

DIVERSITY, USE PATTERN AND MANAGEMENT OF FOREST RESOURCES IN THE EASTERN HIMALAYA: A CASE STUDY OF MIZORAM, INDIA

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ABSTRACT

This paper examines forests diversity, their use pattern and management in the Eastern Himalaya with a case study of Mizoram state. The Eastern Himalaya is one of the bio-diversity hotspots of the world where the forest diversity varies from the tropical rainforest to temperate and alpine types because of the altitudes. In the case study area i.e. Mizoram, forest types vary from tropical evergreen forests to montane and temperate with rich biodiversity. Forests are lifeline for livelihoods sustainability in Mizoram as it is the second largest source of income after agriculture. Total forestland is 90.68%. They are conserved by the community people and the state forest department. Even, the whole country received decrease in forestland; Mizoram has registered about 1.4% increase. A study on forest cover and changes in the eight sister states of the Eastern Himalaya during the last decades was carried out to penetrate the current status of forest. Data from the secondary sources were gathered largely from the Forest Survey of India (FSI) 1991, 2001 and 2011. Similarly, data from the Department of Environment and Forest, Government of Mizoram on forest diversity and their distribution were also collected. Further, wide range of discussion was made with the officials working in the forest department and with the local people to elaborate the other aspects of forest resources such as use pattern of forest products. Personal observations on forest diversity use pattern and management of forest resources in Aizawl district was also carried out.

Keywords: Diversity, Forest resource, Tropical rainforest, Forest management, Eastern Himalaya, Mizoram.

Contribution/ Originality

This study contributes the existing literature of forest resources in the Eastern Himalaya with special reference to Mizoram state.

1. INTRODUCTION

India obtains great altitudinal variations, diverse soil types and varying climatic conditions with rainfall variations, have been blessed with sixteen forest types ranging from tropical

rainforests to dry thorn forests based on species composition and plant functional types [1]. Out of the total forest cover in India (19.7%), approximately a quarter of forest cover is found in the Eastern Himalaya with an area of 637,293 km² and within the reserved, protected and unclassified forests. The eastern Himalaya, comprises of the eight sister states namely, Sikkim, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura, is considered as one of the global biodiversity hotspots [2] with varied climate ranging from humid tropical to sub-alpine type [3]. These states are also known for obtaining high ethnic and biological diversity and occupied part of the Indo-Burma biodiversity hotspots [2]. They obtain some of the largest reserves of tropical and sub-tropical forests of wet evergreen, semi- evergreen, moist deciduous, coniferous forests, mixed forest and shrub land [3, 4]. The two states of the Eastern Himalaya – Sikkim and Arunachal Pradesh – are characterized by the presence of coniferous forests in the higher reaches of the Himalaya (1600-2800 m). These forests include pine, oak, deodar, fir and spruce trees. The state of Mizoram has the diversity in forest types and these forests are distributed according to an elevation from tropical evergreen to montane and temperate forests.

Climatic factors mainly rainfall influence the forest types in the Eastern Himalaya. Several studies related to vegetation-climatic factors (rainfall) have been extensively documented in arid and semi-arid environments, there has been relatively limited research on such a link between vegetation activity and rainfall in high precipitation belts of the world, for instance the Eastern Himalaya [5-7]. The tropical forest of the Eastern Himalaya is the least water stressed region of all the tropical forests due to heavy rainfall [8]. Here, the rainfall trend follows an uneven and continuity throughout the year. The longest wettest period between May and September was witnessed during 1990-2000 [5].

2. GEO-ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS

Mizoram, literary known as the 'land of highlanders' lies in the eastern extension of the Himalaya, as a part of Arakan-Yoma mountain ranges of Myanmar. Its international boundary is delimited by Bangladesh in the west and Myanmar in the east and south. It obtains 21081 km² area and shares 0.64% of the country's geographical area. The state lies between 21° 56' N and 24° 31' N and 92° 16' E and 93° 26' E (Figure 1). The average altitude ranges from 500 m to 800 m with the maximum elevation 2157 m is found in Blue Mountain (Phawngpui) [9]. Climatic conditions vary from the moist tropical to the moist sub-tropical, not very warm in the summer season and not very cold in the winter season. During the winter, the temperature varies from 09°C to 18°C and in summer, it varies between 18°C and 30°C. Presence of regular monsoon tremendously influences this area. Heavy downpour occurs during the monsoon season from May to September and the average annual rainfall ranges from 2160 mm to 3500 mm. The high velocity of wind, characterized by turbulence storms blow during the two months of March and April. The direction of winds is cyclonic and the monsoon rain is also characterized by cyclones. The winters in Mizoram are normally rain free and sky remains almost clear during the four

months – November, December, January and February. High rainfall and moist climate provide high base for the rich biodiversity consequently the total land under vegetation is 90.68%. The actual tree cover area is about 75%. Forest is a lifeline of the populace of Mizoram as the large numbers of people are directly dependent on forest resources for running their livelihoods [10]. Agriculture, dominated by shifting cultivation, runs parallel and constitutes a major source of livelihoods. It covers about 50% area of the total sown area (4.5%). Industrially, this state is lagging behind as there are no major industries established till now. Forest based industries have the high potentials. Tourism may be the important industry as climatic conditions are very feasible throughout the year. Further, the panoramic landscape and evergreen forest are quite attractive and they will accelerate the tourism practices [11]. The population of the state was 1.09 million [12] which constituted 0.09% of the country's population. Of this, rural population was 48.49% and urban population was 51.51%. The population density was 52 persons per km². The livestock population of the state was 0.33 million [13].

3. FOREST DIVERSITY IN MIZORAM

Mizoram state has very high forest diversity. It forms a part of the **Indo-Burma Global Biodiversity Hotspot**. Forests diversity is characterized mainly by tropical rain forests; as most of the part of the state lies in the tropical regime. Meanwhile, montane and temperate forests are also found above 900m and 1600m, respectively. Bamboo forests are found almost in all altitudinal zones but restricted upto 1500m. In Mizoram, diversity in forests is found according to altitude, rainfall and dominant species composition. Table 1 shows altitudinal distribution of forests and their characteristics in Mizoram state.

4. FOREST COVER AND CHANGES IN THE EASTERN HIMALAYA

According to the latest satellite-based survey report of FSI, the Eastern Himalaya has 163 799

Table-1.Altitudinal Distribution of Forests in Mizoram

Types	Altitude	Characteristics
Tropical Wet Evergreen and Semi Evergreen Forests	< 900m	These forests are distributed mainly on the steep slopes, rocky and steady river banks and areas not suitable for shifting cultivation; and where rainfall occurs between 2000 and 2500 mm and temperature remains from 20° C to 22° C. However, tropical wet evergreen forests are found in the southern and western part and semi evergreen forests are found in the northern, northwestern and central part of Mizoram.
Montane Tropical Forests	Sub 900-1500 m	These areas are characterized by comparatively low temperature and less precipitation and are found in the eastern fringes bordering with Chin Hills of Myanmar. Pine forests are largely grown. The common species are <i>Castanopsispurpurella</i> , <i>Duabangagrandiflora</i> , <i>Myristica</i> spp., <i>Phoebe goalparensis</i> , <i>Pinuskesiya</i> , <i>Podocarpusneriifolia</i> , <i>Prunuscerasoides</i> , <i>Quercusacutissima</i> , <i>Q.semiserrata</i> , <i>Schimarwallichii</i> , etc.
Temperate	> 1600 m	These forests are very distinct from the temperate forests of

Forests		other parts of the Eastern Himalaya and are mostly found in the Lengteng, Naunuarzo, Pharpak, Thaltlang and Phawngpui reserve forests. The predominant arboreal forest species are <i>Pinuskesiya</i> , <i>Actinodaphnemicroptera</i> , <i>Betulaalnoides</i> , <i>Exbucklandiapopulnea</i> , <i>Elaeocarpusserratus</i> , <i>Dilleniapentagya</i> , <i>Micheliadoltsopa</i> , <i>M. Champaca</i> , <i>Garciniaanomala</i> , <i>Schisandraneglecta</i> , <i>Photiniaintergrifolia</i> , <i>Litseasalicifolia</i> , <i>Myricaesculenta</i> , <i>Lithocarpusdealbata</i> , <i>Rhododendron arboreum</i> , etc.
<i>Quercus</i> Forest	1100-1800m	These forests are distributed in small areas of the eastern part of Mizoram mostly in the Champhai-Baite hill ranges. The main species are <i>Quercus</i> and <i>Lithocarpusdealbata</i> .
Bamboo Forest	400-1500m	Bamboos usually grow as an under-storey to the tree species in tropical evergreen and sub-tropical mixed-deciduous forests, whereas <i>Melocannabaccifera</i> forms dense or pure forests in certain areas in the State. Bamboo forests are more sustainable in the <i>jhuming</i> system of cultivation. Along with bamboos <i>Emblicaofficinalis</i> , <i>Litseamonopetala</i> , <i>Pterospermumacerifolium</i> , <i>Terminaliamyriocarpa</i> , <i>Caryotamitis</i> , <i>Artocartuschama</i> , <i>Duabangagrandidiflora</i> , <i>Albiziaprocera</i> , <i>Gmelinaarborea</i> , <i>Syzygium</i> are also grown.

Source: Compiled by the authors

km² of forest, which is about 25% of the total forest cover in the country [14]. Here, all eight states have average 80% forest cover with huge biodiversity. Table 2 shows state-wise forest land cover and changes in the Eastern Himalaya during the three consecutive periods – 1991, 2001, and 2011. Even decrease in forest cover recorded in some states; -7% in Nagaland, -3.4% in Manipur and -1.9% in Arunachal Pradesh, the Eastern Himalaya as a whole registered 2.6% increase in forest cover from 1991 to 2011. The highest increase under forest cover was registered in Tripura (44.1%) followed by Assam (11.8%) and Sikkim (10.5%). Meghalaya registered 8.8% increase while Mizoram state obtained 1.4% increase in forest land cover during the corresponding years. This increase has been taken place at the time when shifting cultivation in the Eastern Himalaya got more frequent and intensified.

Table-2. State-Wise Forest Land Cover (KM²)/Change (%) in the Eastern Himalaya

States	1991	2001	2011	Change 1991-2011
Arunachal Pradesh	68757	68045	67410	-1.9
Asam	24751	27714	27673	11.8
Manipur	17685	16926	17090	-3.4
Meghalaya	15875	15584	17275	8.8
Mizoram	18853	17494	19117	1.4
Nagaland	14321	13345	13318	-7
Sikkim	3041	3193	3359	10.5
Tripura	5535	7065	7977	44.1
Total	168818	169366	173219	2.6

Source: FSI (Forest Survey of India) [9].

A group of people who are looking into the environmental affairs in this region has criticized the practices of shifting cultivation advocating that forest depletion at a large scale in this region is due to this practice. But, this study reveals that though, the practices of shifting cultivation are more intensified and frequent yet, it is limited in the areas where shifting cultivation was already carried out. On the other words, shifting cultivation did not spread in the other forest area during the past decades.

5. FOREST COVER AND CHANGES IN MIZORAM STATE

The forest cover in the state, based on interpretation of satellite data of January 2009, was 19, 117 km², which was 90.68% of the state's geographical area. The data of 2011 supports this number. Out of the total forest cover, protected area was 1240.75 km² which was 5.88% of the total geographical area. In terms of forest canopy density classes, the state has 134 km² area under dense forests, 6086 km² area under moderately dense forests and 12897 km² area under open forests. Table 3 presents district wise forest cover in km². It further reveals nature of forest cover i.e., very dense forest (VDF), moderate dense forest (MDF), open forest (OF) and percent of geographical area. Lunglei Lawngtlai and Saiha districts cover highest forest area (and 92.72%, 92.61% and 92.21% respectively) followed by Mamit (91.70%) and Aizawl districts (91.33%). The whole state covers 90.68% forest. In terms of the forest cover change during the last two decades, 1.4% increase was registered in Mizoram state.

Table-3. District-Wise Forest Cover (Area in KM²)

District	Geographical Area	VDF	MDF	OF	Total	Percent of GA
Aizawl	3575	26	1205	2034	3265	91.33
Champhai	3185	57	1096	1632	2785	87.44
Kolasib	1382	0	175	1046	1221	88.35
Lawngtlai	2557	0	704	1664	2368	92.61
Lunglei	4536	1	1233	2972	4206	92.72
Mamit	3025	45	697	2032	2774	91.70
Saiha	1400	0	568	723	1291	92.21
Serchhip	1421	5	408	794	1207	84.94
Total	21081	134	6086	12897	19117	90.68

Source: FSI (Forest Survey of India) [9]

Data on altitude-wise forest cover of Mizoram state was gathered from India State of Forest Report (ISFR) of 2011 (Table 4). The highest forest cover is found in the altitude below 500 m (42.4%) followed by 41.5% between 500 and 1000 m. Between 1000 and 2000 m altitude, forest cover is 16.0% while above 2000 m, it is 0.02%. Out of the total forest cover in the different altitudes, OF covers highest area (12897 km²) followed by MDF (6086 km²). VDF covers only 134 km².

Table-4. Forest Cover According to Altitude (KM²)

Altitude (M)	VDF	%	MDF	%	OF	%	Total	%
<500	15	11.2	1971	32.4	6129	47.5	8115	42.4
500-1000	56	41.8	2872	47.2	5001	38.8	7929	41.5
1000-2000	62	46.3	1241	20.4	1765	13.7	3068	16.0
>2000	1	0.7	2	0.03	2	0.02	5	0.02
Total	134	100	6086	100	12897	100	19117	100

Source: FSI (Forest Survey of India) [9]

(Based on SRTM, Digital Elevation Model)

Protected areas, in the forms of national parks and wildlife sanctuaries, covered 1240.75 km² which was 5.88% of the total geographical area (2011). There are three national parks and seven wildlife sanctuaries spread in seven districts of state. The first tiger reserve Dampa was established in 1994 is the first and the biggest (500 km²) national park located in Mamit district. The area of national parks and wildlife sanctuaries varies from 35 km² to 500 km². Table 5 reveals national parks and wildlife sanctuaries of Mizoram state.

Table-5. National Parks and Wildlife Sanctuaries

S. No.	Name of Protected Areas	Area in Km ²	District	Establishment year
1.	Dampa Tiger Reserve	500	Mamit	1994
2.	Murlen National Park	100	Champhai	2003
3.	Phawngpui National Park	50	Lawngtlai	1997
4.	Ngengpui Wildlife Sanctuary	110	Lawngtlai	1997
5.	Khawnglung Wildlife Sanctuary	35.75	Lunglei	2000
6.	Lengteng Wildlife Sanctuary	60	Champhai	2002
7.	Tawi Wildlife Sanctuary	35	Aizawl	2001
8.	Thorangtlang Wildlife Sanctuary	50	Lunglei	2002
9.	Pualreng Wildlife Sanctuary	50	Kolasib	2004
10.	Tokalo Wildlife Sanctuary	250	Saiha	2007

Source: DoEF, GoM, 2012

6. FOREST RESOURCES USE PATTERN

The forest resources have multiple uses in the Eastern Himalaya. As this region is economically backward, agricultural practices are the main occupation of the people. Thus, the populace of the region is more relied on the forest resources as collection of timber and non-timber forest products. For instance bamboo is the major source of livelihood as it is used for food and household items. Here, bamboo practices have become an economic activity and a part of major industry.

A large proportion of population in the Eastern Himalaya is vitally dependent on forest products and services for running their livelihoods. This dependency leads to challenges for forest resource management mostly in and around of the forest protected areas. The major use pattern of forests is large-scale use of timber for constructing houses. A large number of houses are made of timber. In the rural area, 100% houses are constructed by timber. As the economy of the region is primitive, the rural people are completely dependent on forests for firewood and fodder. Use of non-timber forest products (NTFP) is tremendously high and they are used to meet daily households need even to meet food requirement.

The tribal communities of the Eastern Himalaya occupy an integral part in the forest regions. They live isolated and meet their firewood, fodder and food needs from the forests as it is the main source of their livelihoods. The United Nations report on 'Development of Tribes' states that "tribal people derive either directly or indirectly a substantial amount of their livelihood from the forests. They subsist on edible leaves and roots, honey, wild game and fish. They build their homes with timber and bamboo and practice cottage crafts with the help of local raw materials. They use herbs and medicinal plants to cure their diseases and even their religious and folk-lore and woven round the spirits of the forests. Commercial transformations are predominantly by barter, trade being left mostly to the outsiders who controlled the money economy."

Bamboos and their products are most important food substances to the people of Mizoram as a large proportion of population has full dependency on them. Bamboos are edible and bamboo shoots are very popular amongst the Mizo community. Bamboos are also used for constructing houses in both rural and urban areas. Mizoram state has abundant natural Bamboo resources. About 57% of the geographical area of Mizoram is under Bamboo cover found at heights ranging from 400 m to 1500 m. Bamboo forests are found mainly along the river banks and abandoned *jhumland* as a dominant secondary vegetation.

7. FOREST RESOURCE MANAGEMENT

The tribal people of the Eastern Himalaya have spiritual, cultural, social and economic relationship with forest resources. During the past, these people followed animism that means everything on the surface of earth has a soul. They lived in balance and harmony with the nature. All natural things were sacred for them and they offered worship of plants and used them during the customary ceremony. In due course of time, there has been a transformation of culture and traditional belief on forests and nature but its pace is quite slow.

Forest resource management is practiced in different forms in Mizoram. Community forests are conserved by the local people based on the principles of providing opportunities for extraction of goods for legitimate needs and ensuring the continued existence of forest resources for future [15]. The extent of forests under community control in Mizoram was 31.35% [16]. There is great variability in management practice, which has evolved under different biophysical and cultural environments [17]. However, scientific research on the forest management practices of

traditional and tribal societies is lagging behind but a few studies have investigated that sacred grove, home gardens and agro-forestry is practiced here scientifically [18].

In Mizoram state, forest resource management has been carried on by the two institutions – the forest department (state owned) and community people. About 66% forest land is directly under the state forest department. The state forest department is structured from the state level to the village level where the department meets the various needs of the local people and also implements the rules related to forest conservation. The state forest department has divided the state forests into reserved forests and protected forests; and there are 10 national parks and wild life sanctuaries established from 1994 to 2007. All these initiatives were taken to conserve the economically viable forest resources of Mizoram. Owing to various steps forwarded to conserve the forests by the state government, there is a slight increase in the forest land from the last three decades.

Role of the community people towards forest management is also noteworthy as the community people owned about one-third forest area for their different households need. According to Tiwari, et al. [19], traditional forest management in Mizoram was administered by the 'chieftain'. The Chief is called 'Lal' (now 'chairman' Act of 1956) had absolute decision-making authority. There is pyramidal structure of the village office bearers; those are involved in the management of forest. The councilor and youth commander (Val Upa) are the members of the council and the council is responsible to Village Assembly. This traditional institution is no longer existed and it has taken over by the Young Mizo Association. The new organization is doing so promptly towards management of forests.

The conservation of forest is very peculiar [20]. There are two forest areas in the surrounding of village. In the one forest area, the villager can go and collect the forest products and in the other forest area nobody can go insight and nothing can be taken outside without the permission of the conservators. These forest protected areas are called 'closures' in Africa [21]. All these traditional concepts are practiced today. The community people have created recreational forests and village reserved forest where from they can collect the forest products.

8. CONCLUSIONS

Diversity, utilization pattern and management of forest resources in the Eastern Himalaya with special reference to Mizoram, India were widely discussed in this paper. It was penetrated from the fact that forest products are lifeline of the people of the Eastern Himalaya and are most important source of livelihoods after shifting cultivation practices. Forest diversity is high, ranging from tropical wet and dry forest to subtropical, montane and temperate. Therefore, it is one of the biodiversity hotspots of the world. This study shows that even a tremendous use of forests is carried on; forest cover has been increased 2.6% in the Eastern Himalaya and 1.4% in Mizoram, during the last decades. Sustainable use of NTFPs that include Bamboo shoots, jack fruits, pineapples, medicinal plants (all grow wild) and many more can enhance livelihoods as the

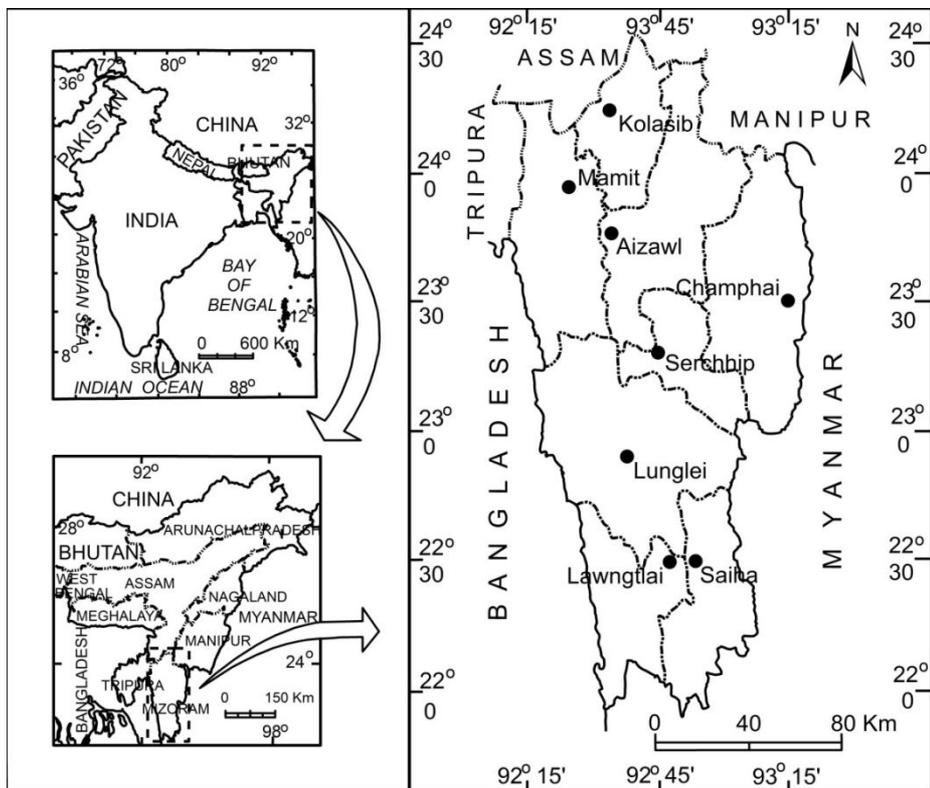
prospects of NTFPs in development process is high as they are grown tremendously in the Eastern Himalaya in general and Mizoram in particular.

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Figure-1. Location Map of the Eastern Himalaya and Mizoram



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