

Assessment of Non-Timber Forest Products from Community Managed Forest of Thenzawl Forest Division, Mizoram, Northeast India

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Abstract Non-timber forest products (NTFPs) represent one of the key sources of income and subsistence to the fringe communities living in rural areas. A study was conducted for the assessment of NTFP within the community forest of five villages under Thenzawl forest division. Participatory rural appraisal (PRA), questionnaire, field exercise, discussion, interview with the first hand NTFPs exploiter and sellers was adopted for the field study. Fuelwood, medicinal plants, fodder, wild vegetables, fruits, broom grass, thatch grass, bamboo pole and cane species are the main NTFPs harvested from the community forest. Among all the NTFPs, the highest percentage of household involvement was found in fuelwood, i.e. 53% of household and least in medicinal plants 5%. It was harvested for their own consumption as well as for selling to the market to meet their needs. Edible food and fruits are sold to the market and it was estimated that Rs 300 (Rs/hh/yr) was earned by each household through the selling of this NTFPs from the community forest alone. No marketing channels are linked with fuelwood, medicinal plants and fodder since they harvest only for their own consumption.

Keywords Community forest, Subsistence, Non-timber forest products (NTFPs), Thenzawl forest division.

Introduction

Non-timber forest products (NTFPs) are known to contribute significantly to the household income of people living in and around the forest. They also play a vital role in sustaining their livelihood for centuries (Mukul et al. 2015). According a study made by World Bank (2002), more than 1.6 billion people rely on the forest resources for their livelihood while 350 million people depend for their subsistence and income. It was also estimated that one third of the world's population use different NTFPs in their day to day lives, biomass fuel, mainly firewood is used to cook and heat their homes, they also rely on some of the traditional medicinal plants (Arnold et al. 2006). NTFPs contribution to the rural livelihood and subsistence has been studied by a number of authors (Shrestha et al. 2003, Gauli and Hauser 2009, Singh et al. 2013, Harnandez-Barrios et al. 2014, Mukul et al. 2015, Pandey et al. 2016, Sanjay and Paul 2016, Suleiman et al. 2017, Asfaw and Etefa 2017, Islam and Quli 2017, Saikia et al. 2017). Most of these studies report the dependence of the non-timber forest products in terms of collection and household consumption. There is hardly any information on the collection and marketing dynamics of these NTFPs and to what extent these could help sustaining the rural livelihood (Bista and Edward 2006).

In India, more than 41 million tribal and forest dwellers derive their earning through NTFPs after

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they use 60% of their collected NTFPs for their own consumption (Prasad 1985). From a household survey at Midnapur forest, it was observed that 122 plant species are used by the people out of which maximum was food species (44), followed by fuel (39) and medicinal purposes (18) (Malhotra et al. 1991). Marketing channels linked through NTFPs especially bamboo and cane are not a high cost but it provides an active and efficient strategy for employment generation giving opportunity for the illiterate, and semi skilled laborers in rural areas (Alamgir et al. 2005, Alamgir et al. 2006, Mukul and Rana 2013). The same case was seen in the context of the state, different kinds of NTFPs especially wild fruits, vegetables and bamboos provide an opportunity for the landless farmers, illiterate and women. NTFPs play an important role in the social domain of Mizo villagers (Lalremruata et al. 2011). Since they rely on their agricultural crop which was grown once a year based on rain—fed, they exploit more NTFPs (Sahoo et al. 2010). Non-timber forest products are considered to be more important resource than the timber yielding plants (Wunder 2000).

As far as the ownership is concerned there are two types of forest in Mizoram, namely government owned and community owned forests. While the management of the former rest with the government department, the later is managed by the community since time immemorial. In the northeast region of India, the local people conserve the community forest based on principles of providing different opportunities for extraction of goods, legitimate needs and to ensure continued existence for future (Chatterjee et al. 2000). According to the studies conducted by Tiwari et al. (2013) 11 types of community forest are recorded in the three north eastern states of India viz. Group of village forest, village forest, restricted forest, sacred forest, clan forest, cemetery forest, regeneration forest, bamboo forest, recreation forest, village reserved forest and medicinal plantation.

Unlike the harvesting of non-timber forest products in natural or government owned forests for majority of products where auctions are being invited. The collection and harvesting dynamics in

community forest are different, the villagers can easily accessed NTFPs but over harvesting of any kinds of NTFPs are prohibited, they can harvest for their own consumption and if the product is in surplus they retain some and sell it to the market. Rules and regulations are formulated by themselves based on the socio-political and economic environment of their village (Tiwari et al. 2013). Under customary law, the forests are classified into different types depending on their intended use. The community forest has its own pattern of ownership which is very complex and diverse (Tiwari et al. 2010). Harvesting of NTFPs do lesser damage to the forest and its surroundings, maintain sustainable harvesting of forest resources and thus serve economically competitive and sustainable alternative to logging (Ros-Tonen and Wiersum 2003). The modern days forest exploiters are no longer merely hunters and gatherers and the farmers are no longer exclusively farmers. As such is the case, harvesting of NTFPs play a very important role and even if they engaged in other external networks, they still partly rely on NTFPs for their own consumption (Wiersum and Shackleton 2003).

Though a number of studies have been undertaken in Mizoram to document the non-timber forest products and their potential to contribute to rural livelihood (Sahoo et al. 2010, Sahoo et al. 2012, Mukul et al. 2015) no efforts have been made to inventorize the NTFPs from the community owned forests. The objective of the present study was to document the traditional use of different medicinal plants and other non-timber forest products, their use value, harvesting and processing of major NTFP from community forest.

Materials and Methods

General introduction to Mizoram

Mizoram is one of the north-eastern states of India and situated between 21°58' North to 24°15' North latitude and 93°15' East to 93°29' East longitude covering an area of 21,081 sq km with a population of 1,091,014 (2011 census, Economic survey of Mizoram). The state share its international bor-

Table 1. Socio-economic profile of different villages under Thenzawl forest division (BKT-Baktawng, KTM-Keitum, SLK-Samlukhai, RLT-Ranlaitui and NLH-Neihloh).

Attributes	Thenzawl FDA				
	BKT	KTM	SLK	RLT	NLH
Population					
No. of household	681	446	256	120	70
Male	1890	1200	700	318	197
Female	1814	1000	800	212	125
Total population	3704	2200	1500	580	392
No. of BPL &	40 &	70 &	60 &	50 &	26 &
AAV household	25	30	40	33	15
No. of VFDC beneficiaries (hh)	140	120	135	70	60
Educational level					
Matriculation	300	100	100	48	33
Graduate	60	50	15	15	–
Literacy rate %	90%	95%	95%	94%	92%
Occupation					
Government service	50	30	30	20	20
No. of <i>Jhum</i> families	80%	80%	75%	80%	95%
Full time NTFP exploiter	–	2%	4%	3%	6%
Part time NTFP exploiter	50%	60%	70%	50%	70%
Infrastructure					
High school	1	1	1	1	–
Primary school	5	3	3	3	1
Anganwadi centers	2	4	5	2	2
Sub-center / PHC	–	1	1	–	1
Bank	–	–	–	–	–
Spring water	10	2	10	3	5
Community hall	2	1	1	–	1
Church	8	9	5	4	3
Transport					
Road connectivity	Black toppin g	Black toppin g	Black toppin g	Black toppin g	Jeepable
Location (in kms from Aizawl)	75	225	60	120	105

der with 722 kms with Bangladesh and Myanmar (Government of Mizoram 2016). Mizoram enjoys moderate climate and temperature varies from 11°C in winter to 30°C in summer or spring. According to the Indian State Forest Report 2015, 86.27% total geographical area of the state is covered by forest. According to the report, Mizoram has an area of 138 sq km very dense forest (VDF), 5,858 sq.km of

moderately dense forest (MDF) and an area of 12,752 sq km of open forest (OF).

Study site

The study on the assessment of non-timber forest products (NTFPs) was carried out in community forest of five villages under Thenzawl Forest Di-

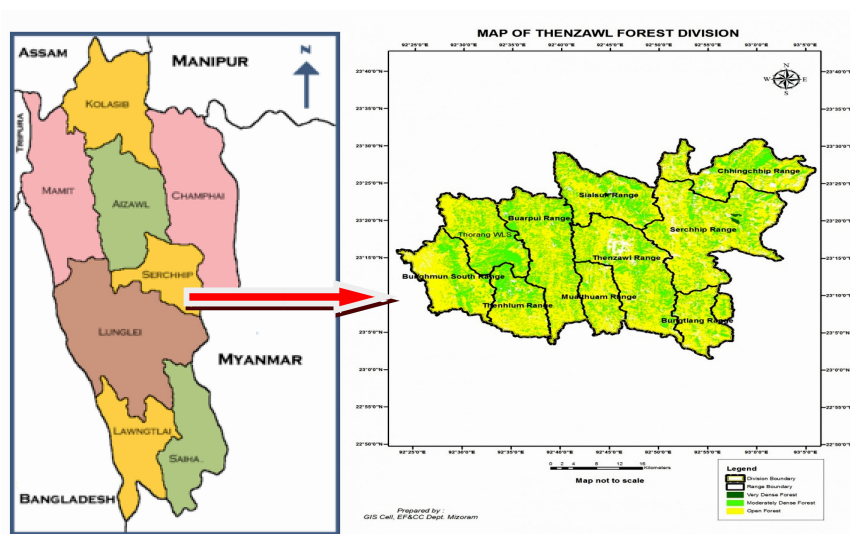


Fig. 1. Map of Mizoram showing study sites.

vision viz. Baktawng (23.5365°N 92.8465°E), Keitum (23.2320° N 92.9114°E), Neihloh (23.2349°N 92.7065°E), Ramlaitui (23.4129°N 92.7313°E), and Samlukhai (23.1815°N 92.7369°E), during the year 2014-2017 (Fig. 1).

Participatory rural appraisal (PRA) was adopted for the field study. Both primary and secondary data were collected through semi-structured questionnaire, field observation, personal interview and group discussion with the community. In order to avoid the gender biasness, both the men and women are included while collecting information. The socio-economic profile was noted to know the status of each of the village. Detailed information on marketing channel of NTFPs was also collected from the first hand NTFPs exploiter and stakeholders were interviewed from local market and nearby junction selling points. Assessment of NTFPs in different aspects like use value (UV), locally growing condition, use category and marketing channel are also done from the five villages by participatory discussion method.

Use value (UV)

The use value of plants by Pardo-de-Santayana et al. (2008) was used to calculate the diversity of uses

of plants. In this method the informants were asked to identify the nature and use of five selected plants on the basis of three categories (food, medicinal and economic) values. The overall mean value UV_{is} represents the mean number of a given plant species (s), as recognized by a single informant (i_s). Then the overall use value of species (UV_s) based on the information from the total number of informants can be calculated by using the following equation.

$$UV_s = \sum UV_{is} / i_s$$

UV_{is} = The overall use-value of species s, UV_{is} = The use-value of the species s as determined by informant i, i_s = Total number of informants interviewed for species s.

Results and Discussion

Socio-economic profile

Population : Among the five surveyed villages Baktawng village has the highest number of household 681 with 3704 population followed by Keitum village with 446 household and 2200 population, Samlukhai village with 256 household and 1500 population, Ramlaitui village with 120 household and 580 popu-

Table 2. Medicinal plants and their uses under Thenzawl forest division.

Sl. No.	Medicinal plants	Local name (Mizo)	Family	Parts used	Mode of utilization
1	<i>Adiantum philippense</i> L.	Lungpuisam	Adiantaceae	Whole plant	The whole plant is boiled and used in treatment of dysentery and stomach ulcers.
2	<i>Aporosa roxburghii</i> (Wall. ex Lindl.) Baill.	Chhawntual	Euphorbiaceae	Bark	Decoction of bark is used as remedy of stomach ulcer and diarrhoea.
3	<i>Anogeissus acuminata</i> (Roxb. ex DC) Guill.	Zairum	Combretaceae	Bark	Decoction of bark is boiled and used for the treatment of stomach problems.
4	<i>Artemisia vulgaris</i> L.	Sai	Asteraceae	Leaves	Leaves are boiled and used in treatment of stomach-ache and sores.
5	<i>Benincasa hispida</i> (Thunb.) Cogn	Mai-pawl	Cucurbitaceae	Fruit	Fruit juice is used for treating diarrhoea and vomiting.
6	<i>Begonia sikkimensis</i> A. DC.	Sekhupthur	Begoniaceae	Stem	Juice of stem for treating pile related problem.
7	<i>Blumea lanceolaria</i> (Roxb.) Druce	Buarze	Asteraceae	Leaves	Decoction of leaves used for treating stomach pain and also to rejuvenate cancer patient.
8	<i>Costus speciosus</i> (J. Konig) Sm.	Sumbul	Zingiberaceae	Rhizome	Juice of crush roots given to kidney related problems.
9	<i>Dendrocnide sinuate</i> (Blume) Chew	Thakpui	Urticaceae	Roots	Decoction of roots used in disease of liver, jaundice and skin itching.
10	<i>Hedyotis scandens</i> Roxb.	Kelhnamtur	Rubiaceae	Leaves, Roots	Decoction of leaves is used in urinary problems.
11	<i>Homalomena aromatica</i> (Spreng.) Schott.	Anchiri	Araceae	Leaves, stem	The leaves and stem are cooked along the fodder of pigs to increase their breast milk.
12	<i>Imperata cylindrica</i> (L.) Raeusch.	Di	Poaceae	Roots	Decoction of roots used for expelling thread worms from the body.
13	<i>Jasminum laurifolium</i> Roxb. ex Hornem.	Maufimhrui	Oleaceae	Leaves	Juice of the leaves is an effective remedy for kidney disease.
14	<i>Litsea monopetala</i> (Roxb.) Pers	Nauthak	Lauraceae	Leaves	Crushed leaves applied to cattle sores and also added along the fodder.
15	<i>Lindernia ruellioides</i> (Colsm.) Pennell	Tha-suih	Scrophulariaceae	Whole plant	The whole plant is used as a poultice for cramps, rheumatism, sciatica and wounds.
16	<i>Mikania micrantha</i> Kunth	Japan hlo	Asteraceae	Leaves	Juice of leaves applied to cuts as antiseptic.
17	<i>Molineria capitulate</i> (Lour.) Herb.	Phaiphek	Hypoxidaceae	Tuber	Juice of crush tuber is used to cure abdominal pain.
18	<i>Securinega virosa</i> (Roxb. ex wild.) Baill.	Saisiak	Euphorbiaceae	Leaves	Decoction of the leaves used for bath in case of measles and chickenpox.
19	<i>Sapindus mukorossi</i> Gaertn	Hlingsi	Sapindaceae	Fruit	Infusion of the fruit pulp is used for curing sore throat and also fruits eaten by tonsillitis.
20	<i>Solanum indicum</i> L.	Tawkte	Solanaceae	Fruit	Crush fruits are applied to burns and insect bites.
21	<i>Trema orientalis</i> (L.) Blume	Belphuar	Ulmaceae	Leaves	Crushed leaves are applied to tooth for treating toothache.
22	<i>Vitex glabarta</i> R. Br.	Thingkha-wilunu	Verbenaceae	Bark	Decoction of the bark is used as a remedy for stomach problems.

lation and least populated in Neihloh village with 70 household and 392 population. Household who are engaged in other sector of economy are less likely depending on NTFP compared to their counter parts in

the farming enterprise (Jimoh and Azeez 2002). The village with the lesser number of household has higher percentage of involvement in harvesting of NTFPs as there are fewer number of livelihood options in

rural areas that can supplement household income.

Level of education : The level of education of a family is expected to influence the nature of their economic activity and level of income as well because education would make easier for household to comprehend negative externalities and passive user values of natural resources (Muchapondwa 2013, Newton et al. 2016). The respondents with higher education has lower exploitation rate of NTFPs as compared to those of respondents with lower educational qualification. This is mainly because education opens up alternative employment opportunities and diverts people from different activities for harvesting NTFPs (Newton et al. 2016). The NTFPs in community forest are more benefited by the household living in remote areas as compared to those living in towns because there is lack of alternative sources of income in remote areas which makes them to rely more on harvesting of NTFPs. Literacy rate was high in all the surveyed villages (Table 1).

Occupation : The occupations of majority of the villagers are agriculture and most of them are part time NTFPs exploiter. Highest percentage of full time NTFPs exploiter was found in Neihloh village (6%) followed by Samlukhai village (4%), Ramlaitui village (3%), Keitum village (2%) where no full-time NTFPs exploiter was found in Baktawng village as majority of the villagers are engaged in furniture works. Samlukhai and Neihloh village has the highest part time NTFP exploiter (70%), followed by Keitum village (60%) and least in Baktawng and Ramlaitui village with 50% of household engaged in exploiting NTFP part time.

Harvesting and processing of NTFPs

The Non-timber forest products utilized by the villagers are broadly classified into six major categories-Bamboo pole and cane, broom grass and thatch grass, edible food and fruits, fuelwood, fodder and medicinal plants. Harvesting period of NTFPs differs according to the plant species. NTFPs are harvested all through the year but there are some seasons in which the production favors higher harvesters, during

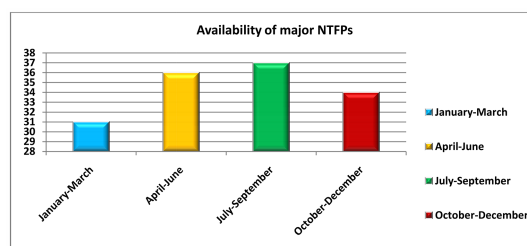


Fig. 2. Seasonality of NTFPs under Thenzawl FDA.

the month of July-September harvesting peak of NTFPs (Fig. 2). Least availability of NTFP was observed during the month of January–March.

Bamboo pole and cane

A total of six bamboo species belonging to four genera and four cane species belonging to four genera were encountered during the field sampling over the five community forest under Thenzawl forest division. *Bambusa tulda* Roxb., *Bambusa vulgaris* Schrad.ex J. C. Wendl, *Dendrocalamus longispatus* (Kurz) Kurz, *Dendrocalamus giganteus* Munro, *Dendrocalamus hamiltonii* Gamble, *Melocana baccifera* (Roxb.) Kurz, *Schizostachyun mannm* are the six bamboo species. Besides bamboo, cane species viz. *Arenga pinnata*, *Calamus gracilis*, *Melocana compactiflorus* and *Pinanga gracilis* are also utilized by the villagers. They harvest these bamboo and cane species to meet their daily requirement ; however, people also harvest bamboo poles and other NTFPs from adjoining areas. They have a strong believe that for all species of bamboo, harvesting mature culms and at the right season sustain their productivity. The bamboo species are used differently depending on the species. *Dendrocalamus longispatus* is mainly harvested for weaving local carrier Paiem and Paikawng. One mature bamboo (approximately 15 feet) is sufficient to complete one local carrier. *Bambusa tulda* is preferred over other bamboo species for weaving winnowing fan. *Melocanna baccifera* is used for making locally used different instrument handle.

Broom grass and thatch grass

Broom grass (*Thysalolaema latifolia*) is harvested during the month of January to April annually. It is

Table 3. Use value (UV) for fuel wood species under Thenzawl FDA.

Fuel wood species	Total ($\sum U_{is}$)	Mean (UV_{is})
<i>Quercus dealbata</i>	2	0.4
<i>Macaranga indica</i>	3	0.6
<i>Schima wallichii</i>	3	0.6
<i>Anogeissus acuminata</i>	7	1.4
<i>Quercus pachyphylla</i>	6	1.2

harvested by direct hand pulled on the clumps or using cutter. The harvested culms are further processed by spreading thoroughly in open air and exposed to sunlight for a week. Value addition of broom grass is also found in some of the study site which increases the market price. The demand of broom grass by every household makes the number of harvesters high in the entire study site.

Thatch grass (*Imperata cylindrica*)

Thatching is one of the most important sources of livelihoods for the villagers. Different materials are used for thatching their roof and *jhoom* hut, besides *Imperata cylindrica*, *Licuala peltata* leaves are also harvested and utilized for thatching. Thatch grass signifies the Mizo tradition in so many ways. Besides thatching roof, thatch grass is harvested for so many purposes like thatching pigsty, coop and also for decorating stall during cultural event. The processed grasses are used for thatching and mulching.

Medicinal plants

The medicinal plants harvested by the villagers are *Adiantum philippense* L., *Aporosa roxburghii* (Wall. ex Lindl.) Baill., *Anogeissus acuminata* (Roxb. ex

Table 4. Use value (UV) for five medicinal species under Thenzawl FDA.

Medicinal plants	Total ($\sum U_{is}$)	Mean (UV_{is})
<i>Artemisia vulgaris</i>	7	1.4
<i>Lindernia ruellioides</i>	5	1
<i>Securinega virosa</i>	12	2.4
<i>Litsea monopetala</i>	6	0.5
<i>Mikania micrantha</i>	13	2.6

Table 5. Use value (UV) for wild vegetables under Thenzawl FDA.

Vegetable species	Total ($\sum U_{is}$)	Mean (UV_{is})
Bamboo shoot	21	4.2
<i>Amorphophallus nepalensis</i>	12	2.4
<i>Amomum dealbatum</i>	9	1.8
Mushroom species	7	1.4
<i>Arenga pinnata</i>	7	1.4

DC) Guill., *Artemisia vulgaris* L., *Benincasa hispida* (Thunb.) Cogn, *Costus speciosus* (J. König) Sm., *Dendrocnide sinuate* (Blume) Chew., *Hedyotis scandens* Roxb., *Homalomena aromatica* (Spreng.) Schott., *Imperata cylindrica* (L.) Raeusch., *Litsea monopetala* (Roxb.) Pers. *Lindernia ruellioides* (Colsm.) Pennell, *Mikania micrantha* Kunth, *Molineria capitulate* (Lour.) Herb, *Securinega virosa* (Roxb. ex wild.) Baill., *Sapindus mukorossi* Gaertn, *Solanum indicum* L., *Trema orientalis* (L.) Blume and *Vitex glabarta* R. Br. They are used for treating different ailments like stomach ulcer, diarrhoea, stomach problem, kidney problem, urinary problem sores, antiseptic, and tooth ache (Table 2).

Leaves has the highest utilization among all the parts of medicinal plants (38%) followed by rhizome / roots / tuber (21%), fruit (13%), bark (12%), and least in stem and whole plant (12%). The highest parts used in leaves are mainly due to the easy availability and easy accessibility of leaves in most of the medicinal plants.

Edible food and fruits

Amomum dealbatum Roxb., *Amorphophallus nepalensis* (Wall.) Bogner and Mayo., *Centella asiatica* (L.) Urban., *Clerodendrum colebrookianum* Lindl., *Cucurma longa* Linn., *Dendrocalamus longispathus* (Kurz) Kurz, *Diplazium esculentum* (Retz) Sw., *Entoloma microcarpum* Berk and Br., *Eurya acuminata* DC., *Gnetum gnemon* L., *Homalomena aromatica* (Spreng.) Schott., *Melocanna baccifera* (Roxb.) Kurz, *Musa glauca* Roxb. *Oroxylum indicum* (L.) Kurz, *Parkia roxburghii* G. Don, *Persea americana* L., *Picria felterrae* Lour., *Solanum torvum* Sw and *Zanthoxylum rhetsa* (Roxb.) DC are the 19 edible

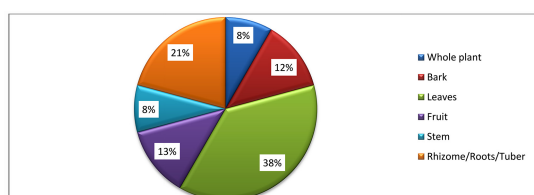


Fig. 3. Use of medicinal plants in parts wise from Thenzawl FDA.

food harvested by the villagers. *Amorphophallus nepalensis* undergo a number of processing steps to make it into edible form.

Fruits : *Artocarpus heterophyllus* Lam, *Ficus prostrata* (Wall. ex Miq.) *Ficus semicordata* Buch. Ham ex Sm, *Garcinia lanceifolia* Roxb. *Garcinia sopsopia* (Buch. -Ham.) Mabb. *Phyllanthus emblica* L., *Rhus chinensis* Mill and *Spondias mangifera* Wild. are the eight fruits species harvested by the villagers.

Fuelwood

Albizia chinensis (Osbecks) Merr. *Anogeissus acuminata* (Roxb. ex DC) Guill., *Bischofia javanica*, *Callicarpa arborea* Roxb, *Derris robusta* (DC.) Benth., *Elaeocarpus lanceifolius* Roxb. *Gmelina arborea* Roxb., *Macaranga indica*, *Schima wallichii* (DC.) Korth, *Quercus dealbata* and *Quercus pachyphylla* are the fuelwood harvested by the villagers from the community forest site. Not all the non-timber forest products are freely accessible. The amount of fuelwood allowed to harvest are limited to certain extend. Fuelwood was harvested mainly for their own consumption.

Fodder

Bidens pilosa L., *Imperata cylindrica* (L.) Raeusch., *Mikania micrantha* Kunth, *Musa balbisiana* Colla, *Thysanolaena maxima* (Roxb.) Kuntze are the five plant species harvested for fodder. They belong to the family Asteraceae, Poaceae and Musaceae. These fodders are harvested only for their own used.

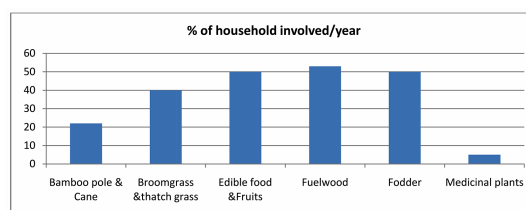


Fig. 4. Percentage of household involved in collection of NTFPs from Thenzawl FDA.

Involvement of villagers on harvesting of NTFP

Among all the non-timber forest products harvested from the community forest fuelwood has the highest percent of household involvement (53%) followed by edible food, fruits and fodder (50% each), broom grass and thatch grass (40%) and least involvement in medicinal plants 5% (Fig. 3).

The amount of NTFPs harvested from the community forest was calculated based on questionnaire and detailed interviewed from the harvesters. Fuelwood has the highest amount of NTFP harvested (44 kg / hh/ yr) followed by fodder (40 kg/hh/yr), edible food and fruits (30 / kg / hh / yr), bamboo pole and cane (26 kg/hh/yr), broom grass and thatch grass (25 kg/hh/yr) and least in medicinal plants (3/kg/hh/yr) (Fig. 4). Fuelwood, fodder and medicinal plants are harvested only for their own consumption while bamboo pole, cane, broom grass, thatch grass, edible food and fruits are linked with marketing channel.

Marketing of NTFPs

Bamboo pole and cane are made into handicrafts for weaving local carrier Paiem and Paikawng and sold in the local market @ Rs 300–400. Broom grass and thatch grass are also sold within the local market and nearby junction selling point at a small scale. One bundle of broom grass cost Rs 30. Thatch grass is also sold in bundle. *Eurya acuminata*, *Dysoxylum excelsum*, *Amorphophallus nepalensis*, *Amomum dealbatum*, mushroom and *Picrio felterrae* are the main food items harvested from the community forest. Leaves of *Eurya acuminata*, *Dysoxylum excelsum* and bulb of *Amomum dealbatum* are sold at Rs 20-30 / bundle. Semi processed bulb of *Amorphophallus*

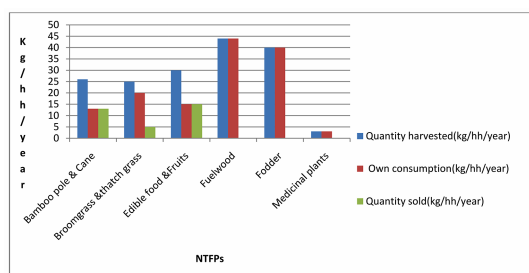


Fig. 5. Utilization of different groups of NTFPs under Thezawl FDA.

nepalensis was sold at 1 cup @ Rs 20. *Picria felterrae* are sold in the market only in dried form, one packet of *Picria felterrae* (20 g) cost Rs 30 (Fig. 5).

Monetary value from NTFPs

The amount of earning from selling NTFPs to the market was highest in edible food and fruits category with an earning of (300 Rs/hh/yr) representing 52%, followed by bamboo pole and cane (190 Rs/hh/yr) with 33% and least earning from broom grass and thatch grass (90 Rs/hh/yr) with 15% from total earnings from all the NTFPs (Fig. 6).

Use value (UV)

In this method, 10% respondents are randomly chosen from each study site. Each informant was then asked about the uses of those selected plants in order to determine the number and range of uses of each species. Data from each informant were then used to calculate the mean number of uses of a given plant species.

From Table 3, *Anogeissus acuminata* has got the highest mean use value ($UV_{is} = 1.4$) followed by *Quercus pachyphylla* ($UV_{is} = 1.2$), *Macaranga indica* ($UV_{is} = 0.6$) and *Schima wallichii* ($UV_{is} = 0.6$), and *Quercus dealbata* with the least mean use value ($UV_{is} = 0.4$). Overall use value for fuel wood species :

$$UV_s = \sum UV_{is} / i_s$$

$$= (0.4 + 0.6 + 0.6 + 1.4 + 1.2) / 5 = 1.64$$

From Table 4, *Mikania micrantha* ($UV_{is} = 2.6$), has got the highest mean use value followed by *Securinega virosa* ($UV_{is} = 2.4$) *Artemisia vulgaris* ($UV_{is} = 1.4$) *Lindernia ruellioides* ($UV_{is} = 1$) and with the

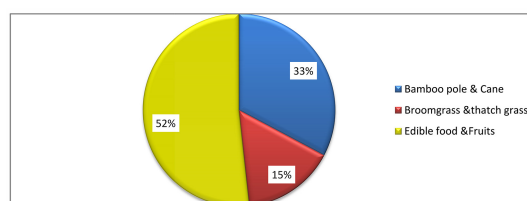


Fig. 6. Income generated through various groups of NTFPs under Thezawl FDA.

least mean use value *Litsea monopetala* ($UV_{is} = 0.5$). Overall use value for medicinal plants species :

$$UV_s = \sum UV_{is} / i_s$$

$$= (1.4 + 1 + 2.4 + 0.5 + 2.6) / 5 = 1.58$$

From Table 5, Bamboo shoot got the highest mean use value ($UV_{is} = 4.2$) followed by *Amorphophallus nepalensis* ($UV_{is} = 2.4$), *Amomum dealbatum* ($UV_{is} = 1.8$), *Arenga pinnata* and mushroom with the least mean use value ($UV_{is} = 1.4$). Overall use value for fuel wood species :

$$UV_s = \sum UV_{is} / i_s$$

$$= (4.2 + 2.4 + 1.8 + 1.4 + 1.4) / 5 = 2.24$$

From the above use value it is evident that higher UV value in each NTFP has got broad spectrum of uses in comparison to the lower value of NTFPs.

Conclusion

Non-timber forest products play a major role in enhancing the economic conditions of the people around the forests, especially for those who were landless farmers. In general, it was found that the villages that were remotely located had higher utility of non-timber forest products and was also linked to higher full-time exploiters and vice-versa. Among the different group of NTFPs, collection of fuel wood was a major activity by higher proportion of households across the villages. Edibles like fruits and wild vegetables contributed maximally to the household economics. Though there were seasonal fluctuations in NTFP availability, major share of NTFPs was available during July-September, arguably the peak season for NTFP production, during which the landless laborers (full-time exploiters) could be employable in sus-

taining their livelihood from the community forests.

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References

- Alamgir M, Bhuijan MAR, Jashimuddin M, Alam MS (2006) Economic profitability of cane based furniture enterprises of Chittagong City Corporation Area, Bangladesh. *J For Res* 17 : 153—156.
- Alamgir M, Jashimuddin M, Bhuijan MAR (2005) Employment generation and economics of cane based furniture enterprises of Chittagong, Bangladesh. *J Bamboo and Rattan* 4 : 279—292.
- Arnold JEM, Kohlin R, Person R (2016) Wood fuels, Livelihoods and Policy Interventions : Changing Perspectives. *World Development* 34 : 596—611.
- Asfaw A, Etefa L (2017) The contribution of non-timber forest products to the rural livelihood : The case of Yayo district, illuababora zone, Oromia regional state, Western Ethiopia. *Int J Appl Agric Res* 12 (2) : 157—169.
- Bista S, Edward WL (2006) Collection and marketing of non-timber forest products in the far Western Hills of Nepal. *Environm Conserv* 33 (3) : 244—255.
- Chatterjee S, Dey S, Rana RS, Sastrya ARK (2000) Conservation and sustainable use of natural bio resources : A case study on Apanati in Arunachal Pradesh, New Delhi: World Wide Fund for Nature - India, pp 19—32.
- Directorate of information and public relations (2016) Government of Mizoram.
- Economic Survey of Mizoram (2012–2013) Planning and Program Implementation Department Government of Mizoram.
- Gauli K, Hauser M (2009) Pro-poor commercial management of non-timber forest products in Nepal's Community Forest User Groups: Factors and success. *Mountain Res and Develop* 29 (4) : 298—307.
- Hernandez- Barrios JC, Anten NPR, Inez - Ramos MM (2014) Sustainable harvesting of non-timber forest products based on ecological and economic criteria. *J Appl Ecol* 52 : 389—400.
- Islam MA, Quli SMS (2017) The role of non-timber forest products (NTFPs) in tribal economy of Jharkhand, India. *Int J Curr Microbiol and Appl Sci* 6 (10) : 2184—2195.
- Jimoh SO, Azeez IO (2002) Prospects of community participation in the management of shasha forest reserve, Osun State, Nigeria. In : Abu JE, Oni PI, Poppla L (eds). *Proc of the 28th Annual Conf of Forestry Assoc of Nigeria. For and Challenges Sustain Livelihood, Akure*, pp 208—216.
- Lalremruata J, Sahoo UK, Lalramnghinglova H (2011) Inventory on non-timber forest products of Mizoram in North-East India. *J Non-Timber Forest Products* 14 : 173—180.
- Malhotra KC, Deb D, Dutta M, Vasulu TS, Yadav G, Adhikari M (1991) Role of non-timber forest produce in village economy: A household survey in Jamboni range. Mimeographed, Indian Institute of Bio Social Research and Development, Calcutta.
- Muchapondwa E (2013) The economics of community-based wildlife conservation in Zimbabwe. Number-130, PhD thesis.
- Mukul SA, Manzoor Rashid AZM, Uddin MB, Khan A (2015) Role of non-timber forest products in sustaining forest products in sustaining forest-based livelihoods and rural households resilience capacity in and around protected area: A Bangladesh study. *J Environm Planning and Manag* 59 (4) : 628—640.
- Mukul SA, Rana MP (2013) The Trade of Bamboo (Graminae) and Secondary Products in a Regional Market of Southern Bangladesh: Status and Socio-Economic Significance. *Int J Biodiver Sci Ecosyst Serv & Manag* 9 : 146—154.
- Newton P, Miller DC, Byenkya MAA, Agarwal A (2016) Who are forest-dependent people ? A taxonomy to aid livelihood and land use decision-making in forest regions. *Land Use Policy* 57 : 388—395.
- Pandey AK, Tripathi YC, Kumar A (2016) Non-timber forest products (NTFPs) for sustained livelihood: Challenges and strategies. *Res J For* 10 (1) : 1—7.
- Pardo-de-Santayana M (2008) Cultural importance indices : A comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). *Econ Bot* 62 (1) : 24—39.
- Prasad BN (1985) Regional Wood Forest Product Industries. Forest Industries Development Group. Asia Pacific Region, FAO, Kualalampur.
- Ros-Tonen MAF, Wiersum F (2003) The importance of non-timber forest products for forest-based rural livelihoods: An evolving research agenda. Paper presented at the International Conference on Rural Livelihoods, Forests and Biodiversity 19—23rd May.
- Sahoo UK, Jeecelee L, Lalremruata JH, Lalramnghinglova H (2012) Diversity of non-timber forest products of plant origin, use and local dependence in Mizoram, North-East India. *J Non-Timber Forest Products* 19 (4) : 261—268.
- Sahoo UK, Lalremruata J, Lalramnghinglov H, Lalremruati JH, Lalliankhuma C (2010) Livelihood generation through non-timber forest products by rural poor in and around Dampa tiger reserve in Mizoram. *J Non-Timber Forest Products* 12 : 147—161.
- Saikia A, Borah MP, Sarmah R, Autum A (2017) Non-timber forest products (NTFPs) and their role in livelihood economy of the tribal people in Upper Brahmaputra Valley, Assam, India. *J Bot Sci* 6 (1) : 23—28.
- Sanjay KV, Paul SK (2016) Sustaining the non-timber forest products (NTFPs) based rural livelihoods of tribals in Jharkhand: Issues and challenges. *Jharkhand J Develop and Manag Studies XISS, Ranchi* 14 (1) : 6865—6883.
- Shrestha KK, Tiawari NN, Rajbhandari S, Shrestha S, Uprety Y, Poudel RC (2003) Non-timber forest products (NTFPs) in the Critical Bottlenecks and Corridors of Terai Arc-landscape Nepal : Documentation, Utilization, Trade and Peoples Livelihood. Kathmandu : WWW-Nepal.

- Singh A, Bhattacharya P, Vyas P, Roy S (2013) Contribution of NTFPs in the livelihood of Mangrove Forest Dwellers of Sundarban. *J Human Ecol* 29 (3) : 191—200.
- Suleiman MS, Wasonga VO, Mbau JS, Suleiman A, Elhadi YA (2017) Non-timber forest products and their contribution to households income around Falgore Game Reserve in Kano, Nigeria. *Ecologic Proc* 6 : 23.
- Tiwari BK, Tynsong H, Lynrah MM, Lapasam E, Deb S, Sharma D (2013) Institutional arrangement and typology of community forests of Meghalaya, Mizoram and Nagaland of North-East India. *J For Res* 24 (1) : 179—186.
- Tiwari BK, Tynsong H, Lynser MB (2010) Forest management practices of the tribal people of Meghalaya., North-East India. *J Trop For Sci* 22 (3) : 329—342.
- Wiersum KF, Shackleton CM (2003) The role of natural resources in maintaining and enhancing livelihood diversification in South-Eastern Africa. Paper presented at land and livelihood in Eastern and Southern Africa, Cape Town, South Africa, 27—31st January.
- World Bank (2002) A revised Forest Strategy for the World Bank Group. Washington, DC : The World Bank.
- Wunder S (2000) Poverty Alleviation and Tropical Forest. What Scope for Synergies ? *World Development* 29 : 1817—1833.