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Sustainable Harvesting Techniques for NTFPs of
Hoshangabad Landscape



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PARTNERSHIP FOR LAND USE SCIENCE (FOREST- PLUS) PROGRAM

SUSTAINABLE HARVESTING TECHNIQUES
FOR NTFPs OF HOSHANGABAD LANDSCAPE

DECEMBER 2013

DISCLAIMER

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ACRONYMS AND ABBREVIATIONS

BDA	Biological Diversity Act
DFO	Divisional Forest Officer
FRLHT	Foundation for Revitalization for Local Health Traditions
GACPs	Good Agriculture and Collection Practices
GoI	Government of India
IIFM	Indian Institute of Forest Management
JFMC	Joint Forest Management Committees
MFP	Minor Forest Produce
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MKSP	Mahila Kisan Shashaktikarn Pariyojna
MoRD	Ministry of Rural Development
MP	Madhya Pradesh
MPFD	Madhya Pradesh Forest Department
MPMFPP	Madhya Pradesh Minor Forest Produce Federation
MSP	Minimum Support Price
NGOs	Non-Government Organisations
NRLM	National Rural Livelihoods Mission
NTFP	Non Timber Forest Produce
NWFP	Non Wood Forest Produce
PFPCS	Primary Forest Produce Cooperative Societies
PIP	Program Implementation Plan
SFM	Sustainable Forest Management
TFRI	Tropical Forest Research Institute
WHO	World Health Organization

ABOUT THE SCOPE OF THE ASSIGNMENT

As per the Program Implementation Plan document¹ of the Forest-Plus program, one of the objectives of the program is to develop techniques for sustainable harvesting of economically important NTFPs of the landscape.

The destructible harvest of NTFPs species has affected availability of NTFPs and natural regeneration of the species. However, sustainable harvesting practices are not being implemented.

Of late there has been increased focus at the National level towards the NTFP sector. This is manifested in three major initiatives that were recently taken up at the National level. First, the proposal to provide Minimum Support Price (MSP) for 14 selected NTFPs including for Achar (*Buchanania lanzan*) is under consideration with the central government. Second, a sub-group on NTFPs for adequately capturing the situation in the 12th plan period was formed. And third, inclusion of sustainable harvesting and trade of NTFPs in the Mahila Kisan Shashaktikaran Pariyojna (MKSP) component of the National Livelihood Mission (NRLM).

Statutory provisions that provide spaces for ensuring sustainable harvesting of NTFPs at National level include, The Biological Diversity Act, 2002 and The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. In addition to these, government of Madhya Pradesh rules with regard to ownership, management and sustainable harvesting of NTFPs are not only important legislative provisions but are also seminal for other states of the country towards ensuring sustainable harvesting of NTFPs. The spaces available under these laws towards implementing the sustainable harvesting measures have also been mentioned to provide framework for implementation of the suggested sustainable harvesting techniques.

The present report attempts to develop sustainable harvesting techniques for Achar (*Buchanania lanzan*) in the present policy context. The potential of Achar on two critical parameters, namely, on the potential to address the livelihood concerns and secondly, the efficacy of the effort towards contributing the overall carbon savings have been the basis for selection of the species for developing the sustainable harvesting technique. Larger challenges of funds, institutions and sustainability have also been included in the report.

BACKGROUND OF NON TIMBER FOREST PRODUCTS (NTFPs)

Traditionally Non Timber Forest Products (NTFPs) refer to all biological materials other than timber extracted from natural forests for human and animal use and have both consumptive and exchange value. Globally NTFPs / NWFPs are defined as “forest products consisting of goods of biological origin other than wood, derived from forest, other wood land and trees outside forests” (FAO, 1995²). In Indian context MFP and NTFPs are used interchangeably. MFP finds definition in Indian Forest Act, 1927. However, the definition of minor forest produce provided in the Forest Rights Act, 2006 differs from the definition of MFP in Indian Forest Act, 1927. Till National Forest Policy, 1988 rights over MFP were largely in the form of concessions to the locals living in the vicinity of forest areas. The National Forest policy, 1988 for the first time in the history of Indian Forest management,

¹ PIP Forest Plus 2012-13

² <http://www.fao.org/docrep/x2450e/x2450e0d.htm>

provided perspective of community need, dependence and rights over NTFPs both for domestic and livelihoods perspective.

Forestry is in concurrent list. This means that both the federal government and the state government have the constitutional authority to legislate. Therefore, both the state and national policies determine implementation and roll out programs. Implementation is done as as per working plans prescriptions. Working plans are comprehensive plans for ten years and is approved by the respective state government. The extent of coverage of NTFPs harvesting techniques in the working plan therefore holds immense significance.

The NTFP sector, both from livelihoods and ecology perspectives, is one of the country's largest unorganized sectors. From the ecological perspective, the miscellaneous and fruit bearing species were only treated as associates and not as the main crop. It is estimated that about 275 million people are dependent in some way or the other for their livelihoods on NTFPs (Malhotra & Bhattacharya, 2010³; Bhattacharya & Hayat, 2009⁴). Only in the recent years did the NTFP sector draw attention of policy makers. NTFP contributes to about 20% to 40% of the annual income of forest dwellers who are mostly disadvantageous and landless communities with a dominant population of tribals. It provides them critical subsistence during the lean seasons, particularly for primitive tribal groups such as hunter gatherers, and the landless⁵. The NTFP sub-group formed for 12th five year plan identified poor regeneration, high exploitation and absence of sustainable harvesting methodology as major factors for reduced availability of NTFPs. The report further recognizes Climate change as affecting the phenology and the reproductive biology of various trees, shrubs and herbaceous plant species. The sub-group recommended various technical and institutional measures to be adopted in 12th Plan period also providing for budgetary provisions. One of the strategies included tapping the concept of Payment for Ecosystem Services (PES).

Although a very large number of people are engaged in NTFP collection, it is actually not a very remunerative activity for them. The daily income from collecting NTFPs is usually below the official minimum wage rate. Most people collect NTFPs for sale or barter simply because of lack of alternative employment opportunities (Saigal, 2008)⁶. Fair return to the forest dependent NTFP collectors, in the longer run, is dependent on effective institutional mechanisms through which dependent communities are identified, capacitated, and organized. (NAEB⁷, MoEF). On the other hand, the increase in demand and availability of market for NTFPs led to indiscriminate, unscientific and destructive harvesting practices. Many empirical studies have highlighted that indiscriminate and unscientific harvesting practices have led to decline of these NTFPs (Kotwal et al, 2009⁸).

The NTFP sector is expected to generate approximately 100 million workdays in the 12th plan and about 20 million workdays per annum thereafter in a sustainable manner, helping promote a green GDP, and contributing to the fulfillment of Millennium Development Goals. The annual turnover of NTFP business is estimated to be to the tune of over INR 60000 million (Report of NTFP sub group for 12th Plan). NTFP sub-sector has a growing market with INR 32000 million as current exports out of which only about 25% of this value reaches NTFP collectors at present (MKSP guidelines, GoI).

³ Malhotra, K.C. and Prodyut Bhattacharya(2010). Forest and Livelihood. Published by CESS, Hyderabad. pp.246

⁴ Bhattacharya, P. & Seyed Faiz Hayat(2009). "Sustainable NTFP Management for Livelihood and Income Generation of Tribal Communities: A case from Madhya Pradesh, India. (in) "Non timber Forest Products: Conservation Management and Policy in the Tropics". Ed. By Shaanker R. Uma, Ankita J. Hiremath, Gladwin C. Joseph & Nitin D. Rai. Published by ATTREE & University of Agriculture Science, Bangalore pp. 21-34

⁵ The sub-group on NTFP under the Planning Commission Working Group on Natural Resource Management

⁶ Non-Timber Forest Products and Forest Governance, Forest Governance Learning Group – India 2008

⁷ Non Timber Forest Products: Institutional Mechanism for Fair Returns to Primary Collectors

⁸ Mishra M, Kotwal PC and Prasad C (2009). Harvesting of medicinal plants in the forest of central India and its impact on quality of raw materials: a case of Nagpur district, India. ECOPRINT. Vol. 16 : 34 - 42.

Despite this huge potential, the NTFP sector has largely been ignored and only recently the potential of the sector to ensure health of the forests and towards ensuring sustainability of livelihoods was broached at the national level. Even the working plans (including those of forest divisions of the landscape) lack defining adequate sustainable harvesting practices for NTFPs.

Realizing the importance of overcoming market inefficiencies and inadequate space for the marginalized collectors, Dr. Haque Committee⁹ recommended to the central government for initiating strategic intervention in the short and medium term in the form of minimum support price (MSP) for at least 14 main MFPs including for Achar (*Buchanania lanzan*). According to the committee report, formation of collectives of NTFP gatherers is required to enable them to get market-based better prices in the long run and also to ensure sustainable management of MFPs. The report further suggests that there is need to ensure that regeneration of MFPs and sustainable harvesting methodology to be made an integral part of the Forest Working Plans.

⁹ Information available on <http://www.pib.nic.in/newsite/erelease.aspx?relid=92442> sited on 4/11/2013

1.0 STATUS OF NTFPs IN MADHYA PRADESH

1.1 DEFINING NTFP AND SUSTAINABILITY

Definition of NTFP

The MP government defines¹⁰ "MFP" as "non-timber forest produce which can be harvested on a non-destructive basis and will not include minerals and wild animals or their derivatives". Important parameter in this definition is the qualification of harvesting on non-destructible basis.

Sustainability

Section 2(O) of BDA, 2002 defines sustainable use as “the use of components of biological diversity in such manner and at such rate that does not lead to the decline of the biological diversity thereby maintaining its potential to meet the needs and aspirations of present and future generations.”

Sustainable Forest Management (SFM), as defined by the United Nations Commission on Sustainable Development is the "Management to meet the social, ecological, cultural and spiritual needs of present and future generations."

1.2 STATUS OF FOREST AND NTFP IN MADHYA PRADESH

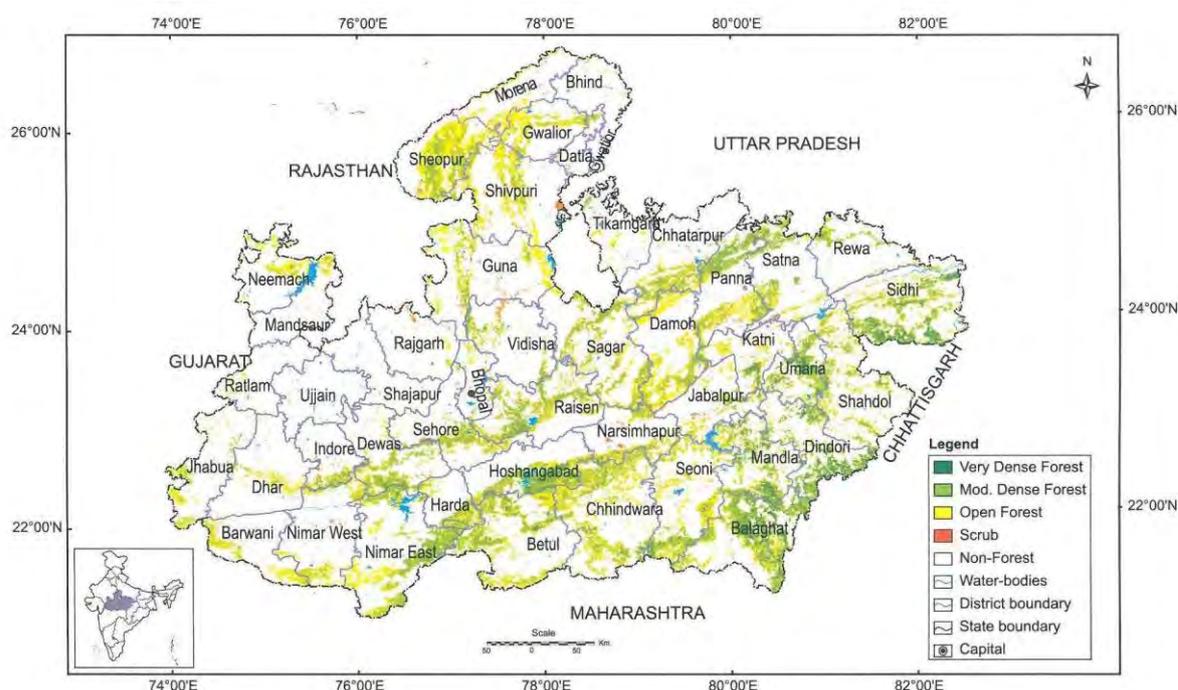
Forest Classification and Area

Madhya Pradesh is the second largest state of the country with an area of 3,08,245 km² constituting 9.38% of the geographical area of the country. The recorded forest area of the state is 94,689 km² which is 30.72% of its geographical area. The forest cover in the state is 77,700 km² which is 25.21% of the state's geographical area. In terms of forest canopy density classes, the state has 6,640 km² area under very dense forest, 34,986 km² area under moderately dense forest and 36,074 km² area under open forest. (India State of Forest Report, 2011).

Tropical Dry Deciduous Forests accounts for maximum forest cover of 88.65% followed by Type Group 3-Tropical Moist Deciduous Forest (8.97%) and Type Group 6- Tropical Thorn Forest (0.26%) (Forest Survey of India, 2009). Refer to Figure 1-1 highlighting forest types of Madhya Pradesh.

¹⁰ circular dated 15/05/1998

FIGURE 1-1: FOREST COVER MAP OF MADHYA PRADESH



(Source: Forest Survey of India, 2009)

TABLE 1-1: AREA UNDER DIFFERENT FOREST TYPE GROUPS AND CANOPY DENSITY CLASSES (AREA IN KM²)

S.No	Forest Type Group	Very Dense forest	Moderately Dense Forest	Open Forests	Scrub	Total
1	Group-3- Tropical Moist Deciduous Forest	380.13	3303.88	3132.40	194.78	7011.19
2	Group-5- Tropical Dry Deciduous Forest	3758.11	32663.37	30968.30	1925.59	69,315.37
3	Group 6- Tropical Thorn Forest	11.01	95.74	90.77	5.65	203.17
4	Plantation/TOF	89.75	780.01	739.53	45.98	1655.27
	Total	4239.00	36843.00	34,931	2172	78,185

(Source: Forest Survey of India, 2009)

1.3 ECONOMIC IMPORTANCE AND ESTIMATED VALUE OF NTFPs COLLECTED

NTFPs contribute significantly to the annual income of the households residing in the vicinity of forest areas in the state of Madhya Pradesh. Since the trade is done in open market (except for nationalized NTFPs), the data on the same is not available. However, estimates have been made by research organisations from time to time. An estimation¹¹ done by FRLHT and MPMFPF, Bhopal on the production of NTFPs in the state is provided in the table below:

¹¹ www.iifm.org.in

TABLE 1-2: PRODUCTION (IN QUINTALS) OF NTFPs IN MADHYA PRADESH STATE

S. No.	NTFP	Botanical Name	MP MFP	FRLHT report-2005-06
1	Tendu leaf	<i>Diospyros melanoxylon</i>	2374000*	
2	Sal seeds	<i>Shorea robusta</i>	76519*	
3	Harra	<i>Terminalia chebula</i>	10948**	
4	Kullu gum	<i>Sterculia urens</i>	228 *	
5	Salai gum	<i>Boswellia serrata</i>	5072**	
6	Other gums		210**	
7	Mahua	<i>Madhuca indica</i>		5720
8	Aonla	<i>Emblica officinalis</i>		49700
9	Sal seeds	<i>Shorea robusta</i>		50
10	Chironji (Achar)	<i>Buchanania lanzan</i>		5810
11	Chirota	<i>Cassia tora</i>		16010
12	Mahul leaf	<i>Bauhinia vahlii</i>		3050
13	Bahera	<i>Terminalia bellerica</i>		3810
14	Kusum seeds	<i>Schlichera oleosa</i>		90
15	Karanj seeds	<i>Pongamia pinnata</i>		160
16	Bel	<i>Aegle marmelos</i>		3330
17	Dhawai phool	<i>Woodfordia fruticosa</i>		400
18	Bhilwa	<i>Semecarpus anacardium</i>		1690
19	Kalmegh	<i>Andrographis paniculata</i>		640
20	Tulsi	<i>Ocimum basilicum</i>		6970
21	Reetha	<i>Sapindus mukorossi</i>		510
22	Satavar	<i>Asparagus racemosus</i>		1800
23	Palash	<i>Butea monosperma</i>		320
24	Marodfali	<i>Helicteres isora</i>		370
25	Ratanjyot	<i>Jatropha curcas</i>		2900
26	Malkangni	<i>Celastrus paniculatus</i>		130
27	Nagarmotha	<i>Cyperus scariosus</i>		3140
28	Neem	<i>Azadirachta indica</i>		1920
29	Arjun	<i>Terminalia arjuna</i>		1890
30	Nirmali/clearing Nut	<i>Strychnos potatorum</i>		10
31	Ber	<i>Zizyphus mauritiana</i>		530
32	Gudmar	<i>Gymnema sylvestre</i>		2370
33	Bach	<i>Acorus calamus</i>		50
34	Babul	<i>Acacia arabica</i>		50
35	Tikhur	<i>Curcuma angustifolia</i>		140
36	Aloe vera	<i>Aloe barbadensis</i>		2010
37	Safed musli	<i>Chlorophytum tuberosum</i>		970
38	Amaltas	<i>Cassia fistula</i>		1450
39	Dhawara gum	<i>Anogeissus latifolia</i>		1000
40	Kaans grass	<i>Saccharum spontaneum</i>		1000
	Note: * 2009-10, **2002-03			

(Source: IIFM website)

The table above provides estimation of only the forty most tradable NTFPs of the state. In undivided Madhya Pradesh in 1998 it was found that about 1000 NTFPs were extracted by villagers from the forests of the state. Out of these 1000 NTFPs only about forty NTFPs were traded while the rest were used for domestic consumption (CAMP report 1998¹²).

Nationalized NTFPs:

Tendu leaves, Sal seeds, Kullu gum and Harra are four nationalized NTFPs of Madhya Pradesh. The collection of these and other NTFPs have been regulated or totally prohibited from time to time by the state government. For example, the collection of Lac was banned for one year in ten districts through the state government circular dated 17.09.2009. The collection of Lac was 334.07 and 102.99 in 2009-10 and 2010 respectively. Presently, it is proposed to provide minimum support price to the purchase

¹² CAMP workshop for selected NTFPs of Madhya Pradesh, September 1998.

of Lac. Similarly, on Sal seeds the state government imposed a ban on collection of the seeds for five years (from 2007 to 2011). However, in one year the ban was lifted. Kullu is a nationalized NTFP in eleven districts of the state. The table below shows collection of the nationalized NTFPs during last three years for which data was available:

TABLE 1-3: QUANTITY AND VALUE OF NATIONALIZED NTFPs

NTFP	Collection year	Collection (quantity in 100 KGs and in Jute sacks for Tendu leaves)	Sale (INR 10 Million)
Tendu leaves	2009	20.49	264.90
	2010	21.24	327.28
Sal seeds	2009	76597.33	4.19
	2010	NA	NA
Kullu Gum	2008	231.97	0.2471
	2009	82.22	0.1424

Source: Administrative report of the MP Forest Department 2010-11

TABLE 1-4: BONUS DISTRIBUTED OUT OF PROFIT FROM SALE OF TENDU LEAVES

Collection Year	Bonus (INR 10 Million)
2006	27.41
2007	118.58
2008	38.73
2009	62.11

Source: Administrative report of the MP Forest Department 2010-11

1.4 CHALLENGES IN NTFP SECTOR IN MADHYA PRADESH

NTFPs in Madhya Pradesh are in danger of being overexploited and unsustainable. Out of the total of 40 species (most traded and collected in the state), 2 were categorized as critically endangered, endangered (8), vulnerable (14), lower risk near threatened (6) and in lower risk least concern (9). Achar (*Buchanania lanzan*) available in forest in Madhya Pradesh faces challenges such as biotic pressures, edaphic changes, loss of habitat, habitat loss due to exotic plants and other development and edaphic factors affecting the forest cover. These challenges to the species are emerging from factors such as over-exploitation, browsing, trade of parts, interspecific competition, interspecific competition from exotics, pests, lack of regeneration, un-scientific methods of collection (CAMP report, 1998).

This status of NTFPs in Madhya Pradesh has been further corroborated by other studies highlighting unsustainable practices. Destructible practices have adversely impacted biodiversity and regeneration of *Emblca officinalis*, *Buchanania lanzan* and *Chlorophytum spp* (Prasad et al., 2000¹³). Correlation between ill-effects of over harvesting on regeneration was established by Murali and Hegde (1996¹⁴). The study found that the number of seedlings was less or nil under the trees which are over harvested for fruits. For regeneration and support of wild life, these studies have suggested harvest of only 50% of fruits.

NTFP collectors often are from the lowest strata and lack bargaining power. They are often paid only small portion of the value of the product harvested. To overcome the loss due to low returns, the collector tries to maximize gains in the short period by engaging in destructible practices such as pollarding, lopping and felling of trees. As a result the present system of unsustainable extraction of NTFP and its sale in raw form depriving the gatherers of remunerative price continuing, the resource

¹³ Prasad Ram, P.C. Kotwal and Manish Mishra (2000). Sustainable harvesting regime of some NTFP species of Madhya Pradesh New Delhi, IIFM (unpublished).

¹⁴ Murlu, K.S. and Hegde, R. (1996). Sustainable harvest of NTFPs and forest management. In Management of minor forest products for sustainability. Economic Botany, 50: 221-223

depletion has been increasing (Dr. Ram Prasad, MoEF, 2006¹⁵).

1.5 MADHYA PRADESH MINOR FOREST PRODUCE FEDERATION¹⁶

Madhya Pradesh Minor Forest Produce Federation (MPMFPP) was established in 1984. The institution was established to promote trade and development of NTFPs. This is a three tier structure where MPMFPP is at the Apex level body at the state level. In 1988, the Madhya Pradesh Government decided to totally eliminate the middlemen in collection, storage and trade of Minor Forest Produce, and authorized the formation of Co-operative Societies of actual collectors. At the village level, Primary Forest Produce Cooperative Societies (PFPCS) were formed in selected areas based on availability of NTFPs. At the secondary level, 44 District Forest Produce Co-operative Unions were formed under the Chairmanship of the District Collector.

MPMFPP stresses on the need of maintaining the health and vitality of the forest ecosystem while evolving a people's friendly minimal damage forest management practices to overcome unsustainable harvesting of NTFPs. Inadequate institutional capability and uncertainty about tenure and future access are the limiting factors while adequate legal, policy and administrative environment. Towards ensuring maximum possible benefits for the collectors and to address the issue of destructible harvesting, MPMFPP focuses on institutional capacity building over technical know-how about the sustainable harvesting levels, their rejuvenating power and consequent implications on the resource.

Role of Primary Societies and MP MFP Federation

Primary societies carry out collection and trade of nationalized and non-nationalized MFPs to ensure maximum economic benefit from the trade reaches the gatherers. The income from the trade of MFPs is utilized by distributing (a) 60 percent to the actual gathers (b) 20 percent for development of the resources and (c) for infrastructural development of the village or again distributed to the gatherers.

Four NTFPs have been nationalized (the collection and trade is controlled by the state) in Madhya Pradesh. These are Tendu Leaves, Harra, Sal Seed and Gums. Other NTFPs such as Mahua, Achar, Aonla etc. are collected by Gram sabhas.

At present the collection of NTFPs by cooperatives is done only for Tendu leaves. Trade and collection of other NTFPs was undertaken by the federation from 1998 but the operations were later on put on hold. There are 13 primary forest produce cooperative societies in Hoshangabad but none of them are actively involved in collection of any NTFP other than Tendu leaves. (Source: Field survey)

¹⁵ National Status Report on Forests and Forestry in India, Survey and Utilization Department, MoEF, GoI, September 2006. Strategy for Sustainable NTFP management in India, paper number 8, pg 93-108.

¹⁶ The information in this section is taken from MPMFPP Website www.mpmfp.gov.in as on 04/11/2013

2.0 APPROACH AND METHODOLOGY

2.1 ABOUT THE STUDY

The Hoshangabad Landscape identified for the project comprises forest area from identified ranges of Hoshangabad forest division, Harda forest division and some areas of Satpura National Park. The working plans of Hoshangabad Territorial Forest Division (2013-14 to 2022-23) and the previous working plan (2003-04 to 2012-13) were referred. Similarly, the present (2010-11 to 2019-20) and the previous working plan (for the period 2000-01 to 2009-10) of Harda¹⁷ were referred.

Review of literature was undertaken to collect the present available information on existing harvesting techniques and assess the present level of implementation of the identified and accepted methodology of the harvesting technique. The secondary information available on websites of resource institutions such as Madhya Pradesh Minor Forest Produce Federation (MPMFPP), Indian Institute of Forest Management (IIFM) and Tropical Forest Research Institute (TFRI) was gathered and included in the report wherever required. Available relevant documents on the website of Madhya Pradesh Forest Department were also referred. Other documents and records including the statutory provisions applicable were also referred to.

Eight day field visit was carried out to the landscape. Data and information from community was collected through focus group discussions. In such discussions, front line staff of the forest department also participated and shared their experience and understanding on the subject including required measures for sustainable harvesting. Discussions with forest officials were also carried out during the field visit. **Table 2-1** presents list of JFMCs visited for developing the sustainable harvesting technique.

TABLE 2-1: LIST OF JFMCs VISITED

Division	Range	JFMC
Hoshangabad	Sukhtava	Morpani
		Madhikho
		Jalikheda
		Hiranchapra
		Dhai (relocated)
	Seoni-malwa	Pansi
	Banapura	Pipalgota
Harda	Rahetgoan	Badwani
		Kheljhiri
	Temagoan	Cheerpura
		Khatmakheda

2.1.1 Approach for developing document for Sustainable Harvesting Techniques for a commercially important NTFPs

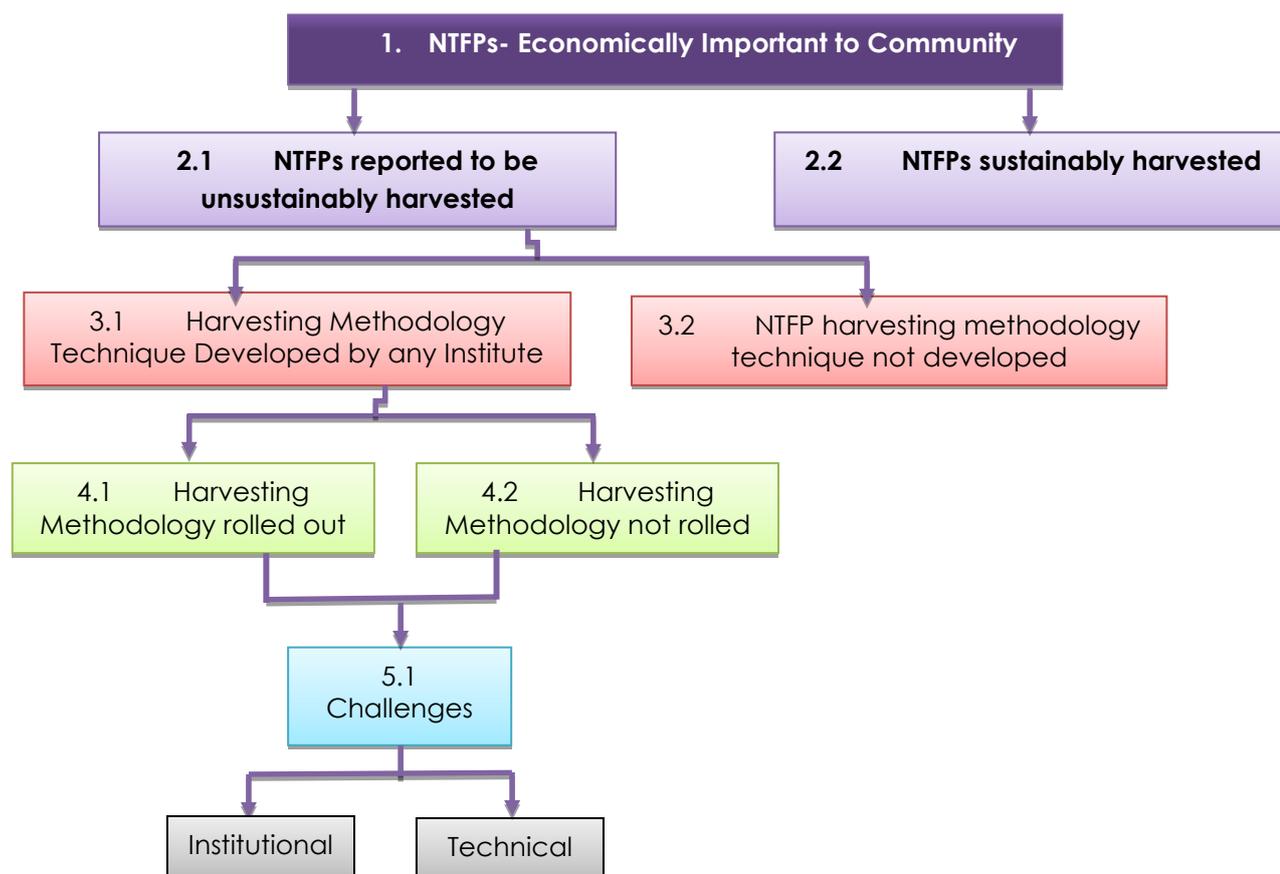
Following procedure was adopted for selection of NTFP for developing sustainable harvesting techniques:

- Step 1: Identification of NTFPs economically important to the community.

¹⁷ The working plan of Harda Forest Division includes Rajabarai estate and Seoni and Banapura Range of Hoshangabad Forest Division.

- Step 2: Further segregating NTFPs identified in Step 1 to those that are being un-sustainably harvested.
- Step 3: Identification of sustainable harvesting techniques of NTFPs unsustainably harvested and identified in Step 2.
- Step 4: Assessing the status of implementation of sustainable harvestings techniques as per the suggestions of MPFD officials).
- Step 5: Assessing challenges in implementing sustainable harvesting techniques.
- Step 6: Outcome to be discussed with FD officials and staff.

The Approach is explained through the flow chart:



2.1.2 Methodology for developing document for Sustainable Harvesting Technique for an economically important NTFP

Sustainably Harvesting Techniques for one NTFP was to be developed. As a first step, an economically important NTFP facing destructible harvesting practice was identified. The technique has been developed through a consultative process. This includes review of present available literature and field assessment of the methodology through consultation with collectors and the forest staff and officials. Based on recommendations of working plans and imperatives identified at the national level for sustainable harvesting methodology, the scope of the present Sustainable Harvesting Technique was determined.

Since, in the landscape there are many economically important NTFPs. Therefore a matrix was developed to zero-in on the most important NTFP. This was done based on the following factors; duration and quantity of availability (number of days particular part or parts are available for harvest or has potential to harvest), number of persons/households engaged, market potential, quantity

collected. Requirement of skills for identification or harvesting, level of human intervention in harvesting were factors also considered for identification of NTFPs for developing sustainable harvesting techniques. For example Mahua flower is collected approximately all the households in villages but technically there is no human intervention/or technical is required for harvesting flowers because its falls naturally at the ground after maturity. Therefore, though Mahua flower is a commercially important NTFP, it was not selected for developing the sustainable harvesting technique. The **Table 2-2** shows the NTFPs availability and economic importance in high and low category:

TABLE 2-2: MATRIX FOR SELECTION OF NTFP

Availability (trend in Quantity)	Economic Importance (Persons engaged in collection of NTFP)		
		High	Low
High		Tendu leaves, Mahua flowers	Mahua Seeds
Low		Achar, Aonla	Safed Musli (found in very small quantity), Bark of Arjuna

Step 1: Economically important NTFPs of the landscape were identified and put into a matrix based on availability period of collection and economic importance (**refer Table 2.2**). The Matrix reflects the dependence of community NTFPs and return to the household. Based on the matrix economically important NTFPs with shorter duration are identified. Safed Musli is found in small quantities and is very sparsely found. Similarly, the bark of Arjuna is collected by a small number of households. The economic importance of these NTFPs is limited to few households and therefore not selected for developing the sustainable harvesting techniques.

Step 2: NTFPs whose harvesting does not affect sustainability of species and extraction of which has not affected regeneration and future availability are recognized. Mahua flowers and Tendu leaves falls in this category. Therefore these NTFPs have not been selected for developing the sustainable harvesting techniques.

Step 3: Aonla and Achar are two NTFPs that are found across the landscape and has economic importance to the collectors. Availability of these NTFPs has declined and unsustainable harvesting have been the main reasons for this decline in availability. A lot of efforts for cultivating Aonla in the private land holding and raising of plantations in the forest land have been undertaken in the past. While, Achar is of more economical importance, it is neither being taken up for plantation in forests nor in private landholdings (and if so only anecdotally). It is a NTFP of immense economic significance and has faced a lot of destruction in last two decades. Achar was therefore selected for developing techniques for sustainable harvesting.

2.1.3 Time frame and Milestone

SN	Activity	Deadline
1	Situational Analysis Note	15 th September 2013
2	Documenting existing practices/identification of sites and selection of NTFPs (field work + desk work)	25 th October 2013
3	Field visit	10-16 th November 2013
4	Report Writing	17 th November to 30 th November 2013
5	Submission of Draft report sustainable Harvesting technique	30 th November 2013

2.1.4 Basis for developing Sustainable Harvesting Technique

Working plans of the Harda and Hoshangabad division mentions the need for defining the maximum limit of harvesting and developing sustainable harvesting techniques for NTFPs unsustainably harvested.

Maximum Limit of Extraction

The work plan mentions the maximum extraction limit for any NTFP shall not exceed one fourth to one third. Review of existing pattern would also be done. The work plan also suggests initiatives to be undertaken on the following four factors for each NTFP:

- Determining the time of harvesting
- Determining the area for harvesting of certain species
- Determining the extraction limit for any species
- Determining the harvesting methodology

In addition to this, measures required on institutional aspect have also been included based on the present legal and institutional framework and spaces available for implementing the Sustainable Harvesting Techniques.

Key questions for focus group discussions have been included as *Annexure I*.

3.0 FOREST BIODIVERSITY, NTFPs AND REGENERATION STATUS OF NTFPs IN HOSHANGABAD LANDSCAPE

3.1 ECONOMIC IMPORTANCE OF NTFPs IN THE LAND SCAPE

Agriculture is the primary source of income for most of the households residing in the vicinity of forests areas. The land holding size is small and is generally restricted to rain-fed crops because of paucity of irrigation sources. Besides agriculture, marginalized animal husbandry, primarily for domestic consumption is also practiced. Second most important source of income for the households is earnings from labor work. The intensity, frequency and number of members engaged in the labor, varies from household to household and the pattern is also determined by availability of other livelihood

FIGURE 3-1: THE VILLAGE HAAT



options. Collection of NTFPs is an important source of income for the households living in forest vicinity. The engagement of households in collection of NTFPs depends on the contribution, the activity could make to the households annual income. It is for this reason almost all the households engage in collection of Mahua flowers and Tendu leaves. As these two NTFPs are available in good quantity and engagement in these activities provides a household significant return for the time invested. For collection of other NTFPs, the level of engagement varies from household to household. For example, a household with limited economic opportunities or members with no or lesser economic opportunity cost, traverse long distances in the forest areas for collection of NTFPs available in small quantities. These marginalized collectors usually have low bargaining power and usually exchange their collection in the Haat (local market) in barter to basic domestic requirement at a very low price. **Figure 3-1** captures villagers bartering in festival purchase in the village Pipalgota. Achar is one such NTFP which is available in small quantity and one is required to traverse long distances for collection. In comparison to the minimum wage guaranteed in the government program of MGNREGA, the average per day collection has far less value. (Source: Field Survey)

NTFP collection is an important livelihood activity in the landscape. In Hoshangabad, on an average a household living in a village within 5 KM periphery of forests spends about one fourth of total working days on collection of NTFPs (Source Working plan Hoshangabad 2013-14 to 2022-23). In Forest villages, the dependence of households over income from forest was highest. The income from forest sources (including NTFPs) was 13.76 % whereas the corresponding figures for villages within 5 KM periphery and outside 5 KM periphery were found to be 9.30 % and 2.68 % respectively. In 2003, the average income for households of forest village, within 5 Km periphery and outside 5 Km periphery was INR 15971.65, 21900.95 and 34060.50 respectively, whereas, the average income of the households from sale of NTFPs (in the same order) was INR 881.22, 1201.88 and 483.06 respectively. (Source: Working plan of Hoshangabad 2003-04 to 2012-13). From this, the household income increased to INR 3042.37, 2181.46 and 650.41 for forest villages, villages within 5 KM periphery and for outside 5 KM periphery respectively in the year 2013.

In Harda, in the year 2013, the contribution of forestry to the average annual income of the household living within the 5 KM periphery and for households outside 5 KM periphery was 19.59 % and 1.14 % respectively (Source: Working plan of Harda 2013-14 to 2022-23).

3.2 DESCRIPTION OF THE LANDSCAPE

(a) Details of Landscape

In the selected Hoshangabad landscape for the project, forest ranges from three forest divisions are included. The landscape includes parts of Hoshangabad, Harda and Satpura National park. Details of the landscape are provided in the table below:

TABLE 3-1: DETAILS OF LANDSCAPE

Landscape	Divisions	Ranges
Hoshangabad	Hoshangabad	Sukhtava
		Banapura
		Seoni-Malwa
		Itarsi
	Harda	Rahetgoan
		Temagoan
	Satpura National Park	Buffer Zone near Tava river

The landscape lies in the central Narmada Valley and on the northern fringe of the Satpura Plateau. All the identified areas of the Landscape (**detailed in Table 3-1**) fall in the jurisdiction of Hoshangabad Forest Circle. The total notified Forest area of Hoshangabad Division is 112965.150 ha. The total notified Forest area of Harda Division is 105320.575 ha.

(a) Harda Forest Division

The forest area under Harda forest area is Teak dominated (with Teak more than 20%) forest area. Out of the total of 105320.575 hectares forest area in the division 100857.902 hectares is teak forest and 9954.337 hectares is miscellaneous forests (teak less than 20%). In teak forests areas, the availability of the three species (Aachar, Aonla and Bel) is limited. The availability of Mahua and Tendu trees is more in teak forest areas. Forest area in Harda comprises 41.3 % of the total geographical area of the district. There are total of 457 villages in the district out of which 217 villages are situated within a range of 5 Km from forest boundary. Most of the forest area of the Harda forest division (according to analysis of forest resource data) is well stocked area with forest density more than 40%. (Source: Working plan of Harda 2013-14 to 2022-23).

(b) Hoshangabad Forest Division

The forest area under Hoshangabad forest area has both Teak and miscellaneous forests. Out of the total of 112965.150 hectares forest area in the division 34.14 percent is teak forest and the 55.63 percent is miscellaneous forests. In teak forests areas, the availability of the three species (Aachar, Aonla and Bel) is limited. The availability of Mahua and Tendu trees is more in teak forest area.

While distribution of Mahua and Tendu is widespread, the presence of Aonla and Achar is sparse and is now available only in pockets. There are total of 644 villages in the district out of which 351 villages are situated within a range of 5 Km from forest boundary. (Source Working plan Hoshangabad 2013-14 to 2022-23)

3.3 FLORA

The forests in the landscape are classified as Teak and Miscellaneous forest on the basis of composition of forests. Range wise classification of forest areas of Landscape is provided in **Table 3-2**. On the basis of resource survey and stock-mapping in the plan area, forests are categorized mainly as Teak forest and miscellaneous forest. Forest areas with more than 20% of teak trees are broadly classified as teak forests whereas forests with less than 20% of teak trees out of the total growing stock as classified as miscellaneous forests. **Figure 3-2** depicts miscellaneous forest area of Sukhtava range of Hoshangabad forest division. Different management practices are prescribed for teak and miscellaneous forests. The availability of NTFPs also varies. The main species found in the Landscape area is Teak (*Tectona grandis*), Saaja(*Terminalia tormentosa*), Dhawra(*Anogeissus latifolia*), Haldu (*Adina cordifolia*), Tendu (*Diospyros melanoxylon*), Papda(*Gardinia latifolia*), Gunja(*Arbus Precatorious*), Bahera (*Terminalia bellirica*), Bhirra (*Cleistanthus collinus*), Kusum(*Schlichera Oleosa*), Achar (*Buchanania lanjan*), Aonla (*Emblca officinalis*), Khair(*Acacia catechu*), Dhaman (*Grewia tiliifolia*), Kari (*Saccopetalum tomentosum*), Tinsa (*Ougenia ojenensis*), Amaltas (*Cassia fistula*), Palas (*Butea monosperma*) etc as tree species and Lantana(*Lantana camara*), Karonda (*Carissa opaca*), Jharberi (*Zizyphus numularia*), Charota (*Cassia tora*), Gokharu (*Xanthim strumarium*) are bushes in the plan area. *Dendroclamus strictus* is the only Bamaboo species occurring in these forests. (Source: Working plan of Harda and Hoshangabad forest divisions.)

The forests have been classified on the basis of system developed by Champion & Seth as under.

TABLE 3-2: CLASSIFICATION OF FORESTS

Type	Classification	Areas	Landscape (Ranges)
3- B/C- 1c	Southern Indian Moist Deciduous Slightly Moist Teak Forests	Magardha, Borpani, Rahetgoan, Temagoan	Rahetgoan, Temagoan
5-A/C-1B	Southern moist mixed dry deciduous teak forest	Sukhtava, Bagda, Sivni-malwa, Banapura, Itarsi, Bankhedi.	Sukhtava, Sivni-malwa, Banapura, Itarsi
5-A/C-3	Southern moist mixed dry deciduous mixed type forests	Sukhtawa, Bagda, Itarsi, Sivni-malwa, Suhagpur, Pipariya and Bhankhedi ranges.	Sukhtawa, Itarsi, Sivni-malwa

Source: Working plan of Harda and Hoshangabad forest divisions

FIGURE 3-2: MISCELLANEOUS FORESTS

In mixed dry deciduous teak forest, teak is about 20-40% of the growing stock. Mixed forests generally have sandy and heavy soils and have poor water drainage. In addition to this, banks of river/streams/nallas where soil and moisture is easily available, mixed forests are found. In mixed forest species such as Saaja (*Terminalia tormentosa*), Dhawra (*Anogeissus latifolia*), Kalam (*Mitragyna parvifolia*), Mahua (*Madhuca indica*), Tendu (*Diospyros melanoxylon*), Bhirra (*Cleistanthus collinus*), Papda(*Gardinia latifolia*), Rohan (*Soymeda febrifuga*), Moyan (*Lannea coromandelica*) and Salai (*Boswellia serrata*) are found in varying density. Budhimai pathar near Jatamau (in Sivni Malwa and Banapura forest range) a unique patch of Papda (*Gardinia latifolia*) and Bamboo clumps and mixed forests is found.



FIGURE 3-3: TEAK FORESTS

There are only few areas in Magardha, Borpani, Rahetgoan, Temagoan ranges where Southern Indian Moist Deciduous Slightly Moist Teak Forest patches are found in the landscape. **Figure 3.3** captures shedding of teak leaves in Southern Indian Moist Deciduous Slightly Moist Teak Forests of Temagoan range of Harda forest division. Out of these both the ranges identified for the landscape includes the two ranges i.e. Rahetgoan and Temagoan, where this type of forests are found. The quality of these types of forests is better than the two other forest types of the landscape. In both the ranges of Rahetgoan and Temagoan good height trees of both timber and NTFP species are available.



Since the areas are predominantly teak areas, NTFPs tree species that are associates of teak such as Mahua (*Madhuca indica*), Tendu (*Diospyros melanoxylon*), Aachar (*Buchanania lanjan*), Bel (*Aegle marmelos*), Jamun (*Syzgium cumini*), Kullu (*Sterculia urens*), Aonla (*Embllica officinalis*) and Khair (*Acacia catechu*) are also found in varying quantity across the landscapes. However, the crop density of species varies because of geo-climatic factors.

3.4 NON TIMBER FOREST PRODUCTS (NTFPS) IN HOSHANGABAD LANDSCAPE

NTFPs of the Landscape

Tendu patta, Mahua flowers, Achar, Aonla and Bel are NTFPs collected in the landscape on a large scale by a number of collectors. However, there are some other NTFPs that are also collected albeit in small quantities. NTFPs such as Lac cultivation is practiced on Kusum (*Schlichera Oleosa* and on Lendia (*Lagerstroemia parviflora*) tree. Resin is extracted Salai (*Boswellia serrata*) and miscellaneous species such as Saaja (*Terminalia tormentosa*), Lendia (*Lagerstroemia parviflora*), Dhawra (*Anogeissus latifolia*) etc. Leaves of Dhawra (*Anogeissus latifolia*) are a good fodder and are also collected in the landscape for its use as a tanning agent and for its therapeutic use. The bark of Moyan (*Lannea coromandelica*) has use in ayurvedic dental care medicines but how much of it collected from the forests and the practice of collection from the forests is to be ascertained from the field visit. Similarly, Bark of Rohan (*Soymeda febrifuga*) has medicinal value. Anjan (*Hardwickia binata*) is a good fodder species. Leaves, flowers, gum and wood of Beeja (*Pterocarpus marsupium*) have therapeutic uses. Likewise roots and stems of Haldu (*Adina cordifolia*) are collected for medicinal uses. Bark of Jamun (*Syzgium cumini*) and Tinsa (*Ougenia ojenensis*) has market as it

FIGURE 3-4: ARJUN TREES



finds use in preparation of anti-diabetic Ayurvedic drugs. In addition to this NTFPs from Herbs and shrubs such as that of Safed Musli (*Chlorophytum borivillanum*), Kali Musli (*Curculigo orchioides*), Marod falli (*Helectries isora*), Chirota (*Cassia tora*) and Sarp Gandha (*Rauwolfia serpentina*) are found in the wild. Many more species are found in the wild and some are collected for domestic purposes only. With relocation of habitations from the forest areas their production has increased. **Figure 3-4** captures Arjun (*Terminalia arjuna*) trees in Harda forest Division and **Figure 3-5** capture natural regeneration of Satawar (*Asparagus racemosus*) in Hoshangabad forest division.

FIGURE 3-5: REGENERATION OF SATAWAR

Some of these NTFPs collected have domestic use while others are sold. In some cases, the NTFPs are used domestically (for treatment, fodder) as well as for sale in the market. The effect of unsustainable harvesting of these species is not documented. Neither has there been any structured initiative undertaken to address issue of unsustainable harvesting.



3.4.1 Assessment of availability of NTFPs in the Landscape

To assess the trend and availability of NTFPs trees in the landscape over last two decades, an assessment of tree density (number of trees per hectare) of NTFP species to the tree stock of the division (according to Forest Resource Survey) has been extracted from working plan and presented in **Table 3-3 (A,B,C and D)**. Table 3-3 (A), shows that the per hectare availability of NTFP trees (including the gum yielding) have reduced. Species wise data for trees per hectare was not available in the Harda working plan (2003-04 to 2012-13).

TABLE 3-3 (A): FREQUENCY OF NTFP TREES (NUMBER OF TREES PER HECTARE) IN HOSHANGABAD DIVISION OVER TWO WORKING PLAN PERIOD

SN	Species (Local Name)	Botanical Name	Hoshangabad (2003-04 to 2012-13)		Hoshangabad Division (2013-14 to 2022-23)	
			Number of trees per hectare	Percentage	Number of trees per hectare	Percentage
1	Mahua	<i>Madhuca indica</i>	20.86	4.34	17.328	3.76
2	Tendu	<i>Diospyros melanoxylon</i>	45.64	9.49	45.620	9.90
3	Lendia	<i>Lagerstroemia parviflora</i>	16.63	3.46	20.386	4.43
4	Dhawra	<i>Anogeissus latifolia</i>	18.76	3.90	18.237	3.96
5	Aachar	<i>Buchanania lanjan</i>	15.55	3.23	15.152	3.29
6	Bel	<i>Aegle marmelos</i>	5.85	1.22	5.702	1.24
7	Palash	<i>Butea monosperma</i>	15.60	3.24	10.716	2.33
8	Aonla	<i>Emblica officinalis</i>	2.96	0.62	1.846	0.40

Source: Working plans of Hoshangabad forest division

Table 3.3 (A) highlights per hectare availability of Aonla has gone down during the decade from 2003 to 2013, whereas per hectare availability of Achar has remained more or less constant during this period. The compositions of Mahua trees (in percentage) in the entire forest crop have also gone down from 4.34 to 3.76 percent.

TABLE 3-3 (B): FREQUENCY OF NTFP_s TREES (NUMBER OF TREES PER HECTARE) IN HARDA DIVISIONS OVER TWO WORKING PLAN PERIOD

SN	Species (Local Name)	Botanical Name	Harda Division (2003-04 to 2012-13)		Harda Division (2013-14 to 2022-23)	
			Number of trees per hectare	Percent age	Number of trees per hectare	Percentage
1	Mahua	<i>Madhuca indica</i>	Species wise volume not available in the working plan		2.72	0.75
2	Tendu	<i>Diospyros melanoxylon</i>		23.19	6.41	
3	Lendia	<i>Lagerstroemia parviflora</i>		13.51	3.73	
4	Dhawra	<i>Anogeissus latifolia</i>		3.16	0.87	
5	Aachar	<i>Buchanania lanjan</i>		1.58	0.44	
6	Bel	<i>Aegle marmelos</i>		3.85	1.06	
7	Palash	<i>Butea monosperma</i>		15.83	4.37	
8	Aonla	<i>Embllica officinalis</i>		1.01	0.28	

Source: Working plans of Harda forest divisions

Table 3-3(B) highlights the composition of NTFP trees in Harda division (other than Tendu and Lendia) is very less. And presently, Achar and Aonla forms only 3.16 and 1.01 of the total crop (in number) of the division.

(a) Assessing change in volume of NTFP trees over two working plan period

There has been decline in Aonla but slight improvement in per hectare volume of Achar trees in Hoshangabad division (refer Table 3-4(A)). In Harda division, the per hectare volume of NTFP tree is low other than for Tendu. Species wise data for volume of trees per hectare was not available in the Harda working plan (2003-04 to 2012-13). Composition of NTFP trees (by volume) is very low in Harda division (refer Table 3-4(B)).

TABLE 3-4 (A): VOLUME OF NTFP TREES IN HOSHANGABAD DIVISION OVER TWO WORKING PLAN PERIOD

SN	Species (Local Name)	Botanical Name	Hoshangabad Division Working plan (2003-04 to 2012-13)		Hoshangabad Division working plan (2013-14 to 2022-23)	
			Volume of trees per hectare	Percentage (vol)	Volume of trees per hectare	Percentage (vol)
1	Mahua	<i>Madhuca indica</i>	4.16	9.63	3.796	7.40
2	Tendu	<i>Diospyros melanoxylon</i>	1.77	4.10	2.927	5.7
3	Lendia	<i>Lagerstroemia parviflora</i>	0.91	2.11	2.091	4.08
4	Dhawra	<i>Anogeissus latifolia</i>	1.28	2.96	1.797	3.50
5	Aachar	<i>Buchanania lanjan</i>	1.12	2.59	1.377	2.68
6	Bel	<i>Aegle marmelos</i>	0.65	1.50	.955	1.86
7	Palash	<i>Butea monosperma</i>	1.38	3.19	0.691	1.35
8	Aonla	<i>Embllica officinalis</i>	0.24	0.56	0.157	0.31

Source: Working plans of Hoshangabad forest division

TABLE 3-4 (B): VOLUME OF NTFP TREES IN HARDA DIVISION OVER TWO WORKING PLAN PERIOD

SN	Species (Local Name)	Botanical Name	Harda (2003-04 to 2012-13)		Harda Division (2013-14 to 2022-23)	
			Volume of trees per hectare	Percent age (vol)	Volume of trees per hectare	Percentage (vol)
1	Mahua	<i>Madhuca indica</i>	Species wise volume not available in the working plan		0.89	1.37
2	Tendu	<i>Diospyros melanoxylon</i>			1.47	2.25
3	Lendia	<i>Lagerstroemia parviflora</i>			1.12	1.72
4	Dhawra	<i>Anogeissus latifolia</i>			0.82	1.25
5	Aachar	<i>Buchanania lanjan</i>			0.20	0.31
6	Bel	<i>Aegle marmelos</i>			0.59	0.91
7	Palash	<i>Butea monosperma</i>			2.78	4.25
8	Aonla	<i>Emblica officinalis</i>			0.29	0.44

Source: Working plans of Harda forest division

The working plan suggests of the two divisions suggest that the management of forest is done mainly to harvest timber, bamboo and for fuel wood. There has been no separate management for NTFP or for medicinal plants found in the area.

(C) NTFPs harvested by different JFMCs

Assessment of dependence of villagers was done during the field visit (refer **Table 3-5**). According to the assessment, two most important NTFP collection activities in terms of contribution to the household income is collection of Tendu leaves and collection of Mahua flowers. This was followed by collection of Achar. Aonla and Bel are sparsely available.

TABLE 3-5: JFMC VISITED

JFMC	Tendu leaves	Mahua	Aachar	Aonla	Bel
Morpani	*****	*****	**	**	**
Madhikho	*****	*****	*****	**	**
Pansi	*****	*****	**	**	**
Pipalgota	*****	*****	***	**	**
Badwani	*****	****	**	**	**
Kheljhiri	*****	***	*	**	**
Cheerpura	*****	***	*	*	*
Khatmakheda	*****	****	*	**	*

Source: Field survey

(Based on livelihood dependence: Significant-*****; Average-****; insignificant but available for domestic consumption-***; Very sparsely available: **; Earlier available but now not available-*)

3.5 STATUS OF REGENERATION

Natural Regeneration is an important parameter to assess the sustainability of tree species in natural forests. Pre-harvesting of fruits from the trees continuously over a period of time has led to deterioration in the growing stock and well as affected the natural regeneration in the landscape.

TABLE 3-6: REGENERATION STATUS OF NTFP AND OTHER IMPORTANT SPECIES

Species	Botanical Name	Established Regeneration in Hoshangabad (per hectare)
Tendu	<i>Diospyros melanoxylon</i>	344.2
Dhawra	<i>Anogeissus latifolia</i>	69.1
Palash	<i>Butea monosperma</i>	68.5
Bel	<i>Aegle marmelos</i>	23.7
Aachar	<i>Buchanania lanjan</i>	19.7
Mahua	<i>Madhuca indica</i>	11.7
Baheda	<i>Terminalia bellirica</i>	1.5
Aonla	<i>Emblica officinalis</i>	1.1
Jamun	<i>Syzygium cumini</i>	0.6

Source: Working plans of Hoshangabad forest division 2013-14 to 2022-23

Table 3-6 presents the regeneration status of NTFP species in Hoshangabad division. According to the working plan (2013-14 to 2022-23), established regeneration of teak has increased but for miscellaneous species over the previous working plan period has witnessed a decline in Pipariya, Bankhadi and in Sukhtava range of Hoshangabad forest division. The trees of species Kusum (*Schlichera oleosa*), Phansi (*Dalbergia paniculata*), Anjan (*Hardwickia binata*), Rohan (*Soymeda febrifuga*), Aastra (*Bauhinia racemosa*), Salai (*Boswellia serrata*), Tinsa (*Ougenia ojenensis*), Haldu (*Adina cordifolia*) and Beeja (*Pterocarpus marsupium*) are less than one percent and therefore put in the endangered species. According to the working plan there is need for conservation of these species. **Figure 3-6** shows natural regeneration of Achar in Hoshangabad division.

FIGURE 3-6: REGENERATION OF ACHAR

Regeneration status and frequency in various girth classes highlights the future availability of species. The trend of key NTFPs species of the landscape for which the data was available over last three working plans covered in last two working plans have been compared in the table below.



NTFP Hotspots

According to the working plan of Hoshangabad (2013-14 to 2022-23), the frequency of stands of NTFPs was observed to be high in the following compartments:

TABLE 3-7: COMPARTMENTS WITH HIGH FREQUENCY OF NTFPS IN HOSHANGABAD FOREST DIVISION

SN	Name of the Range	Name of the NTFP (local names)	Compartment No
1	Hoshangabad	Bel, Aachar, Dhawda, Salai, Mahua	P186, P187 P 188, P 189, P190, P191
2	Itarsi	Bel, Aachar, Dhawda, Aonla, Mahua, Satawar, Kali musli, Chirota, Baheda, Kullu, Palas	168, 169,170, P171, P172, P173, P174, P175, P176, P177,P178, P179,119, 117, 116, 112, 102, 118, 123, 122, 121, 125, 126, 97, 98
3	Sukhtava	Bel, Aachar, Dhawda, Aonla, Mahua, Satawar, Kali musli, Chirota, Baheda, Kullu, Beeja, Harra	41, 42, 43, 70, 62, 58, 57, 59, 60, 54, 55, 53, 52, 51, 50, 88, 28, 73, 74, 75, 76, 77
4	Banapura	Aachar, Aonla, Mahua	1, 2, 4, 5, 6, 7, 8, 9, 10 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24

SN	Name of the Range	Name of the NTFP (local names)	Compartment No
5	Bagda	Bel, Aachar, Dhawda, Mahua, Satawar, Kali musli	92, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 219, 220, 223, 224, 225, 226, P 230
6	Sohagpur	Bel, Aachar, Dhawda, Aonla, Mahua, Satawar, Kali musli, Beeja, Marodfalli	286, 284, 285, 287, 288, 289, 290, 291, 235, 236, 241, 242, 243, 244, 245, 246, 247, 252, 253, 254, 255, 256, 257, 258, 259, 261, 262, 265, 287, P277,P281
7	Pipariya	Aachar, Aonla, Mahua, Satawar	P306, P304, P305, P307, P308,

Source: Working plans of Hoshangabad forest division 2013-14 to 2022-23

Table 3-7 depicts hotspot areas of Hoshangabad division where good availability of NTFPs species. Site specific in-situ cultivation for the NTFPs based on micro-plans for conservation of NTFP species is recommended to be undertaken in workplan. Follow up on the recommendation of working plan for sustainable harvesting of NTFPs would be assessed. Areas with good stocked areas with high density of NTFPs are found in contiguous compartments as could be seen in table above.

Working plans of both the division prescribes involvement of JFMCs to reverse the trend of unsustainable and destructive harvesting practices in NTFPs such as Aonla (*Emblica officinalis*), Achar (*Buchania lanzen*) Harra (*Terminalia chebula*), Baheda (*Terminalia bellirica*) and Tendu (*Diospyrous melanoxylon*). Some of these areas are very rich in NTFPs and therefore require special measures for conservation of its rich flora.

Extinct, critically endangered and threatened NTFP species of the Landscape

In the landscape, for various reasons NTFP tree species of Khair (*Acacia catechu*), Haldu (*Adina cordifolia*), Beeja (*Pterocarpus marsupium*) and Baheda (*Terminalia bellirica*) have become critically endangered over a period of time. Similarly, Mahul (*Bauhinia vahlii*), a creeper whose leaves are used to make plates, have locally become critically endangered in the landscape. Whereas, NTFP tree species such as Arjun (*Terminalia arjuna*), Salai (*Boswellia serrata*), Baheda (*Terminalia bellirica*) and Kullu (*Sterculia urens*) are threatened NTFP tree species. Status of Safed Musli (*Chlorophytum borivillanum*) herb and Gudmar creepers is also in the locally threatened. (Source: Working plans)

3.6 MARKETING OF NTFPS

3.6.1 Trade and Marketing

Tendu leaves is a nationalized NTFP therefore its trade is done by the state government only. The collection and trade of Tendu leaves is done through Madhya Pradesh Minor Forest Produce Federation (MPMFPP) through cooperative societies formed at the village level for the purpose. **Table 3-8** presents season of collection of various NTFPs available in the landscape. Non nationalized NTFPs are traded by traders and business community without any government control or regulation.

TABLE 3-8: CALENDAR OF SEASON OF COLLECTION OF NTFPS FOUND IN THE LANDSCAPE

SN	NTFP	Season	Sr.no	NTFP	Season
1	Mahua	February-March	7	Tendu	April-May
2	Aachar	March-April	8	Sitafal	September-December
3	Aonla	December- January	9	Bel	November- December
4	Bhilwa	April-May	10	Gond	February-March
5	Harra	November-December	11	Palash	February-March
6	Baheda	April-May			

3.6.2 Market for Non-nationalized NTFPs

In Hoshangabad NTFPs are sold in the adjoining markets such as Itarsi, Kesla, Dhekna, Bavai, Suhagpur, Sivni, Malwa, Bankhedi etc. In Harda the local markets for sale of NTFPs are Harda, Timrani, Khidkia, Rahetgoan, Magardha and Makdai.

3.7 EFFECTS OF UNCONTROLLED EXPLOITATION

Destructible harvesting practices are reported for many NTFPs. Trees are done damage due to lopping and cuts made on stem. Aonla, Aachar and Trees of miscellaneous species are done most of the damage. The unsustainable harvesting of Aonla, Achar and Bel was found in both the divisions is to an extent that it is affecting future availability of the NTFP in the forest areas. **Table 3-9** shows purpose of collection of NTFPs in the landscape.

Unscientific extraction techniques employed for over extraction of gum leads to total loss of the tree.

TABLE 3-9: NTFPs SUBJECTED TO UNSUSTAINABLE HARVESTING PRACTICES

SN	Local Name of NTFPs (part harvested)	Scientific Name	Purpose
1	Aachar (seed)	<i>Buchanania lanjan</i>	Commercial
2	Aonla (fruit)	<i>Embllica officinalis</i>	Commercial
3	Bel(fruit)	<i>Aegle marmelos</i>	Commercial/domestic
4	Kullu (Gum)	<i>Sterculia urens</i>	Commercial
5	Safed Musli (roots)	<i>Chlorophytum borivillanum</i>	Commercial
6	Kali Musli (roots)	<i>Curculigo orchioides</i>	Commercial
7	Marodfalli (stem)	<i>Helectries isora</i>	Commercial/domestic
8	Jamun (bark)	<i>Syzgygium cumini</i>	Commercial

The practice of uncontrolled and unsustainable harvesting is quite evident in working plan area. This practice has been noticed in Safed musli, Aonla, Achar and for Bel. For extraction of Aachar, Aonla and Bel the entire branches are cut down and at times the entire tree is brought down in greed by the NTFP collectors. Pre-harvesting is also widely practiced leading to unavailability of viable seeds for germination on the forest floor. This practice is leading to reduced regeneration and future production potential of the NTFP from the forest areas.

A detailed species wise change observed by the community is attached as *Annexure III*.

3.8 HISTORY OF MANAGEMENT

Mahua was nationalized in MP in 1969 -70, but was withdrawn in 3 years. Ostensibly this was done as more trees were found to be in private lands, and it was too important (edible, staple food for some during certain seasons) an item to be nationalized¹⁸. But government was fixing support prices till very recently. The permission of FD was required for storage of Mahua till 1996, when the trade was de-licensed and made free to allow collectors to freely market their surplus. Now one can hold Mahua without any restriction. Similarly in 2000 - 200, Achar and Aonla were nationalized in selective parts of MP, but the regulation was withdrawn in the same year.

The issue of inadequate regeneration of NTFPs bearing species was identified to have reached critical thresholds and therefore the state government issued a circular dated 27.12.1993, putting a ban on felling of trees of NTFP bearing species because of inadequate regeneration. MPMFPF had formed village level institutions for collection of non-nationalized NTFPs. The collection of NTFPs was miniscule and had to be abandoned because of economic infeasibility because of limited quantity.

¹⁸ <http://www.banajata.org/pdf/state-level/Madhya-Pradesh.pdf>

3.9 COMMUNITY OBSERVATIONS ON CHANGES OBSERVED IN PHENOLOGY

The community interacted with during the field visit shared their observation regarding changes in vegetation pattern, availability of NTFPs, quantum of flowering and fruiting and other changes observed in the forest eco-system surrounding them.

- (a) **Reduced Availability of NTFPs:** Availability of most of the NTFPs has declined over a period of time. There are some NTFPs that have altogether vanished from the forest area. Safed musli is one such NTFP that has faced local extinction because of over-harvesting resulting from availability of market for the same. Other NTFPs like Aonla and Achar have considerably reduced in last two to three decades.
- (b) **Flowering and fruiting:** Fruiting of Aonla and Achar species have reduced over a period of last two to three decades. Aonla fruits are almost vanished from the tree by the end of November or latest by early December. This is partially due to pre-harvesting and also because of shedding of fruits by the trees and increased dependence of wild life on the same. Almost all the fruits are harvested raw and this might be one of the reasons for low regeneration of the species. The trend of pre-harvesting is equally prominent in Achar and Bel. Flowering in Palash was also reported to be less than what is used to be about two to three decades ago.
- (c) **Shedding or losing foliage:** The phenomenon of early leave shedding for teak was shared by the villagers surrounding dense teak forest areas.
- (d) **Early flowering in Mahua:** The phenomenon of early flowering was observed in Mahua by the villagers. However, the flowering time varies from year to year.
- (e) **Increase in area under *Lantana camara*:** The area under *Lantana camara* have increased and exotic species have ventured into the forest areas.

3.10 Carbon Stocks

Forests play significant role in managing carbon cycle. Different forests types hold different quantities of carbon. According to FSI, 2009, in Madhya Pradesh, the highest per hectare carbon stock is found in Tropical Dry Deciduous Forests (93.08 tonnes) followed by Tropical Moist Deciduous Forests (65.53 tonnes) and Tropical thorn forests (53.13 tonnes). The carbon stock per hectare for density of forests is given in the **Table 3-10**:

TABLE 3.10: CARBON STOCK IN FORESTS OF MADHYA PRADESH

Forest Type Stratum	Density	Carbon per hectare (tonnes)
Tropical Moist Deciduous Forests	Very Dense Forests	108.25
	Moderately Dense Forests	90.93
	Open Forests	33.57
Tropical Dry Deciduous Forests	Very Dense Forests	154.35
	Moderately Dense Forests	137.50
	Open Forests	38.80

(Source: FSI, 2009)

According to the general concepts and approaches in Forest Carbon Stock Accounting, the sub-category of land use to inventories the carbon between two specific, in present context, would fall in the sub-category Forest Land remaining forest land. Under this category, an increase in carbon stocks of Forest land remaining forest land would mean improvement in canopy density and growing stock of forest. Degradation in forest resource would mean decrease in carbon stock.

The forest area of the landscape witnessed a degradation of NTFP tree resource base. But whether this decrease has led to degradation of forest density is required to establish the direct correlation between the destructible NTFP harvesting and forest degradation ultimately leading to decline in carbon stock.

5.0 HARVESTING TECHNIQUE OF ACHAR (BUCHANANIA LANZAN) AND OTHER NTFPS IN HOSHANGABAD LANDSCAPE

5.1 TAXONOMY AND PHENOLOGY

It is a moderate-size tree almost evergreen with a straight trunk. Bark dark grey or black 0.5-0.8 inches thick, regularly divided into small rectangular plates, somewhat resembling crocodile hide, reddish inside. The wood is of poor quality. Its silviculture importance lies in its great abundance in certain common types of forests and its utility for clothing dry hills. It is distributed in deciduous forest throughout the greater part of India and Burma. In peninsular India, it is abundant in mixed deciduous forests particularly of the drier types. The tree is leafless or nearly so for a very short time during the hot season. The pyramidal panicles of small greenish white flowers appear from January to March and the fruits ripen from April to June. The fruit is an ovoid drupe about 0.5 inches long, black when ripe with a hard two-valved stone 0.35-0.4 inches in diameter. The development of seedling is slow even in moderate conditions. The tree is moderate light demander. It is sensitive to drought and is not readily browsed. Natural Reproduction: The fruits fall immediately before or at the commencement of the rainy season. If they are quickly covered with earth or debris by the rain, or are protected by grass or other low cover, germination soon commences and the seedlings have a chance of establishing themselves, developing slowly. Seeds lying on the surface of the ground exposed to the sun either fail to germinate and soon lose their vitality or, if they germinate, the radicles tend to dry up. Under favorable conditions natural reproduction appears in quantity almost gregariously in places. Regeneration from root suckers, particularly on hilly ground where roots are liable to be exposed, has also been observed. (Troup, 1921¹⁹).

Its bark contains about 13.4% of tannin. Its gum is soluble in water that exudes from the wounds in the stem and it is used in textile business [6]. It is an income generating produce of forest dependent communities. On an average, 40-50 kg fresh fruits are produced per tree, which yields 8-10 kg on drying, resulting in 1-1.5 kg of finished produce per tree (Tewari, 1995²⁰).

Fruits are eaten by the children and family members of the collectors since they do not have market value and the seed is gathered and sold which is further used for extraction of Chironji. Seeds / kernel of *Buchanania lanzan* are nutritional, palatable and used as a substitute of almonds in confectionery. They yield a fatty oil known as Chironji oil and substitute for olive and almond oils in both confectionery and indigenous medicine used for glandular swellings of the neck (CSIR, 1986²¹).

¹⁹ Troup RS, "The Silviculture of Indian Trees", IBP Publishers, Dehra Dun (Reprinted), vol. 1, (1986), pp. 240–243.

²⁰ Tewari, "Bulletin on *Buchanania lanzan* (Chironji)", Indian Council of Forest Research and Education, (1995),

²¹ CSIR, "The Useful Plants of India", Publication and Information Directorate. CSIR, Hillside Road, New Delhi, (1986), pp. 916.

5.2 HARVESTING OF ACHAR SEEDS- WHY SCIENTIFIC HARVESTING IS NECESSARY?

A study²² done on scientific harvesting for quality seed collection of *Buchanania lanzan* Spreng for its conservation and sustainable management suggests that germination of seed and seedling growth gets negatively affected with fruits harvested in the second week of April while maximum values were recorded with seeds harvested in the 2nd week of May. The study concluded that pre-harvesting of the seeds is leading to low natural regeneration. The study recommended that seed collection should be done from second to third week of May.

According to the phenology description provided by Troup (1921²³), the seeds fallen on ground during pre-harvesting losses their vitality and therefore for regeneration it is important that some fruits remains on the tree till the arrival of monsoons.

5.3 GOOD CULTIVATION AND HARVESTING PRACTICES

The WHO (World Health Organization) has published guidelines for GACPs (Good Agriculture and Collection Practices) for medicinal plants. The national governments are required to develop country-specific guidelines for sustainable production of raw material of quality and standardized ingredients. The GACPs cover a wide spectrum of cultivation and collection activities, including the site selection, climate and soil considerations, and identification of seed, main post harvest-operations, and legal aspects. Some basic guidelines under GACPs for cultivation and harvesting of the crop include recommendation of collection of 60-70 % and leaving the rest for regeneration and for not cutting of branches and twigs for collection of plant parts.

For collection of fruits, the guideline recommends the following:

- Harvest only mature plants from healthy plants.
- Do not collect all material of the plant at a time.
- Do not cut branches for collecting leaves, fruits, flowers, and so on.
- Leave some floral parts on the plants to facilitate natural regeneration.
- Fleshy flowers may be dried in the sun, but should preferably be dried in shade.
- Parts like stigma, anthers, buds, and so on should be collected at appropriate time.
- Harvest the seeds once the fruits the completely mature.

For collection of gums, oils, resins, galls, and so on:

- Make incisions only vertically on some portions of the tree and not horizontally.
- Treat the incisions after collection of the desired material.
- Do not collect the gum or resin from a tree continuously and collect them in precisely right season.
- Do not leave gum/resin exposed in the field. Pack them in appropriate containers or drums with polyethylene lining.

(Source: WHO website)

²² Archana Sharma, SFRI, MP, India.

²³ Troup RS, "The Silviculture of Indian Trees", IBP Publishers, Dehra Dun (Reprinted), vol. 1, (1986), pp. 240–243.

5.4 RATIONALE FOR DESTRUCTIBLE HARVESTING PRACTICES

Inconvenience in picking of fruits, lack of ownership, free riding, inadequate livelihood alternatives and fierce competition for the limited resources are factors leading to present destructible practices. In addition to this, the low quantum of availability of NTFPs and dispersed spread of the trees have economic implications which deter implementation of any institutional measure against destructible practices observed for almost two decades. **Figure 5-1** depicts pollarding done on Bel and **Figure 5-2** depicts broken branch of Achar tree. Various measures have been taken at different levels to ensure sustainable harvesting of NTFPs from time to time. Measures that have worked for other species have not worked for Achar. This is because of many factors such as low frequency of trees and concentrations in certain pockets which make it economically non-viable for the villagers to enforce restriction or to check restraint.

FIGURE 5-1: POLLARDING OF BEL



FIGURE 5-2: DAMAGE TO BRANCH OF ACHAR



Economic viability is the supreme and predominant consideration for members of the JFMCs for undertaking measures for sustainable harvesting, if any. Therefore, for any sustainable measure to be successfully implemented, the need for addressing economic viability reigns supreme. The large number of beneficiary groups makes it difficult to implement restrictive measures on extraction especially since the value of watch and ward far exceeds the benefit accruing out of sale of the NTFPs collected.

Another larger development context that have influenced harvesting practices over last decade has been increased reach of traders to the far flung villages thus making almost every commodity saleable, which earlier was not as easy. With easing of policy measures towards strengthening the community' ownership over forest resources, the administrative effort and legality towards restriction further declined. Probably this context has been the reason for destructible harvesting of NTFPs despite it being recognized as important and critical to both the health of the forest and for future economic considerations of the households living in the vicinity of forest areas.

FIGURE 5-3: ACHAR TREE ON PRIVATE LAND HOLDING

For people it is simply not a technology failure. It is a failure of choices, choices of livelihoods and institutional measures that could be adopted in context of specific requirements. Most of the people interacted with during the interview had full understanding of consequences of destructible harvesting of NTFPs. For the same NTFP harvested from private land and forest land, there was difference in harvesting methodology. Pre-harvesting, destructible harvesting and over-harvesting were observed only on forest lands where destructible harvesting was clearly visible. On the other hand, the Achar trees on private lands both on agriculture and private forest areas (refer to **Figure 5-3**) remained healthy. Similarly so for other NTFPs unsustainability harvested from the landscape. Therefore, along with a section of technical measures that needs to be ensured for sustainable harvesting of NTFPs, a section of institutional and policy measures in the present space available are also included as measures that could be adopted for ensuring sustainable harvesting measures.



In this context, it is important to highlight that there needs to be different sets of measures for good stocked areas and forest areas with denuded NTFP resource. Good stocked areas would require protection, conservation and usufruct distribution mechanism. Transparent and clear usufruct rights would help establish roles and responsibilities. Forest areas with denuded NTFP stock would require measures for protection and an enabling mechanism for regeneration of species.

5.5 PRESENT UN-SUSTAINABLE HARVESTING TECHNIQUES

In the landscape, based on the discussion with staff and locals, presently three NTFPs are facing unsustainable harvesting practices. These NTFPs are Aonla, Achar and Bel. Kullu and Safed musli are other NTFPs that have faced unsustainable harvesting. Unsustainable harvesting over a period of time has led to resource degradation to such levels that the availability of these NTFPs has reduced considerably making them economically unfeasible for the collector. The three NTFPs that are still being unsustainably harvested and faces possibility of severe degradation in the near future suffers from felling of tree, lopping of branches and pollarding, and pre-harvesting. These are three unsustainable harvesting practices adopted by the collectors in various degrees for each of the three species. Similarly various user groups ascribe diverse reasons and have different stakes which differentiates the level of severity of un-sustainable harvesting technique adopted. For example, the practice of felling the entire tree is more prominent in harvesting of Achar than in harvesting of Bel fruit. But, the tree of Bel is damaged more by goat herders for fodder especially during summers, as it is more convenient to cut the entire tree rather than climbing the tree and selectively lopping the branches. Since Bel branches also have thorns which makes it difficult to climb the tree, the tree is felled and young crops are over-pruned (refer **Figure 5-4 and 5-6**). This has led to reduction in number of mature trees as well as stalled young seedlings to establish. Since all goats that feed are of households from the same village or members of the JFMC, there seems to be a tacit agreement towards ignoring the damage (refer **Figure 5-1 and 5-4**). Sometimes the damage is done for fulfillment of religious practices (refer **Figure 5-5**). Similarly, where there is good availability of Achar, it attracts outsiders to invade into the forest areas even during night. These people have no

stake in conservation of the area and also remain in competition among them, adopting un-sustainable harvesting measures. In the race to gulp the loot, the entire tree is felled. Members of the JFMC may not resort to such harsh measures but instead use big stones to thrash on tree trunks. This shakes the plant and makes ripe fruits fall. But in the process, the stone damages the tree which then start exuding gum from the wound and over a period of time, the tree dries up.

FIGURE 5-4: DAMAGE TO THE BEL SEEDLING



FIGURE 5-5: DAMAGE TO JAMUN



FIGURE 5-6: HEIGHT OF BEL TREE



5.6 PRESENT HARVESTING PRACTICES OF ACHAR

Achar is harvested pre-mature. Achar is collected for the economic value of the seed. The un-ripened green fruit is generally eaten by the children and the seed is collected for sale. Ideally the fruit should be harvested after it has ripened. This is inevitable because the seed loses its viability if harvested early. The raw fruit of Achar is green in color which changes to black after it has ripened. Small fruits of Achar grow in bunches. The strength of Achar branches and stems is low. It breaks easily and many times it causes injury to people who climb the tree. Taller the tree, climbing on branches to pick

bunches becomes all the more difficult. To avoid possible physical injury, the collector undertakes the following harvesting practices.

- (a) **Hitting tree trunks with big stones:** The use of stone to hit the tree is quite rampant and wide practiced (refer **Figure 5-7**). This is done by middle aged collectors (whose weight the tree might not be able to bear), usually women or men when not accompanied by juveniles. The biggest dis-advantage of this practice is that it leads to damaging the tree trunk. After severe injury the tree exudes gum and dries up over a period of time if the injury is repeated over and over again (refer **Figure 5-8**). Since the injury is repeated by several collectors as the Achar grows and is collected by different collectors, it is estimated that each collector hits the tree twenty to thirty times and five to ten collectors may visit the same tree in one season. Thus, the tree trunk bears about hundred hits in a season.

FIGURE 5-7: STONE-HARVESTING TECH



FIGURE 5-8: THE WOUND AND THE WEAPON



- (b) **Felling the tree:** Felling of the entire tree is another common practice adopted by collectors in fierce competition to collect as much more Achar as possible. Generally, juvenile trees are felled since it does not create much turmoil and the collector escapes scot-free (refer Figure 5-9). The felling could be undertaken with small axes and sickle which is generally used for collection of fuel wood or grass. At times such practices are adopted by members of households other than those of JFMCs, since the collection is done after dark. This practice was observed in areas close to the village and adjoining forest areas.

FIGURE 5-9: STUMP OF ACHAR TREE



- (c) **Lopping of branches:** Lopping of branches is done for convenience. Side branches are lopped and bunches of Achar seeds are then collected. Excessive lopping causes deformed trees and wound leading to rotting of the tree (refer to Figure 5-10 and 5-11).

FIGURE 5-10: LOPPING ON ACHAR TREE



FIGURE 5-11: BRANCH LOPPED



- (d) **Use of bamboo stick to pick the bunch:** Some NTFP collectors use a bamboo with clips fixed on one side of the pole to pick the entire bunch of Achar fruits.

6.0 SUSTAINABLE HARVESTING TECHNIQUE OF ACHAR (BUCHANANIA LANZAN)

6.1 STATUTORY PROVISIONS- OVERCOMING DESTRUCTIBLE HARVESTING

The following statutory provisions provide space for adopting sustainable harvesting of Achar. These provisions are:-

(a) **Madhya Pradesh Forest Produce (Conservation of bio-diversity and Sustainable harvesting) Rules 2005²⁴** provides the state government to initiate actions for conservation of bio-diversity and sustainable harvesting of forest produce. The rules provided the state government and the forest officials of the rank of Divisional Forest officer and above the authority to make rules for sustainable harvesting of NTFPs. Towards this the state government or the authorized forest official may:

- declare prohibition period for collection and extraction of NTFPs based on the life cycle of the species;
- declare any forest area or part of it as “prohibited area” for extraction of NTFP for a particular period of time;
- impose restrictions on the quantity (determining quantity) that could be collected from a particular forest area or part of it;
- undertake measure to ensure sustainable harvesting of NTFPs;
- require reports/ information about collection of NTFPs in format and in duration as required, from the persons engaged in collection of NTFPs.

Anybody who contravenes provisions of the rules would be punishable under section 77 of Indian Forest Act, 1977²⁵.

(b) **THE MADHYA PRADESH LAGHU VAN UPAJ (GRAM SABHA KO SWAMITWA KA SANDAN) VIDHEYAK, 1999**

The law provides Gram Sabha with the ownership of Minor Forest Produce as long as harvesting is done on sustainable basis and for the domestic consumption. The law also provides provision for the state government, by notification, that harvesting and trade of any minor forest produce in the areas notified from time to time shall be done by Co-operative societies of MPMFPF.

(c) **Madhya Pradesh State Forest Policy, 2005**

The state forest policy states it to one of its objectives to ensure sustainable and non-destructible harvesting of NTFPs and assist in economic upliftment of forest dwellers of the state.

²⁴ The rules have been translated from Hindi to English and therefore liable to change of terminology. Please refer to the rules MP Forest Produce Rules, 2005.

²⁵ Section 77 provides for penalties for breach of rules. Any person contravening any rule under this Act, for the contravention of which no special penalty is provided, shall be punishable with imprisonment for a term which may extend to one month, or fine which may extend to five hundred rupees, or both.

- (d) **The Biological Diversity Act, 2002** provides for equitable sharing and for usufruct distribution mechanism of biological resources. Section 37(1) of the Act provides for provision of declaring an area of biological importance as heritage sites. The section states:-

“Without prejudice to any other law for the time being in force, the State Government may, from time to time in consultation with the local bodies, notify in the Official Gazette, areas of biodiversity importance as biodiversity heritage sites under this Act.”

National Biodiversity Board framed rules for declaration of Heritages sites under section 37 of BDA, 2002. The rules states that

- The creation of Biodiversity Heritage Site (BHS) may not put any restriction on the prevailing practices of and usages by the local communities, other than those voluntarily decided by them. The purpose is to enhance the quality of life of the local communities through this conservation measure.
- All kinds of legal land uses whether government, community or private and could be considered under the above categories.
- Areas including very small ones that offer refuge or corridors for threatened and endemic fauna and flora, such as community conserved areas or urban greens and wetlands.

(e) **The Schedule Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006:** Provisions of section 5 of the Act for the holders of forest rights in the JFMC (which in some cases include most of the households) under sub-section (a) and regarding “regulating access to community forest resources and stop any activity which adversely affects the wild animals, forest and the biodiversity are compiled with”.

(f) **NTFP harvesting guidelines of MKSP, Government of India**

As a component of National Rural Livelihoods Mission (NRLM) Ministry of Rural Development is extending the scope of Mahila Kisan Shashaktikaran Pariyojana (MKSP) to empower the tribal women engaged in NTFP collection. This intervention will also evolve into practical guidelines for NTFP identification, regeneration, extraction management, collection, processing, storage and marketing, training on technical issues etc.

Objectives of this component of the program include developing a sustainable model ensuring regeneration and developing a capacitated institution of NTFP collectors. Essential outcomes of MKSP include, development and promotion of sustainable NTFP management practices in pre harvest, harvest and post-harvest technologies to enhance livelihoods opportunities for NTFP collectors leading to climate change resilience and improved bio diversity. Ministry of Rural Development (MoRD) would provide funding support of up to 75% to the project submitted by the State Governments/PIAs under MKSP. Balance is to be contributed by the respective state governments or any other donor agencies, national and international in the form of grants or the Project Implementing Agency.

6.2 SUSTAINABLE HARVESTING TECHNIQUE OF ACHAR (BUCHNANIA LANZAN)

6.2.1 Existing sustainable harvesting methodology recommends

“Mature Fruit Kernels can be collected when black in color. Bamboo stick will be used for shaking branches. Fruits should be collected after April and green collection should be avoided. 1/3 fruits should be left for wild animals and regeneration.”

(Source: Good cultivation and harvesting practices for NTFPs. Accessed from IIFM website)

Important features of this mechanism are:

- Time of harvest
- Use of non-destructible implements
- Quantity of harvest
- Size and color of the fruit at the time of harvest

6.2.2 Suggested Sustainable Harvesting Technique

The destructive harvesting practiced in the landscape is largely ascribed to segment of collectors who are marginalized and without other alternate livelihood options and usually get a low price for their collection. Identification and strengthening of this segment is crucial for successfully implementing sustainable harvesting techniques. The following techniques and measures may be taken up at the divisional level by the concerned DFO or senior officials under the powers provided in the **Madhya Pradesh Forest Produce (Conservation of bio-diversity and Sustainable harvesting) Rules 2005**.

Time of Harvest: When the fruits are ripe. But fruits may be in different stages in a single bunch. Therefore, it is required to define the time of harvest. In April the fruit should not be harvested since the fruits that fall on ground during this time have low viability to germinate. The harvesting may at the earliest start after 1st week of May. The fruit ripens during this time. Seeds from fruits that fall on the ground during this time have better germination potential. If ripen Achar fruits are harvested, they easily fall on the ground and there is no need for the collector to undertake measures like stone thrashing against the trunk.

Use of Non-destructible implements: Ropes, polythene sheets and bamboo should be promoted as the only harvesting tools for harvesting Achar. Large polythene sheets to spread on the floor after sweeping the floor should be undertaken. To shake the branches bamboo sticks may be made available to the prospective collectors before the time of harvest so that no destructible implement is used for harvesting Achar. Effort towards removal of stones and strict penalty over cutting of trees needs to be imposed to deter destructible practices. Clear tenure rights over the resources would help overcome destructible harvesting practices.

Quantity of Harvest: As the data of regeneration and frequency table in different girth class suggests, the regeneration of Achar has been affected in both the divisions. The regeneration gets affected since the fruits are harvested before time. Seeds that fall before onset of monsoon soon lose its vitality. Seeds scattered on the forest floor during pre-harvest do not result into germination which leads to very low regeneration of Achar. Therefore, the time of harvesting of seeds is important to ensure regeneration. There could be variation in flowering time from one year to another by a few days and similar minor variation may be observed from one division to another. Since a lot of households extract Achar fruits at different point of time, it would be difficult to maintain a mechanism to harvest a certain percentage of fruits. According to the working plan about one fourth to one-third of the fruit should be left on the tree for food to wild animals and to assist natural regeneration. This recommendation needs to be strictly adhered to.

Size and Color of Harvest: The fruit should be harvested when it is ripe. The color of the fruit is dark when it is ripe. However, since the fruits are small and in bunch, some fruits in a bunch may ripen while others may not. The quality of seed which is extracted fetches a good price only if it is extracted from mature fruits. Picking mature fruits is almost impossible since the branches are weak and the fruits are too small. In case the entire bunch is to be picked, dispersion of seeds through natural processes such as by wind, birds and animals are sources for ensuring regeneration.

Area of Harvest: Harvesting from critical areas such as hill sides and denuded areas may be restricted for certain period of time to assist natural regeneration. Achar is of immense ecological

importance because of the green cover it provides especially in denuded and deciduous forests. The species may therefore be provided protection for the denuded forest areas to regenerate.

6.2.3 Institutional Mechanism for implementing Sustainable Harvesting

Since the forest area is large and wide, the engagement and role of women and juvenile group from marginalized section of the society becomes inevitable. In the present context it is difficult to protect the Achar tree from destructible harvest by imposing restrictions of time of harvesting in the present institutional set up. Fierce competition and inadequate tenure over the resources makes the implementation of time limit extraction even more an unrealistic proposition. However, this may be overcome by focusing ownership on rotation (year to year or for longer periods) to ensure protection of available stands and further to ensure regeneration. A mechanism providing ownership and secure tenure over the production would be required to be ensured. For this the following measures are suggested:-

(a) Sub-group or Sub-committee on Achar:

To ensure this a strong institution or a group would be required. An institution/group that remains fully committed to ensure that Achar does not gets harvested before the end of first week of May and only when the fruit ripens. The group could be strengthened by providing with forward linkages so that the outside traders may be totally eliminated from the trade. Availability of market at the doorstep and cash requirement forces villagers and especially the marginalized households to harvest the Achar fruits raw. During discussion with the villagers it was suggested that a core group in a village (especially those where there are good number of Achar trees available) of collectors of Achar be identified. A mechanism for protection and management of trees in the vicinity of the village may be undertaken or if successful this mechanism may be adopted for the entire trees available in the forest allocated to the JFMC. The core group on Achar may be authorized to monitor that the pre-harvesting or destructible harvesting is not undertaken. The core group may be further converged with Mahila Kisan Shashaktikaran Pariyojna (MKSP) component of National Rural Livelihood Mission. This may be implemented directly by the JFMCs of the forest department or the Self-help groups formed by the NGO PRADAN or other credible NGO that has quite a good network of women institutions in the area. The provisions provided in the MKSP provides for ample scope for building up federation for trade and processing to ensure that maximum value of the NTFP reaches the primary collector. The sub-group would also provide its members with non-destructible implements.

FIGURE 6-1: ACHAR FLOURING ON PRIVATE FORESTS

(b) Allocation of stands:

Analogy could be drawn from measures taken in the Hoshangabad forest division for harvesting of Mahua flowers. All the trees available to the JFMC are distributed to the households based on preferences to the area covering the same number of trees. The household bears the responsibility of protection and safeguarding the tree from any destructible practice. The suggested measures may be taken up at the divisional level by the concerned DFO or senior officials under the powers provided in the **Madhya Pradesh Forest Produce (Conservation of biodiversity and Sustainable harvesting) Rules 2005**.

(c) Strategy for Achar Hotspots such as the Jatamau JFMC which is an Achar Hotspot:

The rules provided in the National Biodiversity Rules for Biological Heritage sites provides for the state government to take the timely initiative. It would



ensure protection through state and central government assistance, the heritage site would benefit from in case any sight is declared as one. Since, there are some areas in the landscape (one such area is Jatayu JFMC) which are hotspots for Achar and other NTFPs but are threatened in absence of any legal protection and special aid. The declaration of such sites as Biological heritage sites would help conserve the richness of the area.

(d) Reorganization of JFMCs:

The areas allocated to JFMCs were undertaken about one and a half decades back. The allocation of forest areas is based on forest area in the beat and area allocated to one JFMC covers only one beat only irrespective of location of village vis-à-vis boundaries of forest areas allocated to it. At times the farthest distance from the village event extends to seven to ten kilometers. For this reason, protection and conservation of such large tracts and ensuring sustainable harvesting mechanism is difficult. The present crises is manifestation of such a mis-proportionate allocation. Whereas, some village despite their proximity to forest areas are not provided immediate adjoining areas which they would be able to protect and conserve. Such JFMCs where the reason for unsustainable harvesting is the size and extend of the forest area, re-organization measures may be undertaken before implementation of sustainable harvesting measures under 2005 state rules for the same.

(e) Community Rights: Since a lot of JFMCs have expressed ambiguity over ownership, the problem of ownership may be overcome by assisting community in claiming community rights available to communities under section 5 of the Schedule Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. Community could claim their exclusive rights over NTFPs are far being implemented²⁶ and this would help overcome the issue tenure insecurity. In none of the villages visit was the provision of community explored or known to the JFMC members- despite their being demand for exclusive rights of the JFMCs rather than the entire and large spectrum of villages in Gram sabha. Once the community rights are established the next logical step would be for the community to allocate these resources among its own members for protection and harvesting. Allocation of NTFPs by Gram sabha to the community would then not be contested.

These institutional measures would help in implementing proposed sustainable harvesting techniques in the landscape.

²⁶ <http://www.undp.org/content/dam/india/docs/DG/recognition-of-community-rights-under-forest-rights-act-in-madhya-pradesh-and-chhattisgarh-challenges-and-way-forward.pdf>

7.0 ANNEXURES

ANNEXURE I: DISCUSSION POINTS FOR FOCUS GROUP DISCUSSION WITH JFMC MEMBER / COLLECTORS TO ASSESS PRESENT HARVESTING METHODOLOGY

Name of the Respondents: _____

Name of the JFMC/Range/Division: _____

1. What are the different compartments and the area of forest allotted to your JFMC?
2. Name of different NTFPs collected by villagers/ participants members from the forest area?

Name of the NTFP	Collected by which Member/ how many households	Season (no of days spent in collection)	Area	Present regeneration status
Aonla				
Aachar				
Safed Musli				
Mahua				
Gulli				
Any other				

3. Which are the NTFPs that have undergone depletion over last two to three decades?

NTFP	Reasons	Decline (in percent)
Aachar		
Aonla		
Any other		

4. Has there been any shift in timing of collection of NTFPs

Name of the NTFP	20 years ago	Now	Any other NTFPs collected activity during the period (for the collector)
Aonla			
Aachar			
Safed Musli			
Mahua			
Gulli			
Any other			

5. Status/state/ quantity extracted of NTFP when collected

Name of the NTFP	Amount extracted	Number of days	Status (ripe/raw)
Aonla			
Aachar			
Safed Musli			

Name of the NTFP	Amount extracted	Number of days	Status (ripe/raw)
Mahua			
Gulli			
Any other			

6. Sale value of NTFPs

Name of the NTFP	Sale of NTFP last year	Sale of NTFPs this year	Trend over last five years
Aonla			
Aachar			
Safed Musli			
Mahua			
Gulli			
Any other			

7. How to villagers assess flowering level, fruiting condition etc

Name of the NTFP	How do you assess flowering level	Fruiting condition	Maturing stage
Aonla			
Aachar			
Safed Musli			
Mahua			
Gulli			
Any other			

8. Implements carried/ other activity undertaken when NTFPs harvesting undertaken

Name of the NTFP	Any other activity undertaken during the visit	Other NTFP available	Implements carried along
Aonla			
Aachar			
Safed Musli			
Mahua			
Gulli			
Any other			

9. Size/ shape/ color of Achar fruit when harvested

Size:

Shape:

Color:

10. Competition for collection of Achar (detail different factors)

Wild animals:

Juvenile groups:

Any specific caste group:

11. Loans, advances taken and marketing

(please provide information regarding system of trade and loans and advances if taken by the villagers)

12. Problems encountered while harvesting Achar?

Activity	Problem	Identify unsustainable harvesting practice
Picking of fruits		
Collection		

13. Factors affecting regeneration of Achar (tick whichever appropriate)

Pre-mature harvest	Over Harvesting	Weeds
Fire	Any other	

14. To ensure sustainability/availability of Achar in the forests (area wise-distinguish depleted from well stocked areas) what measures needs to be taken up?

Measures	Depleted	Well stocked

15. Is there a mechanism of distribution of trees/area among households/members of the JFMC?
16. What is the total harvest in terms of percentage of production (fruits harvested and left on the tree)?
17. Is the regeneration of Achar as good as it was ten-twenty years ago? If no, what is the trend?
18. How much fruit should be left on the tree for ensuring regeneration?
19. What could be a suitable technique to ensure sustainable harvesting?
20. What could be the suitable technique/mechanism for harvesting of Achar?
21. Any intervention done by forest department of any other agencies for development of NTFPs in their forest areas?
22. Was any training organized for sustainable harvesting of Achar? When the training organized and what were the components of the training?
23. What happened after intervention or training?
24. What are the challenges in implementation of such interventions
 - Literature review
 - Factors influencing Sustainable harvesting of NTFPs
 - Policy and regulatory Framework for harvesting of NTFPs

ANNEXURE II: HARVESTING AND CULTIVATION TECHNIQUES DEVELOPED BY WORK DONE BY TFRI / SFRI / IIFM / MPMFPF

As per information available on the websites on the resource agencies, on following NTFPs harvesting and cultivations methodologies have been developed.

SN	Name of the NTFP	Scientific Name	Cultivation practice	Harvesting practice
1.	Achar	<i>Buchnanian lanzan</i>	TFRI	IIFM/SFRI
2.	Adusa	<i>Adhatoda vasica Nees</i>		IIFM
3.	Amaltas	<i>Cassia fistula</i>		IIFM
4.	Aonla	<i>Emblica officinalis</i>	TFRI	IIFM
5.	Arjun	<i>Terminalia arjuna</i>	TFRI	IIFM
6.	Ashok	<i>Saraca asoca</i>		
7.	Ashwagandha	<i>Withania somnifera</i>		IIFM
8.	Bahera	<i>Terminalia bellerica</i>		IIFM
9.	Bel	<i>Aegle marmelos</i>	TFRI	IIFM
10.	Bhilwa	<i>Semecarpus anacardium</i>		IIFM
11.	Brahmi	<i>Bacopa monnieri</i>		IIFM
12.	Broom grass	<i>Thysanolaena maxima</i>		IIFM
13.	Charota	<i>Cassia tora</i>		IIFM
14.	Chitrak	<i>Plumbago zeylanica</i>		IIFM
15.	Dhawaiphool	<i>Woodfordia fruticosa</i>		IIFM
16.	Giloye	<i>Tinospora cordifolia</i>	TFRI	IIFM
17.	Gudmar	<i>Gymnema sylvestre</i>	TFRI	
18.	Harra	<i>Terminalia chebula</i>		IIFM
19.	Imli	<i>Tamarindus indica</i>		IIFM
20.	Kalihari	<i>Gloriosa superba</i>		
21.	Kalmegh	<i>Andrographis paniculata</i>		IIFM
22.	Karanj seeds	<i>Pongamia pinnata</i>		IIFM
23.	Kunghi	<i>Sida cordifolia</i>		IIFM
24.	Kusum seeds	<i>Schleichera oleosa</i>		IIFM
25.	Mahua seeds and flowers	<i>Madhuca indica</i>		IIFM
26.	Mahul leaves	<i>Bauhinia Vahlia</i>		IIFM
27.	Safed musli	<i>Chlorophytum tuberosum</i>		IIFM
28.	Sal seeds	<i>Shorea Robusta</i>		IIFM
29.	Sarpgandha		TFRI	
30.	Satavar	<i>Asparagus racemosus</i>	TFRI	IIFM
31.	Senna	<i>Cassia angustifolia</i>		IIFM
32.	Tendu patta	<i>Diaspyros Melanoxyion</i>		IIFM
33.	Tikhur	<i>Curcuma angustifolia</i>		IIFM
34.	Van tulsi	<i>Ocimum sanctum</i>		IIFM

ANNEXURE III: VILLAGE WISE OBSERVATIONS OF IMPACT OF CLIMATE CHANGE ON NTFP SPECIES

Cheerura JFMC, Range Temagoan

Villagers of Cheerura had undertaken Seri-culture on mulberry plants. Similar efforts have also been undertaken in other villages on Arjuna tree. This has helped afforestation of Arjuna trees on private land holdings. According to the villagers in last few decades, the Arjuna tree had faced decrease in frequency as most of the trees are found on banks of rivers and nallas and because of erosion or change of course of stream, the tree had to bear the wrath. In absence of plantation intervention for the species, the frequency of tree in the adjoining forest area has decreased significantly.

Satkata gum which was extracted earlier in most of the villages is now done only by few households. There are important reasons for this. First, the availability of gum has decreased i.e. it is no more exuded in the similar quantity as was previously exuded by the trees. And secondly, with other livelihood options available, villagers prefer other livelihood option to collection of Satkata gum.

Agriculture and manual labor is the main occupation of the villagers. The two activities provide for almost 80-90% of the annual household income to the villagers. Other major source of income to the household is collection of Tendu leaves. Collection of Mahua is also done by the villagers but it mostly for domestic consumption.

Kheljiri JFMC, Range Temagoan

This is a forest village. Agriculture and manual labor is the main occupation of the villagers. The two activities provides for almost 60% of the annual household income to the villagers. Other major source of income to the household is from collection of Tendu leaves and Mahua. Mahua is also used for domestic consumption and only the surplus collected is sold.

Two more NTFPs collected by the villagers are seeds of *Cassia tora* and *Tectona grandis* but this was done in small quantity and did not contribute significantly to the annual household income. Achar was earlier available in the adjoining forest area but over a period of time have reduced significantly.

Badwani JFMC, Range Rehtgoan, Harda

This is a forest village. Agriculture and manual labor is the main occupation of the villagers. The two activities provides for almost 80% of the annual household income to the villagers. Other major source of income to the household is from collection of Tendu leaves and Mahua.

Achar was earlier available in good quantity but over last one decade it has reduced to such levels that the availability is not even suffice for domestic consumption. One reason for deterioration of NTFPs has been availability of market which has led to over-extraction of NTFPs. A local haat in Kayda village provides market for sale of NTFPs such as safed musli, Achar and other NTFPs. Villages living in vicinity to the market do undertaken exploitation of forest areas allocated to other JFMCs.

Community Observations on changes observed in availability of NTFPs (species wise)

Mahua flower (*Madhuca indica*) and Chironji (*Buchanania lanzan*) are two commonly found NTFPs in the landscape besides Tendu leaves (*Diospyros melanoxylon*). In addition to these NTFPs several other NTFPs are found in the region. But for Tendu leaves and Mahua, the production of NTFPs has lessened over a period of last two decades. Various factors are ascribed for the decrease in production which includes, change in fruiting pattern, timing of fruiting, over-extraction, change in regeneration and increased dependence of villagers etc. These causal factors vary with the species and thus a primary note on how different factors have affected availability of NTFPs in the landscape is documented in the following points:

- (a) **Tendu Leaves (*Diospyros Melanoxylon*):** The production of Tendu leaves was found to be constant across the JFMCs. However, increase in lantana shrubs has affected regeneration and spread of Tendu to some extent. Tendu leaves are collected by MPMFP through collection centers in most of the JFMCs.

- (b) **Satkata Gum:** Gum extracted from Dhawra (*Anogeissus latifolia*) and other miscellaneous species is called Satkata gum. Younger trees yield better gum compared to old trees with thick stem /boles/ trunks. Since, lantana is spreading widely across the forest floor, the regeneration of miscellaneous species has been affected negatively. As a result, a household which used to collect up to 20 Kilograms of Satkata gum during the year, collect only limited quantity.
- (c) **Aachar/ Chironjee (*Buchanania lanzan*):** The quantity of Chironjee collection has reduced significantly over one to two decades. The production of Chironjee has gone down both in the forest areas as well as that from the cultivated/private landholding. Earlier the fruit used to ripe by mid-March but now till March end the fruit is not ripe. This leads to picking of un-ripened fruits. Along with this unsustainable harvesting technique has also led to destruction of growing stock. The regeneration is also affected over last one decade or more. Outside purchasers/agents disturbs the collection pattern.
- (d) **Mahua Flowers (*Madhuca indica*):** Mahua is one of the important NTFPs of the landscape with regard to the contribution and role the NTFP makes to the livelihood and other requirements of the households of the area.
- (e) **Gulli (Seeds of Mahua):** The fruiting time of Mahua seeds have advanced ahead leading to ripening of fruit by the arrival of monsoons. This has led to some effects on regeneration and harvesting technique since during this time farmers are also involved in agriculture work of field preparation. Since now it comes towards the end of tendu patta collection season, the harvesting of un-ripe fruits in completion was also rampant. This has affected natural regeneration of Mahua. Outside purchasers/agents disturbs the collection pattern. And regulation of the same is required to ensure regeneration.
- (f) **Bai-chandi (*Dioscorea hispida*):** Bai chandi was profusely found in the region every year. It is rhizome with creeper. It is processed and sold in the open market after drying and cutting into pieces. The rhizome is also liked by wild boar. The regeneration is profuse. Similarly other rhizomes such as Dhua bhaji and Krishna mati were used extracted but used only for domestic use.
- (g) **Bel (*Aegle marmelos*):** Only few households are engaged in collection of the Bel fruit. Generally those households with youth engage in collection of the fruit for domestic consumption. The fruit is also sold in the local market. No practice of unsustainable harvesting of the NTFP was reported.
- (h) **Safed Musli (*Chlorophytum borivillanum*) and Kali Musli (*Curculigo orchoides*):** The occurrence of both Safed and Kali musli have reduced in last one decade. Both the species were sporadically found in the area.
- (i) **Maror falli or Aethni (*Helectries isora*) :** The stem skin of the shrub is used by the villagers for making ropes for fuel wood, tendu patta and for other agriculture and domestic practices. Marod Falli is a good coppice species. Cutting leads to stemming of branches. But over harvesting and indiscriminate and unsustainable harvesting of the NTFP has affected fruiting. As a result regeneration of the species has reduced over the years.
- (j) **Bark of Jamun tree (*Syzygium cumini*):** About ten years back a lot of trees died because of indiscriminate extraction of bark of the tree. The bark has medicinal value and makes ingredient to medicines for diabetics.
- (k) **Bark of Kahu/Arjun (*Terminalia arjuna*):** Bark of Kohu is extracted to be sold in the local market for its medicinal and therapeutic value. No significant change in terms of loss of tree was seen due to extraction of bark of the tree.
- (l) **Satawar/Shatavari (*Asparagus racemosus*):** The production of Satawar has reduced significantly over the years. Actual reason for reduced availability could not be ascertained and various factors such as increase in invasive species, over extraction and increased rainfall could be possible reasons for the decrease in availability of Satawar from the adjoining forest areas.
- (m) **Aonla (*Embellica officianalis*):** Unsustainable harvesting has led to reduction in number of trees. After injury many Aonla trees have died out. Also, the quality of Aonla has also deteriorated and very tender unripened fruits (small) fall after black spots develops on the fruit. This has led to reduced natural regeneration. Seasonal change may be one of the reasons. The regeneration has also been negatively affected due to increased invasive species such as lantana, carrot grass and other grasses that have increased in the forest carpet area de-voiding forest of Aonla regeneration.