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Sustainable NTFPs harvesting: A good option model for women forest dwellers' food security and livelihood promotion

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Abstract
The tribal communities in Keonjhar, Odisha are excluded in many ways from accessing and benefiting from the fruits of developmental mainstream. Within tribal groups, women are more marginalised and sidelined than men despite their multiple roles in the household. Women's exclusion from the mainstream knowledge systems, market sphere and their limited access and control over the resources, affects the overall development of tribal communities. Key for economic growth of tribal communities is the equal participation and promotion of women's physical and economic rights. This necessitates for a purposive design of activities and institutional mechanisms for both socially inclusive economic empowerment and environmentally sustainable growth by building their knowledge and skills to sustainable harvesting restore NTFP based value chains for sustainable livelihoods. The present paper is an attempt to address the geographical, social, technological and economic inclusion of tribal women in the NTFP total Value chain including Good harvesting practice, regeneration of NTFP resources base and downstream market integration to improve their incomes in Keonjhor district of Odisha state. It is found that by employing inclusive strategies,- of sustainable harvesting and post harvest processing with application of low cost or zero cost scientific technologies and participative approaches the socially excluded women could be organized, engaged and integrated successfully by leveraging proven NTFP livelihood model in the value chains and markets for increasing their incomes.

Keywords: sustainable harvesting, conservation, women empowerment food security. NTFP value chain, rural markets, sustainable livelihoods

1. Introduction

The tribal communities across the country are largely dependent on Non Timber Forest produce (NTFP) collection as a major source of their livelihoods. Almost round the year, NTFP (also known as Minor Forest Produce or MFP) collection, though often insufficiently remunerative, remains a regular economic activity for them. In fact NTFP collection moderates the seasonality of income for the poor tribal community by providing income during slack seasons. Lack of choice makes the dependence of tribal communities on NTFP collection almost irreversible phenomenon. It is also a well acknowledged fact that the involvement of women in this particular livelihoods activity is extremely high in India.

The NTFP dependent populations per hectare of forest cover probably have remained almost constant or might have even gone up in the last quarter of a century. With dwindling forest cover and without any significant decrease in the number of poor dependent on NTFP collection, the issue of alleviating the livelihoods of the poor especially the tribal women engaged in NTFP collection becomes extremely challenging. The existing regulatory framework though underwent some remarkable changes in recent times at national and state level, still, due to various factors, does not help much to the cause. Government policies over a period of time have only created a large monopoly without really addressing the key issues plaguing the poor NTFP collectors. Ownership, price fixation, value addition and marketing of NTFP remain key issues and the NTFP collectors have hardly any role in determining these thus subjecting them entirely to the mercy of external factors without any bargaining power. Though NTFP collectors are the most important and critical actors in the NTFP value chain, they have no control over the NTFP value chain. *Besides this, one of the biggest challenges still is how to address the over exploitation of the forest resources again compounded by the unsustainable collection practices prevailing in most part of the country*. One hand the livelihoods of some of the most vulnerable groups of the society is under threat and on the other sustaining the bio diversity and preserving the eco system remains a major cause of concern.

NTFPs have attractive considerable global interests in recent times, due to its contribution of food security, income and employment generation for the people living inside and outside forest providing opportunities for forest based outer prices, potential for export market and support to biodiversity conservation. So the conservation of NTFPs is necessary not only for our country but also for the whole mankind. But in present scenario, depletion of forest makes many NTFP in vulnerable condition. Some NTFPs are under serious threats line Patalgaruda root (Raulfia-serpentine-root), Satavari, KOCHILA -Nuxvomica etc. All the varieties are going to be gradually extinct from the nature for its commercial uses.

Many women friendly NTFP which contributes to about 20% to 40% of the annual income are gradually verge of extinction due to destructive harvesting practice increasingly affect the livelihood of the forest dwellers women. The crazy of Little bit of lucrative price offer by the traders to meet their own market demand increased flood gate of destructive harvesting of NTFP that include all item like commercial variety-underutilized and non utilized species ignoring good conservation practice principle. Medicinal plant board of India already identified 32 forest based medicinal NTFP as endangered and attempt has been made to survive these species through ex- situ cultivation.

Encouragingly, there are many interventions, initiated during the two decades in various parts of the country have yielded significant positive result on both the account. Some of these interventions could address market imperfections through interventions on different points of the NTFP value chain; some of them were extremely successful in regeneration and some in both. But what is common in all these interventions is strong focus on building the institutions of NTFP collectors especially women. The SHGs of women NTFP collectors whether in Odisha, MP or AP have demonstrated the capacity of poor women to play very strong role in the NTFP value chain starting from regeneration of species to marketing of value added products. These SHGs federated into higher level institutions like village organisations and even block and district level federations

2. Economic Potential and value of NTFP

- There are over 3000 species of NTFP in India, which are integral components of local economy and culture & the major source of both self-employment and indirect employment in forestry is the collection, processing and sale of a wide range of NTFPs
- There are approximately 700 million+ people living in and around the forests whose survival can be said to be dependent on supplementary income from NTFP. Seventeen percent landless depend on daily wage related to collection of NTFP.
- Over 50 per cent of the revenue earned by the forest department comes from NTFP. Its growth is generally 40 per cent higher that timber (ICFRE, 2000).
- Sixty per cent of NTFP are collected from the eight states of Maharashtra, Madhya Pradesh, Chattisgarha, Rajsthan, Gujurat Jharkhand, Orissa and Andhra Pradesh. These states also contain 65 per cent of total india tribal population, Uttarakhond, Himachal Pradesh alone attributed 22%, Rest by NE states (11th Planning Commission,).
- At the National level over 50 percent of forest revenue and 70 percent of forest export revenue comes from NTFP mostly from unprocessed or raw material.
- Small scale forest based enterprises many of which rely on NTFP, provide up to 50 per cent of the income for about 25 per cent of India's rural labour force.
- Sixty per cent of the NTFP collected are consumed as food or as a dietary supplement by forest dwellers. NTFP serve as a crucial element in the livelihood system of forest dwellers.
- Women's employment in forest based enterprises is estimated to be approximately 571.533 million days annually of which 90 percent is in small scale enterprises using NTFP (11th planning commission)
- The three main cash earners among NTFP, Sal (*Shorea robusta*) seeds and tendu (*Diospyros melanoxyion*) leaves, Mahua (madhuca indica) are collected primarily by women. It is estimated that more than 350,000tonne+

3. Gender Roles in Harvesting of NTFP

It was found that women play a dominant role in harvesting of NTFP. The most common method used by them is by sweeping and gathering from forest floor. It was estimated that out of total collection of NTFP, up to 80 per cent of the NTFP is collected by women alone. It was also noted that productivity of NTFP collected by women and children is stable over the years.

In conclusion, it was found that NTFP is an essential resource for the people of Southern for their survival as well as meeting socioeconomic needs. Recent institutional changes through JFM activities have resulted in increased value and consciousness about method and level of NTFP harvesting. Although, there is an increasing pressure from neighbouring villages due to economic values of NTFP, but women are playing active role in setting of do's and don'ts related to harvesting of NTFP through JFM committee

4. Overarching beliefs in NTFP livelihood

In Keonjhar the forest dwellers especially women following the cultural tradition of worshipping the tree before collection of NTFP it is quite visible in case of Mohua, Mango and Tamarind, Char Sialil eaves. The worshipping of the tree forest fruits and seeds are organized at the community level. It is pertinent to mention here that due to lack of irrigation facility, the agricultural productivity is only at the subsistence level and hardly provide any cash income. The author has observed that out of the annual cash earning per house hold comes from NTFP. However incase of landless families about 50%of annual cash income comes from sale of NTFP. Cutting of Mohua tree is regarded as sin among the tribal's.

The Different policies of forest policy of All government initiatives planned to meet

For the Poor

- Focus on the poor- All initiatives started with the poorest tribal forest dwellers
- Focus on women Food security and, social security of communities - they are more vulnerable within the family be given highest priority in allocating resources
- ensuring increased empowerment of the women tribal forest dwellers community& strategy of engagement of the Poor
- Universal social inclusion and universal social mobilization in a time bound manner
- Transparent and participatory identification of women NTFP dwellers
- Transformation of Federations of institutions poor women NTFP dwellers as 'force multipliers' and as 'sensitive support structures' to promote and nurture NTFP dwellers S.H.Gs.

By the Poor

- Participation of the NTFP dwellers, particularly the poorest, in all decisions on Managerial and financial self reliance
- Development and continuous capacity building of large pool of social capital at village/block level- community leaders, community professionals and community resource persons

Sustainable livelihoods

- Ensuring NTFP as primary sector livelihoods of the poor are viable and sustainable – eco friendly, based on local resources (to the maximum extent), and climate change resilient
- Building social capital (community professionals, community best practitioners) around livelihoods
- Building capacities of the institutions of the poor to manage livelihoods value chains on their own

5. Women Dependence on NTFP along with its employment potential

In general, forest fringe communities and upland farmers are more dependent for their livelihood on NTFPs than lowland farmers for: a) earning cash income; b) satisfying household needs such as fodder, medicine, shelter, and other household goods; 3) sourcing traditional agricultural inputs such as leaf litter, wild plants, small tools and water; and 4) obtaining supplementary foods such as roots, tubers, vegetables, fruits and grains for the family. Due to their physical remoteness, linkage between local community and forestry is traditional and they are economically & ecologically inseparable from each other. Their dependency on the forest resources is both historic and cultural so much so that they constitute an integral component of the forest ecosystem of the region. It is claimed that 1.6 million person years of employment in India are from NTFP while the forestry sector in total provides 2.3 million person years of employment. (Shiva & Mathur, 1998).

Seasonality of Some Commercial NTFP collection and trading Provide direct employment to the Women forest dwellers

Table 1

Name of the Commodity	JAN	Feb	Mar	APR	May	June	July	Aug	Sept	Oct	Nov	Dec
Tamarind		C	C									
			PT	PT	T							
Mahua Flower			C	C								
				PT	PT	PT	T	T	T			
Mahua seed					C	C	C					
							PT	PT	T	T		
Sal leaf	C	C		C		C	C	C		C	C	C
	T	T		T		T	T	T		T	T	T
sialileaf	C	C								C	C	C
	T	T								T	T	T
Char seed				C	C							
					PT	PT	T					
Kusum lac				C	C	C						
					PT	PT	T	T				
Harida	C										C	C
	PT	T	T									PT
Amala	C	C										
	PT	PT										
Gum	C		C	C								C
	PT	T		PT	T							
Neem seed						C	C					
							PT	PT	T			

C : Collection season
PT : Peak trading season
T : Trading season

6. Unsustainable harvesting & increasing vulnerability of women forest dwellers

As in Odisha 2000 NTFP policy, Forest Right Act 2006 and its Rule 2008 made categorically the forest is opened for all in NTFP collection, leading to immense unsustainable harvesting both 68 approved NTFP and good number of non-approved forest fruits, roots, leaves, nuts, seeds and barks. In result important species like medicine and aromatic plants are extinct and some of them coming under red endanger. The Red list of threatened species, prepared by the International Union for Conservation of Nature (IUCN), has listed 60 species forest origin plants as Critically Endangered and 141 as Endangered (IUCN report 2012)

In Keonjhar context prior 2001 one forest dwelling women is getting enough stuff for her family nutritional food, able to meet daily two square meal of the family and also generate good income for clothing and other needs including health and social festivals. It seen the thrust on maximum extraction on behest of traders rather than sustainable harvesting has been a major reason for the dwindling resource base of production/collection particularly NTFP after 2001. As noted earlier, this is an important reason for low incomes from NTFP consequent upon on practice of unsustainable harvesting. According to forest official at keonjhar out of 133 NTFP found in the district it had collected royalty on 70 items since creation of the division till March 2000.

Keonjhar Forest Division royalty collected NTFPs List

Table 3

S. No	Local Name / Trade Name	Botanical Name	Sl.	Local Name / Trade Name	Botanical Name
1.	Amla	*Embelica officinalis*	36	Mango kernel	*Mangifera indica*
2.	Ananta Mula	*Hemidesmus indicus*	37	Mankad kendu	*Diospyros embryopteris*
3.	Antia Patta	*Herictres isora*	38	Marking nut	*Semecarpus anacardium*
4.	Arrowroot	*Curcuma augustifolia*	39	Mat Reed	*Cyperus sacarisus*
5.	Atundi Lai	*Combretum decandron*	40	Nageswar flower	*Mesua ferrea*
6.	Atundi Fruit	*Combretum decandron*	41	Nux vomica	*Strychnus nux vomica*
7.	Baghanakhi seed	*Martynia annua*	42	Palas seed	*Butea monosperma*
8.	Bahada	*Terminalia belerica*	43	Phenaphena	*Oroxylon indicum*
9.	Baidanka seed	*Mucuna prunens*	44	Baduna	*Thysanolaena Maxima*
10.	Bana Haldi	*Curcuma arematica*	45	Putrani	*Roxburghl*
11.	Bana kulthi	*Tephrosia purpurea*	46	Rasna root	*Vanda taselleleta*
12.	Basil / Tulsi	*Oscimum sanctum*	47	Rohini fruit	*Soyamida febrifuga*
13.	Bel	*Aegel marmelos*	48	Sabai grass	*Eulaliopsis binnata*
14.	Benacher	*Vetivena zizanoides*	49	Satabari	*Asparagus racemosus*
15.	Bhuin neem / Kalmegh	*Andrographis paniculata*	50	Siali leaves	*Bauhinia vahili*
16.	Bhursunga leaves	*Murraya koenigii*	51	Siali seed	*Bauhinia vahili*
17.	Broom Grass	*Grass spp.*	52	Sidha fruit	*Lagerstromia parviflora*
18.	Cleaning nut / Nirmala	*Strychnos potatorium*	53	Sikakai	*Acaccia concinna*
19.	Dhatuki flower	*Woodfordia floribunda*	54	Simuli cotton	*Salmalia malabarica*
20.	Hansa Lato	*Aristolochia indica*	55	Soap nut Ritha Fala	*Sapindus emerginatus*
21.	Gila	*Caesalpinia crista*	56	Eksira Fruit	*Schrebera swietenindes*
22.	Gaba	*Recinus communis*	57	Tala Makhana seed	*Hydrophila aunculata*
23.	Harida	*Terminalia chebula*	58	Tamarind	*Tamarindus indica*
24.	Hill Broom Phuljhadu	*Arundinella csetosa*	59	Thatch grass	*Grass spp.*
25.	Honey	*Bee spp.*	60	Thorn Broom	*Astida setacea*
26.	Indra jaba / Korei seed	*Holorrhena antidysenterica*	61	Mahula seed	*Madhuca latifolia*
27	Jangal Jada/ Gaba	*Jatropha curcas*	62	Kusum seed	*Schleichera oleosa*
28	Kamala Gundi Fruit	*Melltus philippenensi*	63	Karanja seed	*Pongamia pinnata*
29	Katha chhatu	*Mushroom spp*	64	Neem seed	*Azadiracta indica*
30	Katha lai	*Cryptolepis bucnnai*	65	Char seed	*Buchananania lanzan*
31	Khajuri patia	*Pheonix sylvestree*	66	Chakunda seed	*Cassia auriculiformis*
32	Khelua Lai	*Denrris uliginosa*	67	Babul seed	*Acacia nilotica*
33	Landa Baguli	*Ocimum basilicum*	68	Baibidanga seed	*Embelia ribes*
34	Mahua flower	*Madhu indica*	69	Sal	*Shorea robusta*
35	Kantapadma	*Euryale ferox*			

Practicing unsustainable harvesting which made without conservation &regeneration strategy that directly affect production/collection of tan stuffs like immature harvesting of myrabolam Harida, Tamarind yield low return to gatherer high branch cutting collection of medicinal product Amala, food stuff Char delaying next fruiting by 3 to 4 years from same tree. Apart from that further production /reduction of tree borne oil seeds like karanja, kusum Neem also from char and Polanga etc increased vulnerability of women. Since they are living with age practice of NTFP collection miserably failed to worked as a casual labour being cope up with changed/upgraded agriculture practice that reduced income from NTFP and almost zero returns from agriculture ultimately suffered a lot under starvation, malnutrition high and on want of medicine high IMR and IMMR and make the forest dwellers women more vulnerable to sustain their livelihood and food security.

Economically Important MTFPs in terms of Women Livelihood and food security

Table 4

S. No	Commodity	Estimated Production Potential Qty in quintal	Average collection Potential Qty in quintal	Collection price fixed district administration per quintal	
				1998-99	1999-2000
1	Tamarind	80000	31000	500	550
2	Mohua flower	90000	22000	1000	500
3	Sal seed	30000	14000	175	225
4	Mohuaseed	18000	6000	1550	500
5	Karanja Seed	9000	3000	850	500

6	Myrabolam Harida	12000	5000	350	450
7	Chiranji Char	6000	3000	5000	10000
8	Lac (stic)	1600	900	2500	2500
9	Gum	12000	2000	900	900
10	Dhaura			900	900
11	Genduli Highly medicinal			500	6000
12	Neem seed	7000	5000	800	500
13	Wild honey	3000	700	500	6000

***Sources*:** TDCC Keonjhar: procurement and marketing plan & DFO office Keonjhar royalty demand from lease holders 1998-99 &1999-2000

A random study was made By RCDC in 2006-07 access economic of livelihood at Bada Jamuposi GP of Ghatagaon Block on 3items which indicated degree of dependency women in NTFPs.

Table 5

S. No	Commodity	Harvesting Period (Months	Period of collection	Period of collection	Total amount Collected In qtl.	Amount consumed in qtl.	Marketed surplus in qtl.	House hold involving in collection and trading
1	Tamarind	FEB- APR	10days	3 to 6	479	44.7	434.3	210
2	Mohua flower	March- APR	20 to 30 days	6 to 8	2596	375	2221	1122
4	Mohuaseed	June July	12 to 25 days	3 to 5	649	216.3	432.7	*

* In case of Mohua seed total HH involved in seed collection were 980 but in selling surplus stuff only 572 as most people keep mohua seed for their edible oil consumption and extracting oil by own indigenous of steam boiling and wood pressing process

Average Income per Women season wise

Table 6

Seasons	NTFP collected high commercial	Economy
January - March	Lac (resin), mahua, flower and tamarind	Over 75 per cent of tribal households in Keonjhar Orissa, Collect mahua flower and earn Rs.5000 a year. 6 to 9 thousand families are involved in lac production. Tamarind also provide Rs3000 to4000 per family
April- June	Tendu leaves, sal seeds and chironji, honey	All the women forest dwellers depend on seeds,leaves and resins from sal trees; tendu leafcollection provides about 90 days of full employment with average income raising from 3000 to 6000 per family involved in collection and selling
July- September	Chironji, mango kernel, mahua seed, neem seed, karanja seed, honey, bamboo and silk cocoons	80% of rural women depend on bamboo for livelihood; NTFP provide handsome income in their rainy days
October- December	Lac, kullu (genduli gum, salresins, Myrabolan sal leaf	1 lakh person days of employment from collection of gums, lac, Myrabolan sal leaf

Changes in quantum of total NTFPs arrival over a period of time in Dhenkikote, Ghatagaon and Suakati market of Keonjhar districts due to non adoption thumb rules of NTFP harvesting

Table 7

Local name	Availbility per anum in quintals		
	Last 1 Year	5 Year back	10 Yearback
Anola	150	560	1000
Bel	270	600	1800
Satabari	30	200	500
Lac	300	200	150
Mohua fruits	1500	2400	5400
Bibidanga	100	300	500
Harida	300	1000	2000
Dhatuki phool	100	700	1800
Char	200	500	2200
Bhuin nimb	38	350	600

Present Nature of Destructive harvesting Practice in the area

Forests whole of India including Keonjhar are under constant pressure from changing land use, poaching and indiscriminate harvest of different non timber forest produce (NTFP). There is need to planned strategy in addressing some Conservation issues that directly affect women livelihood. The specific areas of concern are under;

- Despite people centered policy/act, the anthropogenic pressures continue to be at work.
- Unsustainable / destructive extraction leading to loss ofviable population of g Germ plasm (e.g. char, Aonla, Satabai, Bhuin nimb, patal garuda etc.)
- The poor women collectors & children who are primary gatherer of, especially now have to travel more to collect NTFPs.
- Unsustainable harvesting continues to hunt forest conservation efforts.
- No evidence of positive impact on forest conservation due to employment created through NREGA, FDA, Construction, mining and road transport industries in rural areas.
- Now the Question is? How to set things right! More fund, New regulations, monitoring or CERTIFICATION!!.

7. Part wise destructive harvesting Practice that increases vulnerability of the Women forest gatherers.

i) Flower Fruits and Seed harvest

There are several stages along with the life cycle of an individual plant as it progresses from seed to adult. An adult plant produces flowers which need to be pollinated to produce fruits with seeds. Only some seeds germinate when they are dispersed (or fall under the parent plant) and make it to the sapling stage; likewise, only a few saplings make it to the adult stage of a mature plant. Only a fraction of the seeds in nature actually survive to become adult plants a growing demand for the fruit of *amla (Phyllanthus emblica)* is common across India. When the volume to be supplied is high (the fruits also spoil easily after they are plucked), branches of the tree are lopped for quick harvest of large quantities of fruit. When the fruit can be dried and stored for trade, sustainable harvest of trees has been observed. In many places, this results in stressed wild populations and severe fluctuations in yields Destructive harvest by cutting branches not by shaking greatly affected Bhalia - Marking nut (*Semecarpus anacardium)*, *Kochile*- Nux vomica (*Strychnus nux vomica), Kataka* - Cleaning nut / Nirmala- water purifier (*Strychnos potatorium),* Soap nut Ritha Fala- sampoo fruit (*Hydrophila aunculata)* starts fruiting after 3 years by that time wood mafia clean it from the forest as firewood.

In case of Dhatuki flowers (Woodfordia floribunda) which produce a chemical extracts for treatment of blood pressure many gynecological disorder and stomach ulcer and kidney blockage harvesting of all flowers without leaving a flower for fruiting and cutting shrub climber leads to total extiction of whole plant.

Impact

Removal of the reproductive parts like flower, fruit and seed may directly affect the regeneration, survival and life cycle of the plant. Populations that are subject to overexploitation of flowers, seeds or fruits could have lowered rates of regeneration. This can have a negative effect on the long term continuity of the species ultimately affect availability of food and income potential to women.

ii) Harvesting of Leaf

Like other parts of India the Keonjhar is highly prone to commercial leaf harvests in India. *Sal (Shorea robusta)* leaf, both for subsistence and commercial use, is extensively collected in tribal pockets The multi crore business of *kendu (Diospyros melanoxylon)* leaves, used for rolling *bidis* in the same region, also exists, with well determined markets, collection and post harvest management. *Siali (Bahunia vahlii)* is also collected destructively by cutting climber instead of plucking the leaf in adjacent areas for leaf plate making, a thriving industry in the region.

Impact

Harvesting of leaves may impact the growth, reproduction and survival of individual plants. Removal of leaves means removing some of the capacity of the plant to obtain energy (photosynthesize) and therefore may decrease the growth and reproduction of the harvested plants. For the same reason, over time it may also lead to the production of smaller frond or leaf sizes. Alterations to the growth, reproduction and survival of harvested plants can lead to changes in population structure and persistence. Leaves collection selling either processed or unprocessed or value added as plate and Dana/chauti are most convenient sources of daily bread and butter of women would be affected as explained poor quality immature growth leading loss of heavy wages. The heavy losses of income due to low production under quality directly affect their food security and compel them live in the state of starvation and malnutrition.

iii) Gums and resins

In Keonjhar there is plenty of Dhaura Gum, bahada Gum, palasa Gum and good quantity of Genduligum whose value of Rs6000 to 10000 and to resin –lac specially Kusumi lac provide Rs4000 per quintal and a Kusum tree provide annually 2 quintals of lac. These gums and resin are have many industrial uses like varnish and lacquer, paints and pharmaceuticals wood-work, waterproofing, ceramics, inks, coating, textiles, adhesives and more. In food and drinks they are used for their thickening and stabilizing properties. The industrial use of many gums and resins has declined due to availability of cheaper and synthetic alternatives. Some indigenous communities also use gums and resins for religious ceremonies.

Impacts

Resins are to be found in canals in the bark and wood which, when damaged cause the resins to flow out. Therefore, the impacts of unsustainable harvest of resins and gums are most evident whose yields decrease over time. It has also been observed that termites attack trees at the points where incisions have been made. These trees will have higher mortality rates. One can see many sal and Gum trees are largely affected by termites Apart from increasing vulnerability to pest attack, removal of bark also causes loss of nutrients and moisture. The higher price paying NTFP gum and resin have heavy physiological impact when unsustainable harvesting, heavy tapping resythesized, rates of growth, flowering and fruiting may also decrease production trend & early mortality of the tree. This ultimately leads to a loss of regular high income.

iv) Barks

In Keonjhar, the Terminalia spp like Arjuna (Termilnaia arjuna sap), Lodha medha (*(Litsea sebifera),* Khandakhai, Sunari (Cassia fistula) Phana phana (*Oroxylon indicum*), siali lai (Bahunia vhalli) is the bark of the climber) are bark harvested for medicinal and chemical processes. The presence of tannins in bark is a reason for their extensive collection. Indiscriminate collection of the bark has led to a depletion of the tree in all over keonjhar. Over the years, large scale planting of *Terminalia arjuna* took place in these belts and now, can also be seen along reserve forest area of the Keonjhar.

The tree is severely lopped and bark removed from the branches. The remaining wood is used as firewood another extensively used bark is Lodha medha *(Litsea sebifera)* for incense sticks, leading to an endangered status of the tree in most parts of India.

The bark also protects the plant against fires, fungal and insect attacks; it is often rich in chemical compounds that increase the protective capacity and play a role in medicine and dyes.

Impact

Removal of bark is likely to have a negative impact on the growth, reproduction and survival of individual plants. Bark removal has negative impact on the reproduction and survival of harvested plants, bark removal can lead to changes in population structure and threaten population persistence. It will affect both income and livelihood of the tribal traditional healers; local baidyas as well as women meet their health need and income.

v) Roots, Tubers, Bulbs, Corms, Rhizomes

The ground parts of plants are frequently used for food, medicine, fiber and dyes. A large category of medicinal plants fall into this category and they have been the ones which have on account of destructive harvesting process become rare and endangered *Shatavari (Asparagus recemosus)* and *Arow.roots – patal garuda)* are some of them in this category. Due to high demand and diminishing stocks in the wild, many of them are used as adulterants or substitutes. A study done by the Forest Department shows that 51% of the NTFPs collected for medicine are roots, tubers, bulbs, corms and rhizomes.

Impact

Alterations to the growth, reproduction and survival of harvested plants can lead to changes in population root harvest has a negative impact. It may lead to decline in population size and threaten the persistence of populations. Root harvest may also alter patterns of vegetative reproduction within the population. Many of the indigenous communities depend on the tubers of the *Dioscorea* spp desi alu groups and various rhizome and corms, for food. In many parts of Keonjar it is the only food source during famine. But destructive harvests without leaving a root, bulb, rhizome for regeneration make entire plant vanished or extinct – increased women's hunger days. The situation is very acute at the time of drought. After 2002 the situation is very grave. Though government lunched very soft scheme on food security for BPL but at the time of drought / famine 35% other group bound to suffer as forest has little availability of Roots, Tubers, Bulbs, Corms, and Rhizomes

vi) Whole plant harvest

Whole plant harvest here refers to the practice of harvesting whole plants including herbs, shrubs and herbaceous climbers. Whole plants are harvested for their use as wild foods and for medicinal purposes to extract the chemical components in the leaves and stems.

In cases Bhuin neem (Andrographic –paniculeta), whole plants are uprooted to collect only the tubers, roots, seeds or other parts, while the aerial parts are discarded. However, for some species the whole plant & all its parts are used. Most plants, for which underground parts are used, lose their whole plant. Harvesting of the whole plant results usually ends with in the death of the individual plant. If the plant is harvested before it sets fruit and disperses its seeds, the plant will not have had the no chance to reproduce and contribute to future generations.

Impact

Overharvesting of the Putrani(*Roxburghl),* Rasna root(*Vanda taselleleta),* Baibidanga seed (*Embelia ribes)* can lead to declines in population size and persistence. Unsustainable harvest has the potential to wipe out plant populations, particularly when plants are harvested before setting seed. Plants that are monocarpic – i.e. that reproduce only once in their lives or those that takes a long time to reach reproductive maturity are particularly vulnerable to overharvest when harvest occurs before reproduction. Monocarpic plants are those that flower, set seeds and then die.

Many forest conservation specialist after a good deal of research in field for years to-gether and trialed with local indigenous knowledge has prescribed some Thumb Rules for sustainable harvesting practice. IIFM- Bhopal, Forest Research Institute, P.O. New Forest, Dehradun researchers with practical trial at different climatic condition has suggested Sustainable harvesting protocols are to be practiced in NTFPs ensuring food security of poor tribal women forest dwellers. Some of thumb rules are indicated below:

A. Fruit, flower, and buds

1. In case of Flowers or buds are harvested, care can be taken to leave a percentage on the plant or leave a percentage of plants or an area unharnessed. This can also be the rule for harvest of young immature fruits.
2. In case of fruits are harvested, maturity of the fruit, size, colour and touch may be the indicator and should be adhered to. This can also be the rule for harvest of seeds.
3. When the harvest of fruit requires lopping of branches, tools can be designed to avoid this or decisions can be taken on the size of the branches that are permitted for lopping.

B. Leaf

1. Always leave some leaves on the plant so that growth and reproduction are not negatively affected.
2. When possible, harvest leaves only after seeds have been produced and when leaf production is highest.
3. Harvest less or postpone when environmental conditions are stressful.
4. Decrease harvest rates if leaf size, seed production or plant size is decreasing as this may indicate stress.
5. Decrease harvest if there is heavy pressure from grazing, fire or other events that may negatively affect the plants.
6. 'Spare' plants – leave some desirable plants and some areas unharvested to allow populations to recuperate and to be available for other organisms that may depend on them. Rotate the spared areas over years.
7. Observe whether leaves are short lived or long-lived; if they are long-lived, harvest sparingly and look for ways to increase the number of plants (planting, transplanting, etc). Thick leaves may be indicators of a long leaf life-span.
8. Leaves may have a natural fall time, make a note of this. Leaf fall maybe replaced by leaf exchange

C. Gums and resins

1. Avoid harvesting from young trees.
2. Avoid use of unmanaged fires while harvesting.

3. Use sharp tools when making incisions in bark and make the incisions longitudinal.
4. Do not harvest resins and gums too frequently, the sites should be altered.
5. Think about tree physiology and seasonal factors. The best time to harvest from the perspective of the harvester is often based on use values or ease of bark removal, rather than sustainable harvest. For example, avoid harvesting before or during leaf flushing and flowering. In areas when seasons are distinct, avoid harvesting in spring or fall.
6. Leave some resin or gum-producing trees un-harvested so that they can produce good quality seeds for regeneration.

D. Bark

1. Develop adaptive management plans that keep bark harvest intensity and frequency at a low level.
2. Avoid bark damage if you can. Harvesting only the outer flakes of bark are more sustainable than cutting into the bark deeply, or girdling the tree.
3. Retain adult trees which produce seed. This is especially important for trees that reproduce mainly from seed rather than from re sprouting.
4. Determine the appropriate rotation time. Rotation times vary with tree reproductive strategy, growth rates and the type of bark product required.
5. Think about tree physiology and seasonal factors.
6. Think about tree reproductive strategies. Trees that are able to re sprout vigorously may be more resilient to bark harvest than those that re sprout weakly or not *at all*.
7. Size class selection and thinning can be good management tools. Thinning of trees may increase bark yield.
8. Using banana leaves, moss or other material to wrap the trunk immediately following harvest may help prevent moisture loss and fungal attack.

E. Roots, tubers, bulbs & rhizomes:

1. Think about the type of roots harvested. Removal of the lateral roots of trees and shrubs often has less of an impact than removal of tap roots.
2. Minimize the impacts of harvest on individual plants. If possible, avoid uprooting entire plants. If whole plants must be uprooted, encourage replanting as some plants are able to survive and re-grow if they are replanted. Minimize the proportion of the roots removed from a single plant. Plants need belowground parts to obtain water and nutrients, to store energy and provide anchorage. The whole plant will not survive if too much of its roots are damaged.
3. Determine the appropriate rotation time, the frequency with which an area can be returned to for harvest. Rotation times will vary with the plant's resilience to root harvest and its reproductive strategy. Slow-growing re-sprouting that rarely produce seed are particularly vulnerable to overharvest.
4. Think about reproductive strategies. Trees that are able to re seed or re sprout well following root damage may be more resilient to root harvest than those that re-seed or re-sprout weakly or not *at all*.
5. Think about timing and seasonality. Delaying harvest until after a plant has reproduced may permit the continued persistence of the population even when harvest increases the mortality of individual plants.
6. Retain un-harvested adult plants which produce seed.

F. Whole plant

1. When possible, harvest plants after they have had a chance to set fruit and disperse their seeds.
2. Leave some healthy plants and some areas un-harvested to allow the populations to recuperate and to be available for other organisms that may depend on them. Rotate the spared areas over years.
3. Try to determine what proportion of plants should be left un-harvested as seed plants for the next generation. Because plants have different life histories, producing different numbers of seeds with different germination rates, this proportion will vary for different species under different conditions.
4. Decrease harvest if plant sizes or other desirable traits are decreasing within the population.
5. Decrease harvest if there is heavy pressure from grazing, fire or other events that may negatively affect the plants.
6. Try to determine what kinds of conditions (light, soils etc) the plant grows best in and manage populations to optimize these conditions

The non-destructive practice of NTFP harvesting will strengthen present earning capacity of women to three fold &it will facilitate to play central role in house hold economies apart from that NTFPs will also offer great promise for women producers in the informal economy. Although official production and trade statistics and research have somewhat neglected the sector, there is a sizeable and growing international market for NTFPs. These include essential oils, medicinal plants, gum Arabic, rattan, bamboo, natural honey, brazil (trikona phal)and other edible nuts, mushrooms, various types of fibre and other types of wild nuts and seeds used in cooking, skin care and for other purposes. In all, there are now 150 NTFPs of major significance in international trade.

Adaptation of sustainable harvesting practice, It will open new platform of income and employment to women gatherers. Even NTFPs may be gathered in the wild or from trees outside forests or produced in forest plantations and agro forestry schemes. The poor tribal household can safely rely on NTFPs for subsistence or income use them for health and nutritional needs as NTFPs provide a wide scope of entrepreneurships and wide employment scope include production value addition, and packaging transportation marketing, food additives (edible nuts, mushrooms, honey, fruits, herbs, spices and condiments, aromatic plants, game); fibres (used in construction, furniture, clothing or utensils); resins and gums; and plant and animal products (used for medicinal, cosmetic or cultural purposes) which can be done by women locally. As NTFPs also provide raw materials for national, large-scale industrial processing and are important export commodities, with at least 150 significant products in terms of international trade there is no scope of underemployment distress sale if sustainability of product flow maintained with conservation and continuation regeneration by applying thumb rule of NTFP harvesting.

Table 8: good sustainable harvesting practice for some of selected 17 NTFPs

S. No	NTFP	Botanical name	Parts used	Harvesting Practices		
				What	How	When
1	Aonla	Emblica officinalis	Fruits, seed	Fruit	Fruits can be harvested by using long sticks attached with a hook. as a thumb rule 1/3rd of the fruits should be left for consumption by birds and other animals for regeneration purpose. Cutting the branches or the whole tree for harvesting should be avoided	Oct – Dec. when the fruits have turned golden yellow from green
2	Arjuna	Torbinalia arjuna	Bark	Bark	Bark should be collected by sharp knife in a vertical manner instead of horizontal from the trunk of the tree. It should not touch the inner stem.	Throughout the year especially in summer seasons.
3	Bahada	Terminalia Belerica	Fruit, seed and bark	Fruit	Matured fruit should be collected by long bamboo stick or by shaking the branches. 1/3rd of fruits should be left on tree	Feb – March when the fruits turn black in colour
4	Bhalia (markingnot)	Semicarpus anacardium	Seeds, matured fruits, gum, oil	Fruits	Matured fruits should be collected by bamboo stick or shaking the tree instead of cutting the branches. Oil is extracted from its seeds which is rough and not edible and used as lubricant in cart.	Jan – march. When the fruits looks orange in colour.
5	Bhuin Nimba (chireita)	Andrograpic paniculate	Whole plant	Whole plant	The plant is harvested but some plants in that area should be left for future regeneration	After rainy season
6	Char (chironji)	Buchnania Lanzan	Seed, kernel	Fruits	Matured fruits can be collected by using a long stick fitted with a hook without cutting the tree. Some ripe fruits should be left in the tree to facilitate regeneration.	April – may.
7	Dhatuki	Woodfordia fruiticosa	Flower	Flower	Flowers should be collected by plucking. It should be collected when the buds are in full blossom.	Feb – april.
8	Harida	Terminalia Chebula	Fruit	Fruit	Matured fruits can be collected when they turn black in colour	Feb – mar
9	Khandakhai		Bark	Bark	Bark should be collected vertically from the trunk. The full circumference of the tree should not be removed. 2/3rd should be left for survival of the plants. Its powder is used in preparation of incense stick.	During summer session
10	Kusum (lac tree)	Schieichera oleosa	Fruit, seeds	Fruit	Ripe Fruits should be collected from the ground which fallen naturally. 1/3rd of the ripe fruits should be left in the tree for birds and animals through which regeneration is possible.	May to July when fruits look yellowish
11	Mahula	Madhuca indica	Fruits, seeds	Flower, seeds	Flowers should be collected from the ground. At the matured stage mahula seeds (tola) should be harvested once. For collection of seeds branches should not be cut. Some seeds should be left in the plant to facilitate further natural regeneration.	Mahula flower – mar – April. Mahula seeds- may – June
12	Musa kani		Root and leaf	Root, leaf	The entire creeping plant should not be cut out / dug out. Some person of the plants should be left for further creeping. Its root is used as"MULIKA" by the tribal people in fermentation of rice bear (Handia).	Throughout the year.
13	Patalagaruda	Ranwolfia serpentine	Root and Seeds	Root and Seeds	Generally roots are collected by uprooting the entire plant some plants should be left untouched for future regeneration. While collecting the seeds some seeds should be left on the plant for natural regeneration	Root-April to may Seed- June to July. When it looks fully Black
14	Sal seeds	Shorearobusta	Seeds & leaves	Seeds & leaves	For collection of seeds and leaves harvesters should not cut the branches. They should leave some seeds on the plant for natural regeneration for cleaning of teeth small new plant should not cut.	Seed- may to middle June. Leaves- throughout the year
15	Satavari	Asparagus racemosus	Tuborus & roots	Tuborus & roots	Roots should be collected after maturity. 1/3 of roots should be left in underground with mother plant. It should be collected when leaves of plant look yellow in colour	Dec to Feb.
16	Siali leaves & Seeds	Bauhinia vahili	Leaves & seeds	Leaves & seeds	For collection of leaves branches should not be wrenched out, which causes irreparable and damage to the plant. The matured fruits (not fully dried) should be plucked and seeds extracted by putting the pod on fire.	Leaves- throughout the year Seeds- may to June
17	Tamarind	Tarmarindus indica	Pud	Pud	Tamarind may be left on the tree as long as six month after maturity, so that the moisture content will be reduced to 20% or lower. Pickers should not be allowed to krack the fruits off with poles as this would damage developing leaves and flowers.	Feb to Mar

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