preparation, providing working capital, organizing labour, storage and sale arrangements, accounting, record keeping and reporting. A Training Needs Assessment (TNA) needs to be carried out to understand what data, knowledge and skills are needed for community-based bamboo planning and management and then rolling out the training programs. Pachgaon CFR village in Chandrapur district has established good governance practices in bamboo management and shows lot of promise and provides lessons for the future (Box item 5). This village can be developed as a model, and function as a sustainable bamboo management model resource center. The target should be to develop a network of such live model resource centers, for training and hand holding other community based institutions. A cadre of local, young professionals needs to be developed with skills on sustainable forest management. The Mumbai University diploma course that employs innovative pedagogy to train local youth from Gadchiroli is a step in this direction. The new Chandrapur Forest Academy can also develop a School of CFR/PESA studies and provide special trainings to village youth of these areas. The curriculum of these courses needs to be aligned with the findings of the Training Needs Assessment.

Box item 5: Pachgaon CFR village - an exemplary case of community based bamboo management

For the village of Pachgaon 25th June 2012 is a memorable date, as on this day the gram sabha after a long struggle received Community Forest Rights (CFR) over 1,006 ha of forest land (with 900 ha under bamboo) under the Forest Rights Act, 2006. It became the first village to receive CFR title in the district of Chandrapur. The village is located in Gondpipri taluka, Kothari forest range of Chandrapur district. It is a small village of 74 households with 72 per cent of the population belonging to the tribal Gond community. Less than 40 per cent households in the village own cultivable land and their main source of income is wage labour. In the past, in the absence of secured income, the people migrated to Chandrapur town and neighbouring districts for labour work.

The unique feature of this village is collective decision making in the gram sabha. It has regular monthly meetings, which are supplemented with need-based meetings. The decision taken during the meetings is meticulously recorded. Attendance is compulsory, and each adult member must attend 75% of all meetings in a year. There is fine of Rs 50 for each missed meeting. As a first step after receiving CFR, the village mandated all households to contribute at least five regulations for CFR management. Of the total 500 regulations compiled, the gram sabha discussed and debated and finalized 115 rules. They established a patrolling system to protect and guard the forest resources and wildlife, reporting cases of wood cutting or fire in the forest, restricting access of outsiders etc. The fines for stealing from the forest are Rs 500 for people on motor bicycles; Rs 300 for people on bicycles and Rs 150 for those on foot and carrying a head load. The villagers have divided themselves into groups comprising of 2 to 5 members, with the leader of each group selected on a rotational basis. The name of the group leader responsible for patrolling on a given day is displayed on a blackboard at the village center. These groups patrol the area in turns. Absence from patrolling for unexplained reasons can cost a member up to Rs 200. The gram sabha keeps track of persons entering their forests and their purpose. The gram sabha has set aside 34 ha

as *Devrai* or sacred grove where no extraction of resources is done. A significant resolution of the gram sabha has been to completely ban the collection of *tendu* leaves found in abundance, forgoing huge revenue. The collection of *tendu* leaves requires extensive lopping and setting fire to the forest, and is used for making *beedis* which is a health hazard. The villagers instead prioritized collection of *tendu* fruit, which has nutritional benefits.

Pachgaon is practicing a 3-year felling cycle and one third of the bamboo area is harvested every year. Working plan prescriptions for harvesting are strictly followed. The local community learnt the finer aspects of bamboo harvesting when they worked in the FDCM sites. Before the commencement of harvesting, the gram sabha decides the wage rate, the upper cap on harvesting, supervisors for different activities etc. Expected price of bamboo during auction is also discussed and collectively decided. The gram sabha has appointed 38 persons who are in charge of management such as patrolling, fire management, maintaining stock register, account keeping, expenditure and sale record, supervising harvest, sorting, grading, labour management, wage payments, dealing with contractors, bank work, auction, gram sabha facilitation etc. The wage rate of Rs 266 per day is provided for patrolling, maintaining fire line, soil moisture conservation work etc. Men and women both go for bamboo cutting and are paid equal wages. Bamboo that has been cut is stored in the village depot, where it is graded and sold through open auction. The sale proceeds from the auction are credited into a separate account, which is then used to pay wages to the villagers. The quantum of bamboo harvested per person per day has been presently capped at 55 long bamboos and 5 bundles, with a piece rate of Rs 6.78 per bamboo and Rs 20 per bundle. This translates to a wage of Rs 473 per day during the harvesting season which lasts for 4-6 months in a year. The gram sabha retains 10 percent of wages, which is released in the monsoon months when there is no bamboo cutting. At the end of the bamboo harvest, disclosure is made on quantity harvested, amount deposited in gram sabha bank account and investment plan of the Village Development Fund (VDF).

Year	Turnover from the sale of bamboo (in Rs lakh)	Wages provided for bamboo harvesting (Rs in lakh)	Village development fund created (Rs in lakh)
2013-14	6.33	1.25	5.08
2014-15	33.89	12.86	18.62
2015-16	61.70	12.05	45.56
2016-17	51.22	20.42	30.80
2017-18	53.12	25.85	27.27

Source: Adapted from TISS (2018), CSE (2018) and consultation with the Pachgaon gram sabha

Pachgaon has already reaped significant social and economic benefits from its CFR initiatives. Bamboo alone has created a Village Development Fund to the tune of more than Rs 1.25 crore in five years. The utilization of profits by the gram sabha provides interesting insights into its vision for forests and its people. Some of the profits have been ploughed back to carry out forestry activities such as establishing fire lines and plugging gullies, to improve the health of the CFR area. During 2017-18, the households earned an additional annual income of Rs 46,000 from bamboo cutting alone. Consequently, migration from the village in search of labour has also reduced significantly.

9.3.2 For CFR villages what next?

Every institution needs a vision, mission, purpose, objectives etc. articulated by its leaders to serve as a guiding beacon during their evolution phase. What are the guiding principles for CFR? Where do we see the CFR ten years from now? Can we visualize a CFR village as a model village, where best practices in sustainable forest management are attempted and solutions are provided which work both for nature and people? Visitors are welcomed and flock to these villages to understand the sustainability experiments underway and share their views, this dialogue helps the village to grow and progress. Is obtaining CFR right an end in itself, or is it only a milestone in the journey towards self-rule, democratic decentralization and promoting forest centric sustainable development. Can these CFR villages be developed as a sustainability lab with the best scientific planning practices, traditional knowledge, copybook implementation, accurate book keeping, democratic decision making, good governance, competitive marketing, transparency account keeping, social audit and other best practices. The quality of forest management meets global quality standards and is certified by forest certification agencies (Figure 32, 33). The challenge before the CFR initiative over the next decade, is scaling up of the sporadic success stories. The few gram sabhas that have been able to realize the real potential, have been supported by civil society groups and people's movements. The challenge is who is going to support the thousands of CFR villages who have received CFR rights and now need to manage their forests. The civil society and activists through their efforts have demonstrated the proof of concept that CFR works. But in the deprived swathes of Indian hinterland, to expect them to drive the scaling-up across thousands of villages would be expecting too much. Are CFR/PESA federations possible within the existing legal framework who could drive this forward. What role do forest departments envisage for themselves? Do they remain indifferent and reluctant to engage with the CFR regime or they adapt to the post FRA reality and function as mentors, hand-holding these fledging organizations. Can civil society, academia, forest departments, businesses and the CFR institutions join hands? This appears to be the only scalable model to co-produce sustainable forest management solutions that work both for nature and people. After obtaining CFR rights to conserve and manage their forests, is it time for a new paradigm?

Figure 32: Focus group discussion underway at Pachgaon village, Chandrapur district. Few CFR villages under FRA demonstrated collective leadership, local rule making and involved women in decision making. They have received support and hand-holding from external positive elites and NGOs. These villages have the potential of developing as live model resource center on sustainable forest management, for training and hand holding other community based institutions

Figure 33: Focus group discussion underway at a village in Gadchiroli district. Most of the CFR villages have not received adequate hand holding or support nor do they have the requisite social capital. These young institutions have been left to fend for themselves. Can we visualize a CFR village as a model where best practices in sustainable forest management are attempted and sustainability solutions are provided which work both for nature and people?

Chapter 10

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२३ श्री. विजय एदलाबादकर
२४ श्री. केशव गुरनुले, संयोजक सृष्टी,गडचिरोली
२५ श्री. संदिप तांबे, प्राध्यापक, भारतीय वन प्रबंध संस्था IIFM, भोपाल

विषय:- IIFM भोपाल तर्फे "Co-production of Sustainable Bamboo Management Solutions in Eastern Maharashtra" ह्या अभ्यासाचा अहवाल स्विकारण्या विषयी कार्यशाळा.

संदर्भ:- या कार्यालयाचे पत्र क्र. आर-१/IIFM/ प्र.क्र.५८/७७७/७७६/२०१९-२०, दिनांक ४/०९/२०१९

विषयांकित प्रकरणी संदर्भिय पत्रान्वये IIFM भोपाल तर्फे झालेल्या अभ्यासाबाबत Working group च्या सदस्यांची व वरिष्ठ वनाधिका-यांची एक दिवसीय कार्यशाळा दिनांक ९/०९/२०१९ रोजी मा. प्रधान मुख्य वनसंरक्षक (उत्पादन व व्यवस्थापन) म.रा. नागपूर यांचे अध्यक्षतेखाली हरीसींग वनसभागृह सेमिनरी हिल्स, नागपूर येथे आयोजित करण्यात आली होती.

सदर कार्यशाळेत झालेल्या चर्चेच्या अनुषंगाने कार्यवृत्तांत यासोबत जोडलेला आहे.

सहपत्र:- वरिलप्रमाणे (कार्यवृत्तांत)

(डॉ. किशोर सो. मानकर)
उपवनसंरक्षक
(संसाधन उपयोग), नागपूर

प्रतिलिपी:- प्रधान मुख्य वनसंरक्षक (उत्पादन व व्यवस्थापन) महाराष्ट्र राज्य, नागपूर यांना माहिती करिता सादर.

पुर्व महाराष्ट्रातील शाश्वत बांबू साधनाचे व्यवस्थापन व सहनिर्माण या विषयावर दिनांक ९/०९/२०१९ रोजी झालेल्या कार्यशाळेचा कार्यवृत्तांत.

महाराष्ट्र वनविभाग व भारतीय वन व्यवस्थापन संस्था, भोपाल यांचे दरम्यान द्विपक्षीय सामजस्य करारावर नोव्हेंबर २०१८ मध्ये स्वाक्षरी करण्यात आली होती. त्यानुसार एक कार्यरत गटाची (Working group) स्थापना करण्यात आली होती. तसेच मध्यप्रदेशातील बालाघाट व महाराष्ट्रातील चंद्रपूर व गडचिरोली जिल्हयातील बांबूच्या वनाचा अभ्यास करून भारतीय वन व्यवस्थापन संस्थेने अहवाल वनविभागास सादर केलेला आहे. सदर अभ्यासा संबंधी कार्यरत गटाचे सदस्य व वरिष्ठ वनाधिकारी यांच्या उपस्थितीत दिनांक ९/०९/२०१९ रोजी हरिसींग वनसभागृह सेमिनरी हिल्स,नागपूर येथे कार्यशाळेचे आयोजन केले होते. उपस्थित वनाधिकारी व कार्यरत सदस्यांची यादी सोबत जोडली आहे. कार्यशाळेत खालील मुद्यांवर चर्चा करून निर्णय घेण्यात आले.

सदर कार्यशाळेचे अध्यक्ष श्री. प्रवीण श्रीवास्तव, प्रधान मुख्य वनसंरक्षक (उत्पादन व व्यवस्थापन), महाराष्ट्र राज्य, नागपूर यांनी उपस्थित मान्यवरांचे स्वागत करून भारतीय वन व्यवस्थापन संस्था, भोपाल यांचेव्दारे करण्यात आलेल्या अभ्यासाची पार्श्वभुमी विषद केली.

डॉ.संदिप तांबे, भा.व.से. यांनी त्यांचे संस्थेतर्फे करण्यात आलेल्या अभ्यासाबाबत सादरीकरण करून अहवालाबाबत उपस्थितांना विस्तृत माहिती दिली. अहवालाचे निष्कर्ष पुढील प्रमाणे आहे.

१) आलापल्ली वनविभागात एक वर्ष वया पर्यंतची नविन बांबूची संख्या फारच कमी झाल्याचे दिसुन आले आहे.
२) पेसा व सामुहीक वनहक्क क्षेत्रात खाजगी व्यापाराकडुन ग्रामसभेची फसवणूक करण्यात आलेली आहे.
३) पेसा व सामाजिक वनहक्क क्षेत्रात ग्रामसभेला बांबूची तोडणी, विक्री व इतर बाबी बाबत अनुभव नसल्यामुळे या कायद्याचा पाहिजे तेवढा उपयोग ग्रामस्थांना झालेला दिसुन येत नाही.
४) पेसा व सामाजिक वनहक्क गावामध्ये मजुरांना मजुरी जास्त मिळत असली तरी वनविभाग व वनविकास महामंडळ याव्दारे जास्त प्रमाणात लोकांना रोजगार उपलब्ध होत आहे.
५) या कायदयाअंर्तगत वनहक्क देतांना जंगलाची किंवा वनाची काय स्थिती होती (बेसलाईन डाटा) याची माहिती उपलब्ध नसल्यामुळे या दोन कायदयाची अंमलबजावणी झाल्यानंतर वनावर अनिष्ट परिणाम झाले किंवा कसे याबद्दल ठोस निष्कर्ष काढता येणे शक्य नाही.

अहवालामध्ये बांबूचे वनव्यवस्थापन चांगल्या प्रकारे करण्यासाठी खालील प्रमाणे सुचना दिलेल्या आहेत.

१) बांबू रांझी गुंतु नये म्हणून कार्य आयोजनाप्रमाणे नियमित निष्कासन करणे जरूरी आहे. तसेच वेगळयाने जास्तीची मजुरी उपलब्ध करून देणे गरजेचे आहे.
२) निष्कासन करण्यापूर्वी मजुरांना कापणी बाबत योग्य ते प्रशिक्षण देण्यात यावे.
३) बांबू वनामध्ये मृद व जलसंधारणाची कामे करणे, चांगल्या बियांची निवड करणे, नर्सरी गॅप फिलिंग नियमीत करणे व स्थानिक बियापासुन रोपवाटीका तयार करणे.
४) मोकाट जनावरांचा बदोबस्त करणे,
५) पेसा व सामाजिक वनहक्क कायदयांतर्गत वन जमीन ग्राम सभेला हस्तांतरीत करण्यापूर्वी वनविभाग व संबंधित ग्रामसभेने आवश्यक सर्वेक्षण करून बेंच मार्किंग करणे योग्य राहील.

६) चंद्रपूर व गडचिरोली जिल्हयातील बांबू हे भिन्न आहे का हे शास्त्रोक्त पध्दतीने तपासुन अभ्यास करणे आवश्यक आहे.

७) स्थानिक लोकांना निष्कासनाचे काम दिल्यामुळे लोकांना रोजगार उपलब्ध होईल व तसेच वनाप्रती बांधिलकी तयार होईल.

श्री.संदिप तांबे, भा.व.से. यांच्या सादरीकरणानंतर उपस्थित कार्यरत गटाच्या सदस्यांनी आपले विचार व्यक्त केले.

१) श्री. देवाजी तोफा, मेंढालेखा ग्रामसभा, यांनी त्यांच्या गावामध्ये बांबू व्यवस्थापन करतांना मिळविलेल्या यशाबद्दल आपले मत मांडले, त्यांनी सांगितले कि, त्यांचे गावात बांबू निष्कासन करण्यापूर्वी ग्रामस्थांना आपण तोडणी न करता बांबू रांझीचे व्यवस्थापन करतो असे सांगण्यात येते. त्यामुळे बांबू तोडणीवर भर न देता बांबू रांझीचे व्यवस्थापन करण्यावर भर दिला जातो. बांबू कापणी सुरू करण्यापूर्वी प्रशिक्षित मजुर कापणी करण्यात येणारे बांबू चिन्हाकींत करतात. त्यामुळे फक्त परिपक्व बांबूची तोडणी केली जाते. तसेच त्यांचे गावातील लोकांना वन व वन्यजीव व्यवस्थापनामध्ये सहभागी करण्यात येते.गावातील महिला व पुरूषाचे गट तयार करून त्यांच्या वनामध्ये असलेल्या वनसंपत्तीचे स्थानिक भाषेमध्ये सर्वेक्षण करून माहिती गोळा केली जाते. श्री. देवाजी तोफा, मेंढा लेखा ग्रामसभा,यांनी वनविभागाव्दारे वेळोवेळी मार्गदर्शन करण्याचे आव्हान केले. वनविभागाने ग्रामस्थांना मदत केली असती तर बांबू ठेकेदारांनी ग्रामस्थांची फसवणूक केली नसती. असे मत त्यांनी मांडले.

२) श्री. विजय देठे, पर्यावरण मित्र NGO या संस्थेचे प्रतिनिधी यांनी बांबू निष्कासनावर भर न देता बांबू पासुन लोकांची उपजिवीका करण्याबरोबरच वनहक्क प्राप्त ग्रामसभेने वन व वन्यजीव यांचे संरक्षण करावे असे मत मांडले. वनविभागाने विविध क्षेत्रातील व्यक्तींचा समावेश करून हा अभ्यास केल्याबद्दल वनविभागाचे अभिनंदन केले. तसेच भविष्यात सुध्दा वनविभाग, गैरसहकारी संस्था, जिल्हापरिषद व ग्रामस्थ यांचा समावेश करून या कायदयाचा फायदा करून देता येईल असे मत मांडले. चांगल्या वनाधिका-यांनी पेसा व सामुहिक वनहक्क क्षेत्रामध्ये ग्रामस्थांना उपयोगी पडेल असे काम केल्याचे नमुद केले. ज्या गावामध्ये बांबूचे व्यवस्थापन चांगल्या प्रकारे होते त्याबद्दल मार्गदर्शक पुस्तीका तयार करण्याच्या सुचना त्यांनी दिल्या.

३) श्री. मोहन हिराभाई हिरालाल, वृक्षमित्र NGO यांनी बांबूचे सहनिर्माण हा अभ्यास चांगल्या रितीने पुर्ण केल्याबद्दल श्री.संदिप तांबे, भा. व.से. यांचे आभार मांडले.सुरवातीला वनविभागाच्या हेतूबद्दल त्यांच्या मनात आशंका असली तरी बालाघाट, चंद्रपूर व गडचिरोली येथील बांबू वनानां भेटी देतानां वनविभागाचा अभ्यास करण्यामागचा चांगला हेतू समजुन आला असे त्यांनी सांगितले. पेसा व सामुहिक वनहक्क कायदयातंर्गत ग्रामस्थांनी उपजिविकेचे महत्व लक्षात घेवून बांबू संवर्धनास अनन्य साधारण महत्व द्यावे असे त्यांनी सांगितले. हा विषय गुतांगुतीचा असल्यामुळे वनविभाग व ग्रामस्थामध्ये सहकार्याचे वातावरण असणे आवश्यक आहे. चंद्रपूर व गडचिरोली जिल्हयामध्ये स्वातंत्र्यपुर्वी मालगुजारी व जमिनदारी या दोन्ही पध्दती अस्तित्वात असल्याचे त्यांनी सांगितले. भारतीय वनअधिनियम १९२७ (२८) नुसार ग्रामवनाचे व्यवस्थापन योग्य रितीने झाले असते तर पेसा व सामुहिक वनहक्क कायदयांची गरज पडली नसती असे त्यांनी नमुद केले. पेसा व सामुहिक वनहक्क कायदयांची अंमलबजावणी करतांना Biodiversity Act 2002 सेक्शन ४८ चा विचार करायला हवा. सरकारतर्फे बांबूला आधारभूत किंमत देण्यात यावी.

४) श्री.केशव गुरनुले, संयोजक, सृष्टी गडचिरोली यांनी अहवाला बद्दल संमती व्यक्त करून मनरेगा योजनेमार्फत मृद व जलसंधारण कामाची वनामध्ये अंमलबजावणी व्हावी असे मत मांडले. बांबू वनाशी संबंधीत सर्व ग्रामस्थ, वनविभाग, जिल्हापरिषद, आदिवासी विभाग इत्यादींनी एकत्र बसून समस्या बाबत तोडगा काढावा असे त्यांनी सांगितले. तसेच करण्यात आलेल्या अभ्यासाची अंमलबजावणी व्हावी असे मत त्यांनी मांडले.

५) श्री. विजय एदलाबादकर, व्यवस्थापक पदविका अभ्यासक्रम सीएफआर यांनी मुंबई विद्यापीठातर्फे मेंढालेखा गावातील तरुणांना दिलेल्या प्रशिक्षणाबाबत माहिती दिली. या प्रशिक्षणामध्ये गावातील ५ दिवस तरूण वर्गातील तसेच त्यानंतर १० दिवस गावामध्ये जाऊन प्रात्यक्षिक करायचे. यामध्ये नकाशाव्दारा, जीपीएसव्दारे अभ्यास करून या प्रशिक्षणार्थींना Community Forest Management ही पदविका देण्यात आल्याचे त्यांनी सांगितले. त्यामुळे मेंढालेखा गावात बांबूचे व्यवस्थापन चांगल्या प्रकारे करण्यास मदत झाली असे त्यांनी सांगितले. सामुहिक वनहक्क प्राप्त ग्रामस्थांना वृक्ष लागवडीमध्ये सहभागी करून घेण्याचे सुध्दा त्यांनी आव्हान केले.

६) श्री.संजय तेलहारकर, प्रबंधक BILT, Ballarshah यांनी त्यांचे अनुभव सांगतांना पेसा व सामुहिक वनहक्क क्षेत्रात वन विभागाने योग्य ते मार्गदर्शन पुरविल्यास बांबूचे चांगल्या प्रकारे निष्कासन करू शकतील असे त्यांनी सांगितले. चंद्रपूर व गडचिरोली जिल्हयातील बांबू वेगळा असून फक्त चंद्रपूर जिल्हयातच सन १९८०-८१ नंतर विमानाद्वारे बियांची पेरणी करण्यात आली होती.चंद्रपूर जिल्हयात सुध्दा काही ठिकाणी चांगल्या प्रतीचा बांबू असल्याचे सांगितले. चंद्रपूर व गडचिरोली जिल्हयात वातावरणाचा,फारसा फरक नसल्यामुळे चंद्रपूर जिल्हयात १९८० दशकात Acrial Sowing करतांना वापरलेल्या कमी प्रतीच्या बियांमुळे बांबूची प्रत घसरली असावी असे त्यांनी सांगितले.

कार्यरत गटातील सदस्यांनी मत व्यक्त केल्यानंतर उपस्थित वरिष्ठ वनअधिका-यांनी आपआपले मते मांडून अनुभव सांगितले.

१) श्री.शैलेश टेंभुरणीकर, अपर प्रधान मुख्यवनसंरक्षक (संधारण) यांनी पेसा व सामुहिक वनहक्क कायदयाच्या अंमलबजावणी करतांना वनविभाग व ग्रामस्थांनी बांबू निष्कासनाबाबत सूक्ष्म आराखडा तयार करण्यावर भर दिला.

२) श्री.एम. श्रीनिवासराव, मुख्य व्यवस्थापक, वन विकास महामंडळ,नागपूर यांनी Corporate Social Fund व्दारे चंद्रपूर व गडचिरोली जिल्हयामध्ये करण्यात येणा-या उपक्रमाबद्दल माहिती दिली. पेसा व सामुहिक वनहक्क प्राप्त ग्रामस्थ यांना महामंडळाची कोणत्या प्रकारे मदत हवी आहे , तो पुरविण्यात येईल असे त्यांनी सांगितले. बांबू निष्कासनासोबत ग्रामस्थांना गौण उपजाचे प्रशिक्षण देणे गरजेचे आहे. त्याबर त्यांनी भर दिला.

३) श्री.एस.व्ही. रामाराव, मुख्य वनसंरक्षक (प्रा.) चंद्रपूर व गडचिरोली यांनी सांगितले कि, पेसा कायदयामुळे ग्रामस्थांना अधिकार मिळाले व सामुहिक वनकायदयासाठी ग्रामस्थानांआंदोलन करावे लागले. वनविभाग व पेसा क्षेत्रामध्ये संवादाचा अभाव असल्याचे त्यांनी सांगितले. वनविभाग व पेसा क्षेत्रामध्ये तणाव निर्माण झाल्यास त्याचे निराकरण करण्यासाठी यंत्रणा उपलब्ध नसल्याचे त्यांनी सांगितले. पेसा व सामुहिक वन हक्क क्षेत्रामध्ये ग्रामसभेत १६ प्रकारचे विविध कागजपत्रे जसे बँक पासबूक, एमबी, कॅशबूक इत्यादी नेहमी ठेवावे असे त्यांनी उपस्थितांना सांगितले.

४) श्री कल्याणकुमार, मुख्य वनसंरक्षक (प्रा.) नागपूर हे स्वत: गडचिरोली वनवृत्ताचे मुख्य वनसंरक्षक असतांना केलेल्या कामाचे अनुभव त्यांनी सांगितले. त्यांनी सुरवातीला वेगवेगळ्या विभागाची भुमिका काय आहे हे माहिती नसल्यामुळे पेसा व सामुहिक वनहक्क कायदातंर्गत कोणकोणत्या प्रकारे

प्रशिक्षण आयोजित केले याबद्दल माहिती दिली.गडचिरोली जिल्ह्यात दरवर्षी ८००-९०० कोटी रुपयाचे उत्पन्न वनावर आधारित उद्योगामुळे मिळू शकते. कृषी विज्ञान केंद्राच्या धर्तीवर ८ ते १० ग्रामपंचायतीसाठी १ वनशाळा असावी अशी सूचना त्यांनी दिली. पेसा,जिल्हापरिषद, आदिवासी विभाग यांची नियमित बैठक झाल्यास या कायद्याची अंमलबजावणी करणे सोपे जाईल. पेसा व सामाजिक वनहक्क ग्रामसभेचे जिल्हास्तरावर फेडरेशन करता येईल किंवा कसे हे बघावे.

५) डॉ.किशोर मानकर, उपवनसंरक्षक (संसाधन उपयोग) यांनी अभ्यासा दरम्यान मोकाट जनावरांमुळे आलापल्ली वनविभागा मध्ये एक वर्ष पेक्षा कमी वयाच्या बांबूची संख्या कमी झालेली आहे हे चिंताजनक असुन मोकाट जनावरांचा बंदोबस्त करुन पुढील २-३ वर्षात चंद्रपूर जिल्ह्यात Gregarious Flowering होणार असल्यामुळे बांबू निष्कासन करणे व वनवणवा प्रतिबंध यावर भर दिला. पेसा व सामुहिक वनहक्क गावात बांबू निष्कासनाचे अधिकार ग्रामसभेला दिल्यामुळे वनविभाग निस्तार दरावर बांबुचा पुरवठा बुरूडांना करु शकत नाही. त्यामूळे बुरूडांना बांबु पुरवठा कसा करता येईल यावर मार्ग काढावा लागेल असे त्यांनी सुचित केले.

कार्यशाळेचे अध्यक्ष श्री. प्रवीण श्रीवास्तव, प्रधान मुख्य वनसंरक्षक (उत्पादन व व्यवस्थापन) महाराष्ट्र राज्य, नागपूर यांनी दिवसभर झालेल्या चर्चेवर प्रकाश टाकून खालील बाबींचे पुनरुच्चार केले.

१. शास्त्रोक्त पध्दतीने सुक्ष्म आराखडा तयार करणे,
२. वनविभागाच्या स्थानिक अधिका-यांनी वनकर्मचा-यांना गौण उपजाचे शाश्वत पध्दतीने उत्पादन करण्यासाठी मार्गदर्शन करणे.
३. महाराष्ट्र वनविकास महामंडळाने पेसा व सामुहिक वनहक्क क्षेत्रात बांबू निष्कासना करिता ग्रामस्थांना मदत करावी असे त्यांनी सांगितले. यामूळे सामाजिक आर्थिक व पर्यावरण याचा विकास होवू शकत आहे.
४. उपस्थित सदस्यांनी दिलेल्या सुचनांची दखल घेवून पुढील कार्यवाही करण्यात येईल हे सांगितले.

डॉ.किशोर मानकर, उपनवसंरक्षक (संसाधन उपयोग) यांनी उपस्थित सर्व कार्यरत गटाचे सदस्य, डॉ.संदिप तांबे, यांची चमु व वरिल वन अधिका-यांचे आभार मानून कार्यशाळा संपली असल्याचे जाहिर केले.

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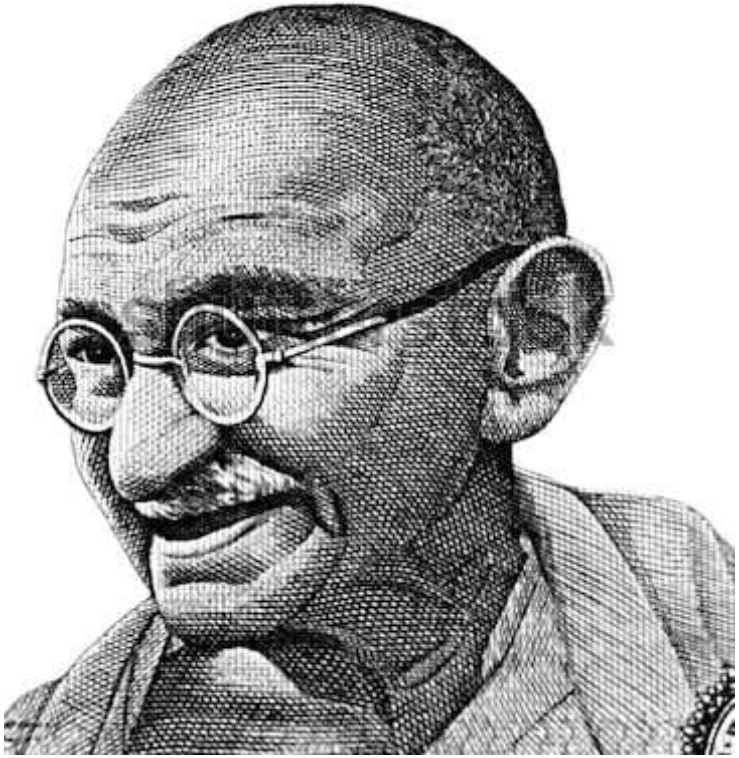
(प्रवीण श्रीवास्तव)
प्रधान मुख्य वनसंरक्षक
(उत्पादन व व्यवस्थापन)
महाराष्ट्र राज्य, नागपूर

"Co-Production of Sustainable Bamboo Management Solutions in Eastern Maharashtra"
Date : 9th Sept 2019, Venue – Harisingh Sabhagruh, Seminary Hills, Nagpur

अ.क्र.	अधिकाऱ्यांचे नाव	पदनाम	स्वाक्षरी
1)	श्री मु. द. [illegible]	प्र. मु. व. सं. (कार्य.प्र.) [illegible]	
2)	श्री प्रवीण श्रीवास्तव	प्र. मु. व. सं. (उ. व. व्य.)	[illegible]
3)	श्री. नितीन काकोडकर	प्र. मु. व. सं. (वन्यजीव)	
4)	श्री. एन. रामबाबू	F.D.C.M. Nagpur	
5)	श्री. साईप्रकाश	प्र. मु. व. सं. (अ. नि. व नि.)	
6)	श्री. एन. के. राव	प्र. मु. व. सं. (मा. तं. व [illegible])	
7)	श्री टी जे चौधरी	अ. प्र. मु. व. सं. (उत्पादन व व्यवस्थापन)	[illegible]
8)	पी. कल्याण कुमार	मु. व. स. (प्रा.) नागपूर वनवृत्त. नागपूर	[illegible] 9/9/19
9)	एम. श्रीनिवास राव	मुख्य महाव्यवस्थापक - FDCM	[illegible] 9/9/19
10)	गुरु श्री. रामाराव	मुख्य वनसंरक्षक, चंद्रपूर [illegible] गडचिरोली	Rama Rao 9/9/19
11)	मोहन हिराबाई हिरालाल	संयोजक, वृक्षमित्र गडचिरोली - चंद्रपूर	[illegible] 9 सप्टें. 2019
12)	विजय झुंगराजी देठे,	अध्यक्ष, पर्यावरण मित्र, मु. पो. [illegible] (स्टे.) तह. राजूरा, जि. चंद्रपूर	[illegible]
13)	केशव गुरनुले	संयोजक, सृष्टी गडचिरोली मु. [illegible] पो. [illegible] ता. कुरखेडा जि. गडचिरोली	[illegible] 9/9/19

अ.क्र.	अभिकर्त्यांचे नाव	पदनाम	स्वाक्षरी
14.	देवाजी नन्नु तोफा	ग्रामसभा संघटना जिल्हा गडचिरोली	[illegible]
15	[illegible]	Faculty, IIFM	[illegible]
16	शैलेश टेंभुर्णीकर	APCCF (CCNB)	[illegible]
17.	किशोर मानकर	DCF (RU)	[illegible]
18	S.M. Telharkar	Manager-Raw Material	[illegible]
19	Vijay Edlabadkar	Ex-Director, Diploma Course in CFA	[illegible]
~~20~~	~~Kailash Dahake~~		
20	Kailash Dahake	SPA IIFM, Bhopal	[illegible]
21	Sandeep Tambe	Professor IIFM	[illegible]



We may utilize the gifts of nature just as we choose, but in her books the debits are always equal to the credits