Drivers of Deforestation and Forest Degradation in Mizoram

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NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

Drivers of Deforestation and Forest Degradation in Mizoram

Indian Council of Forestry Research and Education

P. O. New Forest, Dehradun-248006 (INDIA)

2017

Published by:

Biodiversity and Climate Change Division
Directorate of Research
Indian Council of Forestry Research and Education
P.O. New Forest, Dehradun – 248006 (Uttarakhand), INDIA

ISBN: 978-81-936157-0-6

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Citation:

Rawat, V.R.S., Rawat, R.S., Verma, N. (2017). Drivers of Deforestation and Forest Degradation in Mizoram. Indian Council of Forestry Research and Education, Dehradun (INDIA).

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महानिदेशक
भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्
डाकघर न्यू फॉरेस्ट, देहरादून-248006
(आई.एस.ओ. 9001:2008 प्रमाणित संस्था)

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(An ISO 9001:2008 Certified Organisation)

Foreword

Globally, role of forests is well recognized as low cost carbon mitigation option along with significant co-benefits. REDD+ is one of the climate change mitigation actions in developing countries relating to reducing emissions from deforestation and forest degradation, role of conservation, sustainable management of forests and enhancement of forest carbon stocks. Currently REDD+ is under different phases of implementation in developing countries at national as well as sub national level for getting financial incentives under different REDD+ mechanisms.

India is among the few developing countries where forests are net sink of greenhouse gases and the trend is likely to move upwards with more and more carbon is getting locked in forests and also in the tree outside forest. India's efforts in forest conservation have helped in sequestering the substantial amount of carbon. India can rightfully claim the financial benefits by giving the comprehensive shape to the mitigation actions in the forest sector by way of implementation of REDD+.

Indian Council of Forestry Research and Education (ICFRE) is proactive in the field of forest and climate change. It is significantly contributing to relevant climate change mitigation and adaptation issues in the forestry at national and international level. ICFRE is providing continuous technical support to the Ministry of Environment, Forest and Climate Change, Government of India for implementing REDD+ at national level. Besides this, ICFRE is regularly conducting capacity building programmes for the officers of the Indian Forest Service on climate change and REDD+ issues.

ICFRE in collaboration with International Centre for Integrated Mountain Development is implementing a project titled 'REDD+ Himalayas: Developing and using experience in implementing REDD+ in the Himalayas'. The study report "Drivers of deforestation and forest degradation in Mizoram" brought under aforesaid project has highlighted the importance of different drivers of deforestation and forest degradation in the project area which will be helpful in framing the strategy for addressing the drivers of deforestation and forest degradation, state REDD+ action plan and further implementation of REDD+ in the North-Eastern parts of the country. I compliment the officers and staff of Biodiversity and Climate Change Division, Directorate of Research, ICFRE for bringing out this study report under above mentioned project.

(Dr. Suresh Gairola)

Preface

In the Himalayan Region, local communities are highly dependent on forest resources for their livelihood support and other day to day needs of fodder and fuel wood etc. Local communities of the Himalayan states are involved in managing the forests (*van panchayat* and community forest) under their control. However, forests in this part are under different stage of degradation due to various direct and indirect drivers of deforestation and forest degradation. Identification of area specific and comprehensive analysis of the drivers of deforestation and forest degradation is required to complete the REDD+ readiness process.

Indian Council of Forestry Research and Education in collaboration with International Centre for Integrated Mountain Development is implementing a project "REDD+ Himalayas: Developing and using experience in implementing REDD+ in the Himalayas" in the state of Mizoram. Identification of the drivers of deforestation and forest degradation is one of the activities under this project. This study will be helpful for preparing a strategy document for addressing the drivers of deforestation and forest degradation. The study report on "Drivers of Deforestation and Forest Degradation in Mizoram" has highlighted various direct and indirect drivers responsible for forest degradation in the state of Mizoram. This report will also provide the reference and baseline information to estimate the effectiveness of a particular activity for addressing the drivers of deforestation and forest degradation.

Financial support provided by ICIMOD, GIZ and BMUB (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety) for implementing this collaborative project in trans-boundary landscape is highly acknowledged. Guidance and support provided by Director General, ICFRE and Dy. Director General (Research), ICFRE for implementing the aforesaid project are gratefully acknowledged. We are thankful to ICIMOD for reviewing this report. We take this opportunity to offer our sincere thanks to all the officers, scientists and staff of Biodiversity and Climate Change Division, Directorate of Research, ICFRE who are directly or indirectly involved towards preparation of this report.

Contributors
REDD+ Himalayas Project
ICFRE, Dehradun

Contents

Abbreviations Used

AFOLU	:	Agriculture, Forestry and Other Land Use
BDA	:	Bamboo Development Agency
BMUB	:	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
CF	:	Community Forest
COP	:	Conference of Parties
FREL	:	Forest Reference Emission Level
FRL	:	Forest Reference Level
GCF	:	Green Climate Fund
GIZ	:	Deutsche Gessellschaft fur Internationale Zusammenarbeit
ha	:	Hectare
HH	:	Household
ICFRE	:	Indian Council of Forestry Research and Education
ICIMOD	:	International Centre for Integrated Mountain Development
IPCC	:	Intergovernmental Panel on Climate Change
ISFR	:	India State of Forest Report
km	:	Kilometer
LPG	:	Liquefied Petroleum Gas
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MRV	:	Measuring, Reporting and Verification
NAP	:	National Afforestation Programme
NFMS	:	National Forest Monitoring System
NGOs	:	Non Governmental Organizations
NLUP	:	New Land Use Policy
NBM	:	National Bamboo Mission
REDD	:	Reducing Emissions from Deforestation and Forest Degradation
REDD+	:	Reducing emissions from deforestation and forest degradation, and role of conservation, sustainable management of forests and enhancement of forest carbon stocks
SFD	:	State Forest Department
sq	:	Square
UNFCCC	:	United Nations Framework Convention on Climate Change
VC	:	Village Council
YMA	:	Young Mizo Association

Executive Summary

Globally, REDD+ has become an important initiative to mitigate climate change by incentivizing the developing countries for reducing emission through addressing deforestation, forest degradation and capturing forest carbon through various forest conservation activities and policy measures. It aims to lower the rate of deforestation and forest degradation as well as to sequester more carbon with the active involvement of the local communities in sustainable management of forests. In the Himalayan region, local communities are dependent on forest resources for their livelihoods and the countries are taking serious steps to adopt various REDD+ activities for the effective implementation of REDD+ at national as well as sub-national level.

India is one of the few countries with a documented forest policy since 1894. The first forest policy of independent India came in 1952, and it recognized the need of forest conservation and also emphasized the role of forests for meeting needs of industry and society. National Forest Policy of 1988 emphasizes that derivation of direct economic benefits from natural forests is to be subordinated to the principal aim of maintaining ecological balance. The concept of joint forest management (JFM) in India is a step towards the conversion of low-productivity forests to productive forests. Improving the stocking of poorly stocked forests will also increase carbon stocks in turn. Currently, JFM covers approximately 30% of the total forest area of the country. According to the series of India State of Forest Reports (ISFR) by Forest Survey of India (FSI), total forest area of the country is increasing since 2005.

In context to support REDD+ at country level, Government of India is in the process of developing its National Strategy and Action Plan for REDD+. Ministry of Environment, Forest and Climate Change has prepared a draft National REDD+ Policy and Strategy with the broad objectives to create REDD+ architecture at National and Sub-National levels. The draft National REDD+ Strategy lays emphasis on developing a robust REDD+ framework at national level through establishing a National REDD+ Authority. Implementation of REDD+ aims at improving the livelihood of forest dependent communities along with improving the quality of forest. Active involvement of relevant stakeholders at regional level will help in addressing drivers of deforestation and forest degradation which eventually improves the quality of forest ecosystem.

Indian Council of Forestry Research and Education (ICFRE) is involved in the implementation and piloting of REDD+ at regional level in different landscapes. As a part of REDD+ implementation, ICFRE in collaboration with International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal is developing and implementing REDD+ project in Mizoram, which focuses on trainings, technology sharing and knowledge dissemination in context of REDD+ in northeast region of the country. A study to identify the drivers of deforestation and forest degradation was conducted in REDD+ project area of Mamit District in Mizoram.

During the interaction with local communities, it has been observed that shifting cultivation and fuel wood collection are the major drivers of forest degradation in

Bamboo forest (*Melocanna baccifera*: Muli bamboo) in Mizoram

the region. Shifting cultivation has a major contribution towards the economic status of local community and 70% of the population of the region is involved in this practice. The per capita per day consumption of fuel wood in the region is estimated to be 31.42 kg causing loss of forest resources. Along with the shifting cultivation and fuel wood collection there are certain other indirect drivers (excessive exploitation of non-timber forest products, unemployment, lack of industries, connectivity of roads, lack of knowledge and awareness) of forest degradation.

Activities like restoration of shifting farms patches, introduction of horticultural cash crops, terrace farming, shaded coffee plantation, development of entrepreneurship, handicraft industry, introduction of fuel efficient cook stoves, employment generation opportunities and regular supply of LPG can directly improve the living standards as well as economic well being of local communities in the state and will also be helpful in checking the forest degradation in the region.

Introduction

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1.1 Background

Globally, deforestation and forest degradation has become one of the major causes of greenhouse gas (GHG) emissions besides burning of fossil fuels. According to fifth assessment report of Intergovernmental Panel on Climate Change (IPCC), annual greenhouse gas emission flux from land use, land-use change and forestry activities accounted for approximately 4.3-5.5 $GtCO_2eq/yr$ or about 9-11% of total anthropogenic greenhouse gas emissions (Smith *et al.,*2014). The overall contribution from agriculture forestry and other land use (AFOLU) sector is around one quarter of the global anthropogenic greenhouse gas emissions. Broadly forests are known as source as well as sink of carbon. Deforestation and forest degradation leads to the release of carbon in the form of carbon dioxide which has been stored in the tree biomass. Therefore, in order to address the deforestation and forest degradation as a part of integrated strategy to reduce global GHG emissions the concept of 'REDD (reducing emissions from deforestation and forest degradation in developing countries)' as climate change mitigation option was first introduced in 11th session of Conference of Parties of United Nation Framework Convention on Climate Change (UNFCCC) at Montreal in 2005.

Further in 13th session of COP of UNFCCC at Bali in 2007, India proposed for inclusion of conservation efforts and increment of forest cover to compensate the countries for maintaining and increasing their forest's carbon pools by means of strong conservation efforts as well as enhancement in forest cover and this approach later become the "+" part of the REDD mechanism in UNFCCC. The Para1b (iii) of Bali Action Plan is known as REDD+ which states that the *"Policy approach and positive incentive on issues relating to reducing emissions from deforestation and forest degradation in developing countries and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries*". The Bali Action Plan also recognizes "the complexity of the problem, different national circumstances and the multiple drivers of deforestation and forest degradation" (Rawat and Kishwan, 2008).

Understanding drivers of deforestation and forest degradation is fundamental for the development of policies and measures that aim to alter current trends in forest activities toward a more climate and biodiversity friendly outcomes. In 15th session of COP, decision 4/CP.15 encourages the Non-Annex countries "to identify drivers of deforestation and forest degradation resulting in emissions and also the means to address these and to identify activities within the country that result in reduced emissions and increased removals,

[1] https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf

and stabilization of forest carbon stocks". Further the issue of identifying drivers and activities causing change in forest carbon stock in context of monitoring and implementation of REDD+ at national level had received attention during the 16th session of COP at Cancun in 2010. Decision 1/CP.16 paragraph 70 of Cancun Agreement[1] encouraged developing countries parties to contribute to mitigate actions in the forest sector by undertaking the following activities, as deemed appropriate by each party and in accordance with their respective capabilities and national circumstances:

(a) Reducing emissions from deforestation
(b) Reducing emissions from forest degradation
(c) Conservation of forest carbon stocks
(d) Sustainable management of forest
(e) Enhancement of forest carbon stocks

COP decision further request the developing country Parties to develop the following elements:

(a) A National REDD+ Strategy or Action Plan.
(b) A National Forest Reference Emission Level (FREL) or Forest Reference Level (FRL) or if appropriate interim measure, subnational forest reference emission levels/or forest reference levels.
(c) A robust and transparent National Forest Monitoring System (NFMS) for the monitoring and reporting of REDD+ activities, if appropriate, subnational monitoring and reporting as an interim measure.
(d) A system for providing information on how the safeguards are being addressed and respected throughout the implementation of the REDD+ activities while respecting sovereignty.

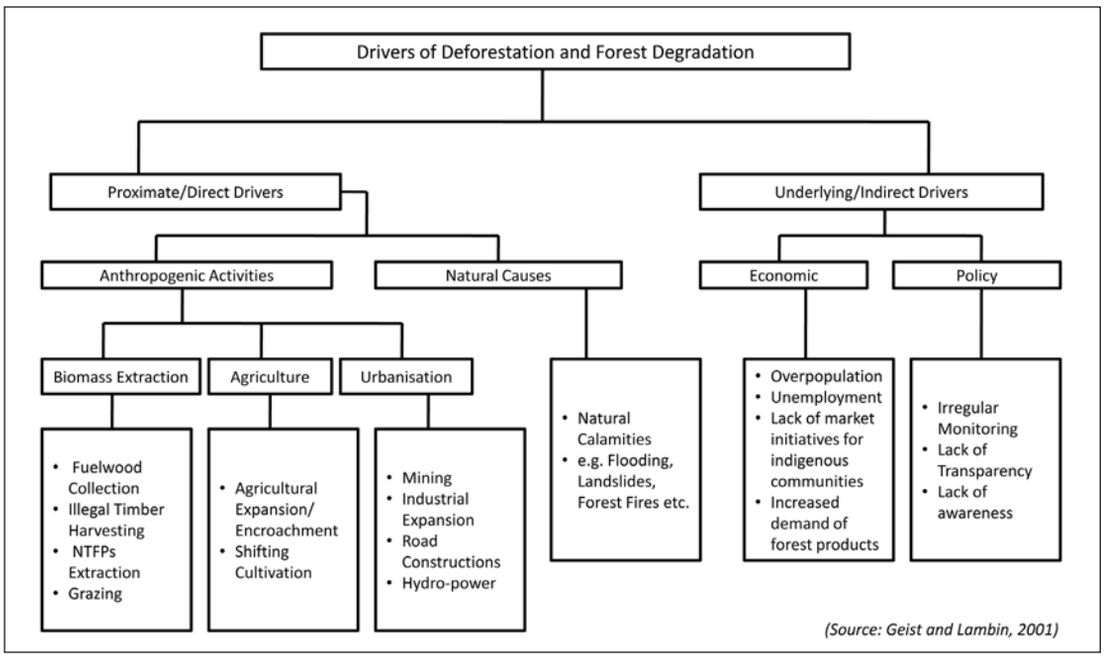
In order to achieve the above REDD+ element the initial step is to understand the drivers of deforestation and forest degradation at regional as well as national level. To design effective REDD+ policy, national REDD+ strategy and implementation plans there is a need to assess the forest dynamics (Boucher *et al.,* 2011; Rudorff *et al.,* 2011). Forest reference levels (FRL) can be estimated, if drivers as well as the activities addressing the drivers of deforestation and forest degradation are identified at regional level (Huettner *et al.,* 2009). As a result, for implementation of REDD+ activities, there is a need of database at regional as well as country level on drivers of deforestation and forest degradation along with the information on change in forest cover and forest carbon stocks.

1.2 Drivers of Deforestation and Forest Degradation

The forest dynamics and transitions can be studied well by understanding the drivers of deforestation and forest degradation at regional as well as national level. Depending upon the causes there are two different types of the drivers i.e. proximate/direct drivers and underlying/indirect drivers. Proximate/direct drivers of deforestation are anthropogenic activities that directly affect the loss of forest, which can be grouped into different categories such as agriculture expansion, expansion of infrastructure and wood extraction (Geist and Lambin, 2001). Agricultural expansion has been identified as a key driver of deforestation in the tropics (Gibbs *et al.,* 2010), drivers vary regionally and temporally (Rudel *et al.,* 2009; Boucher *et al.,* 2011). Development and implementation of policies specifically addressing the issues of livelihood of forest dependent communities and protection of environment can play an important role in conservation of forests.

Globally, over a period of 130 years i.e. from 1850 to 1980, it was found that about 15% of the world's forest and forest resources were cleared out of which 43% constitute from Asia (Sharma *et al.,* 1992 and WRI, 1987). According to the latest India State Forest Report, 2015 (FSI, 2015) there is the decrease of 628 sq km of forest area in the region as compared to India State of Forest Report, 2013. Socio economic conditions at national or sub-national level and structural problems

Box 1. Drivers of Deforestation and Forest Degradation



related to the international economic regime are the major causes of the forest degradation particularly in the developing countries (Tarasofsky, 1995).

Hence to overcome the impact of direct and indirect drivers on landuse and forestry, the Parties to the UNFCCC agreed a package of decisions on financial mechanism and methodological guidance for REDD+ in COP 19 at Warsaw also known as "Warsaw Framework for REDD+". COP decision for REDD+ finance says "result based finance provided to developing country Parties for implementation of REDD+ activities" which may come from variety of sources, public and private, bilateral and multilateral, including alternative sources. Decision 9/CP.19 encourages entities financing the REDD+ activities through wide variety of sources, including the Green Climate Fund (GCF) in a key role, to collectively channel adequate and predictable result-based finance in a fair and equitable manner, taking in account different approaches[2].

For addressing the drivers of deforestation and forest degradation the decision 15/CP.19 encourages all parties, relevant organizations, private sector and other relevant stakeholders to take activities and to continue their work to address drivers of deforestation and forest degradation and further encourages developing country parties to take note of the information shared as a result of their work[3].

Further in COP 22 at Paris in 2015, Parties recognized the role of forests as carbon sink for mitigation of climate change and devoted a whole section (Article 5 of Paris Agreement) to REDD+. Article 5 encourages all parties from developed as well as developing countries, to take action to conserve and enhance sinks and reservoirs of greenhouse gases including forests. It also encourages countries to take action towards the implementation of REDD+ activities through results based payments[4].

[2] http://unfccc.int/land_use_and_climate_change/redd/items/8180.php).
[3] http://redd.unfccc.int/fact-sheets/unfccc-documents-relevant-for-redd.html?decId=13&print=1
[4] hhttps://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf

1.3 REDD+ Himalayas: Developing and Using Experience in Implementing REDD+ in Himalayas

In 2015, ICIMOD-GIZ has initiated a programme on 'REDD+ Himalayas: Developing and using experience in implementing REDD+ in Himalayas' to build the capacity of REDD+ focal points in transboundary landscapes of India, Nepal, Bhutan and Myanmar.

In Indian part, with active collaboration of ICFRE, REDD+ capacity building is being focused on North-East. The programme will assist developing and implementing of REDD+ projects which will focus on trainings, technology sharing and knowledge dissemination. The broad objectives of the programme are:

- Development of methods for calculating, modeling and forecasting carbon storage.
- Developing instruments in preparation for regional REDD+ readiness.
- In working towards harmonization in the region, an exchange of experience and mutual learning on good REDD+ implementation practices are established as South-South cooperation.

The expected output will be enhanced capacity for development and implementation of REDD+ Strategy and Action Plan at each level (community, national and sub-national /state levels) and improved understanding of scientific knowledge for precise estimation of carbon stocks. Under this project, stakeholder's and village council member's consultation followed by household survey was conducted for identification of drivers of deforestation and forest degradation" for implementation of REDD+ programme in Mamit District of Mizoram.

Cultivation of orange on shifting farm

Characteristics of Mizoram State

2

2.1 Introduction

Mizoram state is among the seven sister's states lies in the Northeastern part of the country. Geographically it lies between 21°58' to 24°35'N latitudes and 92°15' to 93°29' E longitudes. It shares interstate border with states of Assam, Manipur and Tripura along with the international borders of Myanmar and Bangladesh. Total geographical area of the state is 21,081sq km which constitutes 0.64% of the total geographical area of the country. The state has 8 districts viz. Aizawl, Champhai, Kolasib, Lunglei, Mamit, Lawngtlai, Saiha, and Serchhip and, 23 sub-divisions. The total population of Mizoram is 10,97,206 (Census of India, 2011) with overall density of 52 persons per sq. km. Population of Mizoram has increased by 23.48% in the decade of 2001-2011 compared to preceding decade of 1991-2001. The literacy rate of the state is 91.58% which is the 3rd highest in the country.

Box-2.1

Types of land ownership in the state

- **Land Settlement Certificate:** Land settlement certificates are issued to the individuals who are involved in some kind of permanent farming practices i.e. terrace farming, wet rice cultivation, horticulture plantations etc.
- **Periodic Pass:** For the purpose of gardening or other form of cultivation over a period of 5 years and one time periodic pass is given for the individuals of the state.
- **Land Lease Pass:** This is a temporary pass which can be issued to the Government Departments, Organizations or Corporate Bodies without any time bound limit. Hence it can be withdrawn at any time if there is any breach in their working against their rights.
- **Revenue Pass:** This type of pass is issued to the individual for building temporary house and later on with the consent of competent authority it can be converted to land settlement certificate.

2.2 Climatic Conditions

State has typical monsoon type of climate. The climate is also influenced by the periodic cyclonic disturbances, local mountains and valley breezes and extensive forest cover. The state receives rainfall from both northeast and southwest monsoons. The climate is humid tropical, characterized by short winter, long summer and heavy rainfall. Temperature (on an average) ranges from 25°C to 30°C during summer, 18°C to 25°C in autumn and

11°C to 23°C in winter season. The average rainfall in Mizoram ranges between 200 to 300 cm per year. Generally, it rains during May to September, while July and August being the rainiest months. November to January is the dry period with minimum rainfall.

2.3 Land Tenure System

In Mizoram, the majority of the land comes under the customary rights of the local communities which provide a significant land for shifting cultivation to the local communities. Shifting cultivation is a most common form of agriculture practice in the state. The communities involved in this practice are known as *Jhumias*. In every village of the Mizoram, there is Village Council (VC) which has control over the complete village land and VC allots land for shifting cultivation, for construction of houses and for taking up other farming practices etc. to the villagers. Apart from the shifting cultivation, terrace farming is also being practiced in the state. This practice is generally being implemented on the private land i.e., the ownership of the land belong to individuals with permanent, heritable and transferable rights under the guidance of land settlement certificates. The transfer of land ownership occurs within the same tribe with the consent of the village communities. The transfer of land ownership is restricted to locals only. Outsiders are not allowed to own land in the state of Mizoram.

2.4 Shifting Cultivation

More than 60 per cent population in rural areas of Mizoram depends on the agricultural sector for their livelihood. Shifting cultivation is an age-old practice of farming in all the northeastern states of India in which each family clears a patch of forest by cutting down whatever is growing in that patch and later dry and burn whatever has been cut down on the ground. The ashes left behind act as fertilizer and this cleared and burnt patch of land is used for the cultivation of rice and other subsidiary crops such as tobacco, cotton, chilli and vegetables etc. Shifting cultivation is also known as *jhum* cultivation/ *jhumming* or slash burn agriculture practice. Over the time, the productivity of the land diminishes and left as fallow land. So a new patch of land has to be cleared and burnt year after year. This unscientific farming system has resulted in patchy deforestation, soil & nutrient loss, moisture loss, and loss of indigenous biodiversity. This has also resulted in drying up of springs and rivers as well as depletion of underground water reserves. *Jhumming* is mainly confined on rotational basis usually ranges from 5 to 10 years. The status of shifting cultivation in north-eastern states is given in Table-2.1.

The area allotted for *jhumming* in the state of Mizoram to a particular family varies from one acre to five acres depending on the family size. In this practice the ownership and rights related to the land remain with the family for a certain period of time and after that it again comes under the control of village council. Earlier in Mizoram, around one third of the cultivated area of the state was under shifting cultivation. Economic Survey 2015-16 of Government of Mizoram highlighted that the total *jhum* area and the total number of *jhumia* families in Mizoram during 2010-11 were 28562 hectare and 68433 families, respectively. As a result of the implementation of New Land Use Policy, the total *jhum* area as recorded during 2014-15 is 20064 hectare which shows decrease in *jhum* area of about 29.75 per cent during the last 5 years. Similarly, the total number of *jhumia* families also decreased from 68433 families in 2010-11 to 60338 families in 2014-15 which accounts for about 11.83 per cent decrease during the last 5 years (Government of Mizoram, nd). Introduction of horticultural cash crops on shifting farms has converted the shifting farms to permanent farming lands and hence, it also becomes one of the major reasons behind reduction in total area under shifting cultivation. Now, the *jhumias* are growing horticultural crops like banana, orange, ginger, turmeric etc instead of traditional crops. Table-2.2 represents land use statistics of Mizoram state.

Table-2.1: Status of Shifting Cultivation in North East India

States	Annual Area under Shifting Cultivation (ha)	Fallow period (Years)	No. of *Jhumia* Families ('000)	*Jhum* Land/Family (ha)
Arunachal Pradesh	70,000	3-10	54	1.29
Assam	69,600	2-10	58	1.20
Manipur	90,000	4-7	70	1.29
Meghalaya	53,000	5-7	52	1.01
Mizoram	63,000	5-8	50	1.26
Nagaland	19,000	5-9	116	0.16
Tripura	22,300	3-4	43	0.51

Sources: 1. Report of the Inter-Ministerial National Task Force on Rehabilitation of Shifting Cultivation Areas, 2008
2. G.B. Pant Institute of Himalayan Environment and Development (2006)

Table-2.2: Land Use Statistics of Mizoram (Area in ha)

S. No.	Year	Forest Area	Not available for cultivation		Other uncultivated Land excluding follow Land			Follow Land	
			Land put to Non Agricultural use	Barren and Incultural Land	Permanent Pasture and other Grazing Land	Land under Miscellaneous Tree Crops and Groves not included in net Area sown	Cultural Waste	Follow Land other than current Follow Land	Current Follow Land
1	1997 - 98	1598.00	121.37	10.77	22.50	30.60	5.10	152.81	30.690
2	1998 - 99	1598.00	88.09	8.50	22.50	30.60	5.10	180.00	46.600
3	1999 - 00	1598.00	121.29	11.94	22.50	30.81	5.20	170.45	50.011
4	2000 - 01	1626.47	121.79	8.60	22.50	30.60	5.31	155.81	36.285
5	2001 - 02	1626.47	122.69	7.80	10.60	19.16	5.10	163.26	35.798
6	2002 - 03	1550.61	125.19	8.20	13.10	27.25	9.50	215.71	41.356
7	2003 - 04	1593.50	125.01	8.92	5.65	15.12	5.95	194.38	38.447
8	2004 - 05	1593.65	125.51	8.52	5.35	10.23	5.00	181.20	49.969
9	2005 - 06	1593.70	125.41	8.62	5.34	10.24	5.23	197.19	40.969
10	2006 - 07	1593.70	125.42	8.62	5.24	68.77	5.23	166.08	41.465
11	2007 - 08	1593.70	125.43	8.62	5.23	66.75	5.23	165.98	44.947
12	2008 - 09	1593.70	124.00	9.00	5.25	794.82	27.00	170.85	30.089
13	2009 - 10	1585.30	93.40	8.78	5.25	32.21	6.70	180.80	66.023
14	2010 - 11	1585.30	94.96	8.25	5.25	37.49	6.70	182.26	66.607
15	2011 - 12	1585.30	95.00	8.25	5.25	40.87	6.70	183.12	61.188
16	2012 - 13	1585.30	95.04	8.25	5.25	41.08	6.70	194.03	50.380
17	2013 - 14	1585.30	99.53	8.25	5.25	73.36	6.70	161.13	47.073
18	2014 - 15	1585.30	42.00	7.45	4.25	32.05	5.70	165.37	48.15

(Source: Government of Mizoram, Economic Survey 2015-16)

2.5 Other Sources of Income

Apart of the agricultural practices, piggery and poultry are the alternative sources of income generation in the state of Mizoram. It provides the economic support for the rural people of the state and has become one of

the important sources of their income. Along with the economic gain from livestock, Mizoram is dominated by bamboo in terms of natural resource which has proved a major contribution towards the socio-economic development in the state and covers around 31% (about 6,446 sq.km) of its geographical area. As many as about 34 species of bamboo have been identified in the state of which *Melocanna baccifera* (mautak) contributes about 77% of the total area covered by bamboo (Table-2.3). Density-wise details, number of culms by soundness and equivalent green weight are given in Table-2.4.

Table-2.3: Common bamboo species of Mizoram state

S. No.	Species	S. No.	Species
1	*Bambusa balcooa*	18	*Dendrocalamus manipureanus*
2	*B. bambos*	19	*D. sikkimensis*
3	*B. dampeana*	20	*D. strictus*
4	*B. mizorameana*	21	*Melocalamus compactiflorus*
5	*B. multiplex*	22	*Melocanna baccifera*
6	*B. nagalandiana*	23	*Neomicrocalamusmannii*
7	*B. nutans*	23	*Phyllostachys edulis*
8	*B. tulda*	25	*P. manni*
9	*B. vulgaris*	26	*Schizostachyum dullooa*
10	*B. vulgaris* var. *vittata*	27	*S. fuchsianum*
11	*B. vulgaris* var. *waminii*	28	*S. mannii*
12	*Dendrocalamus asper*	29	*S. munroi*
13	*D. giganteus*	30	*S. pergracile*
14	*D. hamiltoni*	31	*S. polymorphum*
15	*D. hookeri*	32	*Sinarundinaria falcata*
16	*D. laetiflorus*	33	*S. griffithiana*
17	*D. longispathus*	34	*Thyrsostachys oliveri*

(Source: Bisht, 2016)

Major initiatives have been taken by the Government for improving the bamboo sector in the state. Bamboo plantations of about 1364 hectares were raised by the Environment, Forest and Climate Change Department of Mizoram Government during the years 2014-15 under the 3rd and 4th Phase of New Land Use Policy (Table-2.5). Under the National Bamboo Mission (NMB) activities for bamboo promotion in the state are taken up in both forest and non-forest areas. Forest areas come directly under the control of State Department of Environment and Forest whereas non-forest areas are handled by the Bamboo Development Agency (BDA). Table-2.6 is showing the list of bamboo based industries in the state supported by BDA.

Traditional use of bamboo as bamboo baskets and bamboo cage for birds

Table-2.4: Total bamboo bearing area by density and equivalent green weight of bamboo in Mizoram state

Bamboo bearing area by density in recorded forest area (Area in Km)						
Recorded Forest Area	**Pure Bamboo**	**Dense Bamboo**	**Scattered bamboo**	**Clumps hacked**	**Bamboo regeneration**	**No bamboo**
16,717	226	6,116	2,757	104	42	7,472

Estimated number of bamboo culms and equivalent green weight						
Number of culms (in millions)				Equivalent Green Weight (in 000 tonnes)		
Green	**Dry**	**Decayed**	**Total**	**Green**	**Dry**	**Total**
1953	185	67	2205	11150	2037	**13187**

(Source: Government of Mizoram, Economic Survey 2015-16)

Table-2.5: Physical achievement made in bamboo plantation during 2014-2015 (under 3rd and 4th Phase of NLUP) by Environment & Forests Department of Mizoram

S. No.	Name of Forest Division	Physical Achievement	
		No. of Beneficiaries	Area under Plantation (ha)
1	Aizawl	48	96
2	Darlawn	39	78
3	Tlabung	151	302
4	Mamit	13	26
5	Lunglei	55	110
6	Lawngtlai	149	298
7	Kolasib	22	44
8	Thenzawl	85	170
9	Champhai	120	240
	Total	**682**	**1364**

(Source: Government of Mizoram, Economic Survey 2015-16)

Table-2.6: Bamboo based industries in Mizoram established under National Bamboo Mission

S. No.	Name of Industry	Type of products developed
1	M/s Mizoram Venus Bamboo Products (P) Ltd	Bamboo Laminated Board, Door etc.
2	M/s CeeKee Bamboo & Wood Products (P)	Bamboo Mat Board, Ply Board etc
3	M/s Zonun Matply (P) Ltd	Bamboo Mat Board, Ply Board etc
4	M/s Panson Bamboo Chipping Mill	Bamboo Chips
5	M/s Sena Bamboo Chipping Mill	Bamboo Chips
6	M/s Grace RTP Bamboo	Bamboo Mat and Ply Board
7	M/s Ephraim Bamboo Industry	Bamboo Sliver and Mat
8	M/s L.Z. Bamboo Industry	Raw Bati and Incense Stick
9	M/s Nutech Bamboo Projects (P)	High Compressed bamboo timber
10	M/s S.K. Bamboo Vinegar Unit	Bamboo Charcoal & Vinegar
11	M/s S.K. Bamboo Chipping Mill	Bamboo Chips

Source: http://mizobamboo.nic.in/bamboo industries.html

Box-2.2

New Land Use Policy of Mizoram

The problem of fallow land because of the shifting cultivation has highlighted the importance of New Land Use Policy. In shifting cultivation a new patch of land is cleared and after its use for cultivation of mainly rice crop and other subsidiary crops such as tobacco, cotton, chili and vegetables etc. It again comes under cultivation after a span of more than ten years. This system has caused destruction of local environment and the land has slowly lost its fertility as well as loss of forests has also been observed at an alarming rates.

Hence, New Land Use Policy in the state was implemented on 14th January, 2011 by the Government of Mizoram and addressing the issues of providing stable economy for the state along with the environment protection, land reforms and reclamation. This policy envisaged earmarking of 80% of the geographical area of the State under forest or green cover. Out of which 70% will be protected dense forest and 10% for community reserve forest.

The main objectives of New Land Use Policy are as follows:

- Provide opportunities for income generation to the families who comprise nearly three-fourths of the total population of Mizoram by diverting them away from the destructive and unprofitable shifting cultivation practice.
- Provide livelihood for poor communities by encouraging small scale industries and petty trades.
- Combining the various schemes funded by the Government of India to NLUP for better utilization of funds and avoidance of duplication of works.
- Restoration of land by introducing permanent farming systems and land reforms.
- Restoration and protection of state's natural environment through various means such as expansion of rain catchment areas for recharging rivers, springs and underground water, encouraging rearing of domestic animals and poultry for increased meat production to discourage hunting to protect the fauna etc.

2.6 Forests of Mizoram

Forests are the one of the important natural resource in the state which constitute 19,283 sq km of area under total forest and tree cover, and comprises 91.47 per cent of the total geographical area of the state (FSI, 2015). Overall, Mizoram contributes around 2.43 per cent in the total forest and tree cover of the country. As per India State of Forest Report, 2015 the per capita availability of the forest and tree cover in the state is 0.017 sq km. Table-2.7 shows the District wise forest cover of the state.

Table-2.7: District-wise forests cover of Mizoram (Area in km^2)

District	Geographical Area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	% of Geographical Area
Aizawl	3575	28	1135	2022	3185	89.09
Champhai	3185	60	1042	1570	2673	83.92
Kolasib	1382	0	187	1027	1214	87.84
Lawngtlai	2557	0	705	1632	2337	91.40
Lunglei	4536	1	1186	2954	4141	91.29
Mamit	3025	43	654	2044	2741	90.61
Saiha	1400	0	551	696	1247	89.07
Serchhip	1421	6	398	807	1211	85.22
Total	**21081**	**138**	**5858**	**12752**	**18749**	**88.93**

Note : Very Dense Forest: All lands with tree canopy density of 70% and above
Moderately Dense Forest: All lands with tree canopy density of 40% and more but less than 70%
Open Forest: All lands with tree canopy density of 10% and more but less than 40%

(Source: FSI, 2015)

Six forest types have been identified in the state of Mizoram representing the four major type groups of Champion and Seth (1968) Classification of Forest i.e. Group 2-Tropical Semi-Evergreen Forests, Group 3-Tropical Moist Deciduous Forests, Group 8-Subtropical Broadleaved Hill Forests and Group 9- Sub Tropical Pine Forest (FSI, 2011). The northern part of the state is dominated by Secondary Moist Bamboo Brakes along with the different species of trees and plants while on the other side eastern and southern part of the state is dominated by the East Himalayan Moist Mixed Deciduous forest. Table-2.8 is showing the total area (sq. km) occupied by the different forest types of the Mizoram.

Table-2.8: Forest Types of Mizoram State (according to Champion and Seth, 1968)

S. No	Forest Type Group	Sub-Forest Type	Area (sq.km)	Percent
1	Group 2 Tropical Semi-Evergreen Forest	2B/2S1 Pioneer Euphorbiaceous Scrub	280.75	1.50
2	Group 2 Tropical Semi-Evergreen Forest	2B/C2 Cachar Tropical Semi-Evergreen Forest	4675.93	25.03
3	Group 3 Tropical Moist Deciduous Forest	2/2S1 Secondary Moist Bamboo Brakes	8484.05	45.41
4	Group 3 Tropical Moist Deciduous Forest	3C/C3b East Himalayan Moist Mixed Deciduous Forest	5120.17	27.40
5	Group 8 Sub Tropical Broadleaved Hill Forest	8B/C1 East Himalayan Subtropical Wet Hill Forest	6.82	0.04
6	Group 9 Sub Tropical Pine Forest	9/C2 Assam Subtropical Pine Forest	116.28	0.62
		Total	**18684.00**	**100**

(Source: FSI, 2015)

2.7 Demography of Mizoram State

According to the Census of India 2011 the total population of Mizoram is 10,97,206. In comparison to census of India, 2001 data, the population of the state has increased by 0.209 millions in 2011. Table-2.9 represents district wise population, decadal growth rate, sex ratio and population density of the state.

Table-2.9: District wise Population Profile of the Mizoram State in 2011

S. No.	District	Population	Increase	Sex Ratio	Literacy	Density (Person/km²)
1	Aizawl	400,309	22.92 %	1009	97.89 %	112
2	Lunglei	161,428	17.64 %	947	88.86 %	36
3	Champhai	125,745	16.01 %	984	95.91 %	39
4	Lawngtlai	117,894	60.14 %	945	65.88 %	46
5	Mamit	86,364	37.56 %	927	84.93 %	29
6	Kolasib	83,955	27.28 %	956	93.50 %	61
7	Serchhip	64,937	20.56 %	977	97.91 %	46
8	Saiha	56,574	-7.34 %	979	90.01 %	40
	Total	**1,097,206**				

(Source: http://www.census2011.co.in/census/state/districtlist/mizoram.html)

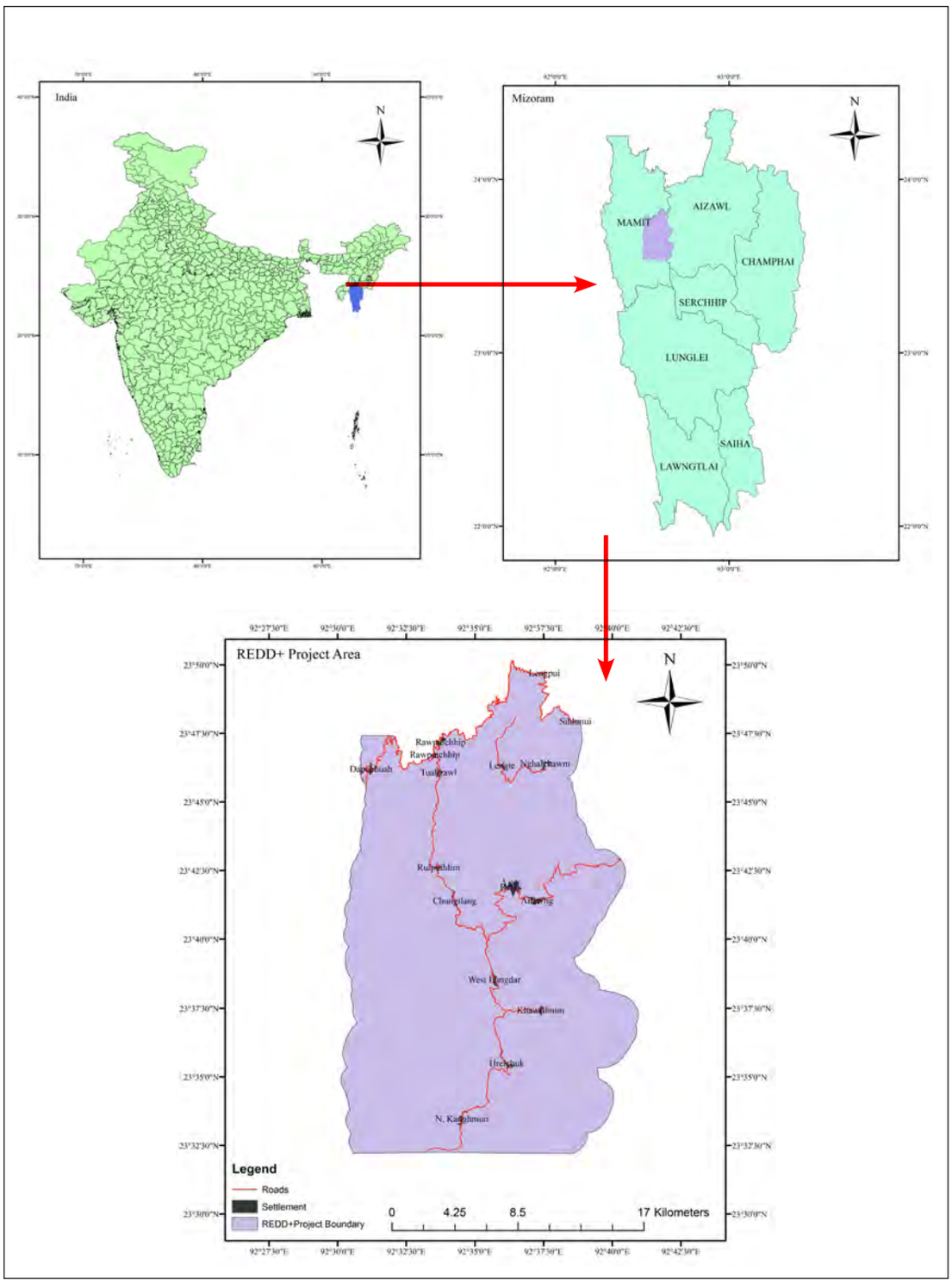
2.8 Project Area

In consultation with the Department of Forest, Environment and Climate Change, Government of Mizoram during the inception workshop of project (REDD+ Himalayas: Developing and Using Experience in Implementing REDD+ in the Himalayas) in 2016, it was agreed to implement the project activities in the Mamit district of Mizoram for developing a REDD+ pilot project. The project area constitutes 12 villages having 1583 households (Table-2.10) with the total population of 8174 under Mamit District. Map of project area is given in the Fig 2.1.

Table-2.10: Village wise population status under REDD+ Project Area under Mamit District

S. No.	Name of Village	No. of Households	Total Population	Male Population	Female Population
1	Reiek	360	1627	786	841
2	W.Lungdar	109	668	340	328
3	Lengte	88	406	211	195
4	Nghalchawm	60	302	161	141
5	Rulpuihlim	78	392	233	159
6	Chungtlang	54	327	174	153
7	N. Kanghmun	166	858	432	426
8	Khawrihnim	128	789	401	388
9	Ailawng	104	510	267	243
10	Rawpuichhip	241	1244	620	624
11	Tuahzawl	80	381	198	183
12	Hruiduk	115	670	356	314
	Total	**1583**	**8174**	**4179**	**3995**

Fig. 2.1. Map of REDD+ project area in Mizoram



Methodology and Site Description

3

3.1 Designing of Questionnaire

In order to identify the different driver of deforestation and forest degradation in the project area, a detailed household survey followed by consultation with the forest department and village council members was conducted in the REDD+ project area in Mamit District of Mizoram state. To study the drivers of deforestation and forest degradation in the state of Mizoram, a questionnaire was designed in consultation with the relevant stakeholders. The questionnaire was pre-tested in the field and after that necessary improvement was made before the actual survey conducted.

3.2 Sampling Method

Keeping in view, the socio economic status of local community and to understand their dependency on the forest resources, household survey was conducted during the month of March, 2017. Out of the 12 villages in the area, the 50% villages i.e. 6 villages, were randomly selected at different altitudinal ranges for making a true representation of complete project area (Fig.3.1).

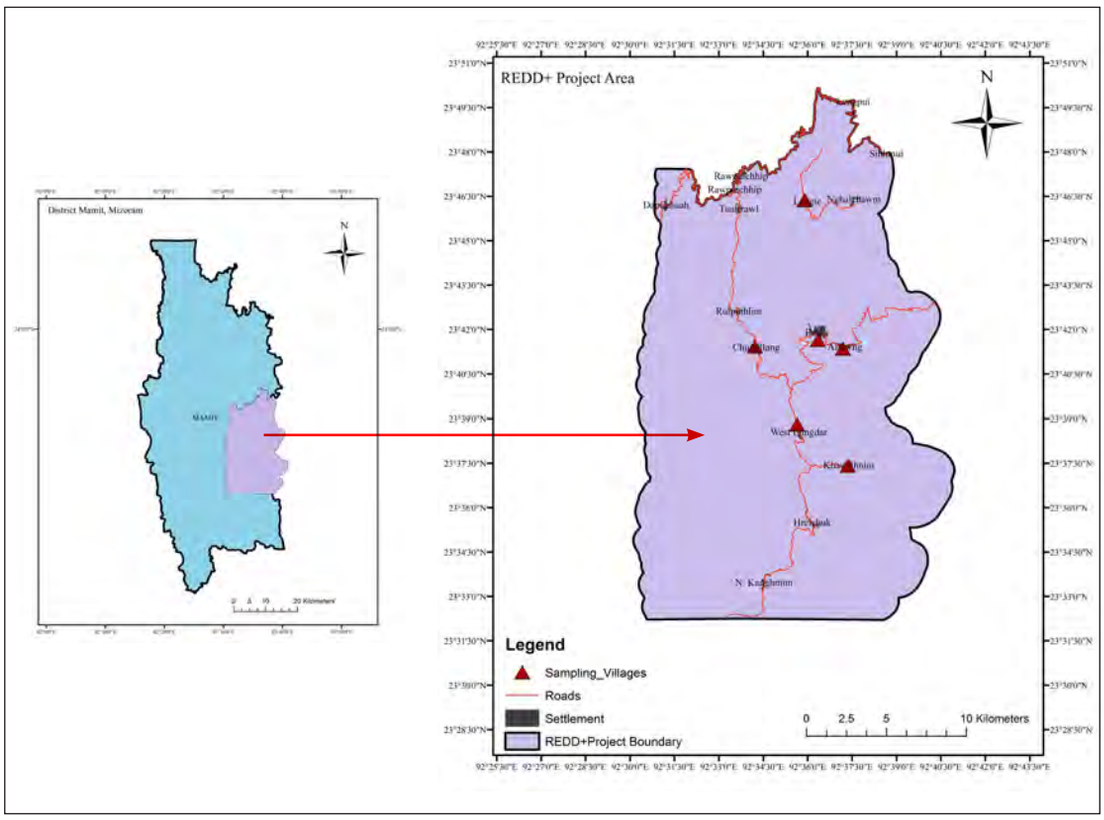
For household survey the 10% household sampling was done in order to get the sufficient set of data. Keeping the whole project area as a unit which consists of total 1583 households in 12 villages, the total numbers of 158 households from 6 villages were surveyed for collection of relevant data on drivers of deforestation and forest degradation. In between the surveyed villages the concept of at least 10% sampling from each village has been kept in mind. Data from household survey were collected by using the questionnaire on free prior informed consent given by respondents from local communities of selected villages. Table-3.1 provides the list of the sampling villages and along with their geo-coordinates.

Table-3.1: Sampling Villages along with Geo-coordinates

S. No	Name of Village	Geo-coordinates	No of House holds (Census Data, 2011)	Total No. HH Surveyed
1	Ailawng	N 23° 41' 21.3'' E92° 37' 11.8'' Altitude:1156 m (amsl)	104	32
2	Reiek	N 23° 41' 38.9'' E 92° 36' 21.1'' Altitude:1211 m (amsl)	360	42
3	Khawrihnim	N 23° 37' 25.2'' E 92° 37' 21.5'' Altitude: 1123m (amsl)	128	24
4	West Lungdar	N 23° 38' 48.7'' E 92° 35' 38.7'' Altitude: 1265 m (amsl)	109	19
5	Chungtlang	N 23° 41' 25.9'' E 92° 34' 13.4'' Altitude: 948 m (amsl)	54	30
6	Lengte	N 23° 46' 22.3'' E 92° 35' 54.0'' Altitude: 479 m (amsl)	88	11

With the help of regular communication and consultation with the forest department as well as

Fig. 3.1. Villages selected for household survey under Mamit District



Interaction with local communities and collection of household data

with village council members, the overall direct and underlying drivers of deforestation and forest degradation in the project area was listed out. Then by means of household survey the extent of each driver of deforestation and forest degradation was observed. Microsoft excel tool has been used for estimating the average land acquired by each family in the project area for shifting cultivation and also estimated the quantity of fuelwood collected by each household annually. SPSS Version16 was used for analysis of data. Further the local communities were asked directly by the enumerator about their opinion towards the major causes of deforestation and forest degradation in their areas. Then each cause was categorised under certain direct or underlying drivers depending upon the common views produced by the local communities. Otherwise, there would be some conflict of interest and information would be biased if there will be pre decided drivers of deforestation and forest degradation and local communities might hesitate to address those drivers during the survey. Hence in order to remove the biasness, enumerator has asked directly the opinion of common person from the field and then categorization of each driver has been done. The questionnaire used for survey is given in Annexure-I.

Identification of Drivers of Deforestation and Forest Degradation

4

4.1 Forest Degradation and Statement of the Problem

Forest ecosystem plays an important role in providing various environmental benefits and life support systems to maintain the ecological balance between various anthropogenic activities and natural phenomenon. Carbon sequestration, nutrient cycling, watershed protection, abatement of pollution along with the micro-climatic regulation are the important processes provided by the forests of a particular area towards its environmental benefits. Broadly the term "degradation of forests" has been emerged as a result of various anthropogenic activities that contribute towards deteriorating the quality of forests. A clearing of forest was not only confined to the settlement of villages but also used for the cultivation and expansion of pastures. Further it has caused over exploitation of land, water resources etc. and ultimately disturbs the quality of a forests locally. Hence the extent of forest degradation can be easily observed at the regional level (Hosonuma *et al.,* 2012).

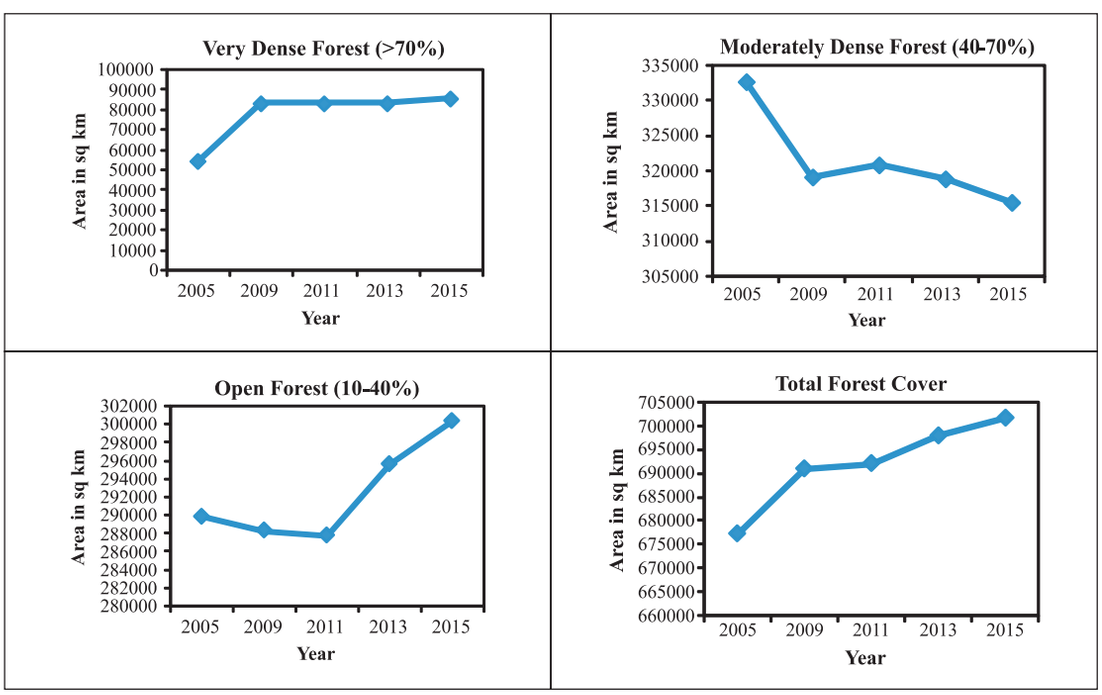


Fig. 4.1. Trend in forest cover of India (sq km) since 2005

(Source: FSI, 2005; 2009; 2011; 2013; 2015)

Total forest and tree cover of the country is increasing continuously since 2005, on the other hand, open forest (10-40% crown cover) area is also increasing (Fig 4.1). While the total area of moderately dense forest (40-70% crown cover) is showing decreasing trends which mean that the moderate dense forest in the country is under the threat of forest degradation. This conversion of moderately dense forest to open forest along with the total increase in the overall forest cover of the country shows that the forest degradation has become the major cause of concern at national level. Table-4.1 reveals that the open forest cover of the country recorded an increase of 7831 sq km of area between 2011-13 assessment (FSI, 2013) while this increase was 4744 sq km between 2013-15 assessment (FSI, 2015).

Table-4.1: Change in forest cover of India's Forest since 2005 (sq. km.)

S. No	Year	Very Dense Forest (VDF)	Change in VDF	Moderately Dense Forest (MDF)	Change in MDF	Open Forest (OF)	Change in OF	Total	Scrub	Non forest
1	2005	54569	-	332647	-	289872	-	677088	38475	2571700
2	2009	83510	28941	319012	-13635	288377	-1495	690899	41525	2554839
3	2011	83471	-39	320736	1724	287820	-557	692027	42176	2553060
4	2013	83502	31	318745	-1991	295651	7831	697898	41383	2547982
5	2015	85904	2402	315374	-3371	300395	4744	701673	41362	2544228

(Source: FSI, 2005; 2009; 2011; 2013; 2015)

In state of Mizoram, the scenario is quite different; the area under very dense forest is increasing while the moderately dense forest is decreasing (Fig 4.2), this is due to the different type of land use scenarios in the state of Mizoram in comparison to other parts of the country i.e. Shifting cultivation in which land is once cleared for the purpose of cultivation and after the span of 4-5 years it has been left abandoned by the local communities to restore in its natural condition. In year 2015, the area under VDF and MDF is decreasing in comparison to 2013, which results in overall decrease of 306 sq km of forest land of the state (Table-4.2).

Table-4.2: Change in forest cover of Mizoram since 2005 (sq. km)

Year	Very Dense Forest (VDF)	Change in VDF	Moderately Dense Forest (MDF)	Change in MDF	Open Forest (OF)	Change in OF	Forest Cover	Change in Forest Cover
2005	133	-	6173	-	12378	-	18648	-
2009	134	1	6251	78	12855	477	19240	592
2011	134	0	6086	-165	12897	42	19117	-123
2013	138	4	5900	-186	13016	119	19054	-63
2015	136	-2	5858	-42	12752	-264	18748	-306

(Source: FSI, 2005; 2009; 2011; 2013; 2015)

Apart from the shifting cultivation practice in the state, the majority of the people are dependent upon forests for collection of fuel wood, fodder, other forests products and illegal hunting. Over exploitation of the forest produces is one of the major cause of degradation of the forest at local level. Continuous increase in the population has increased the problem of employment and hence dependency of local community on forest produces has increased which has ultimately led to degradation of forest to a large extent.

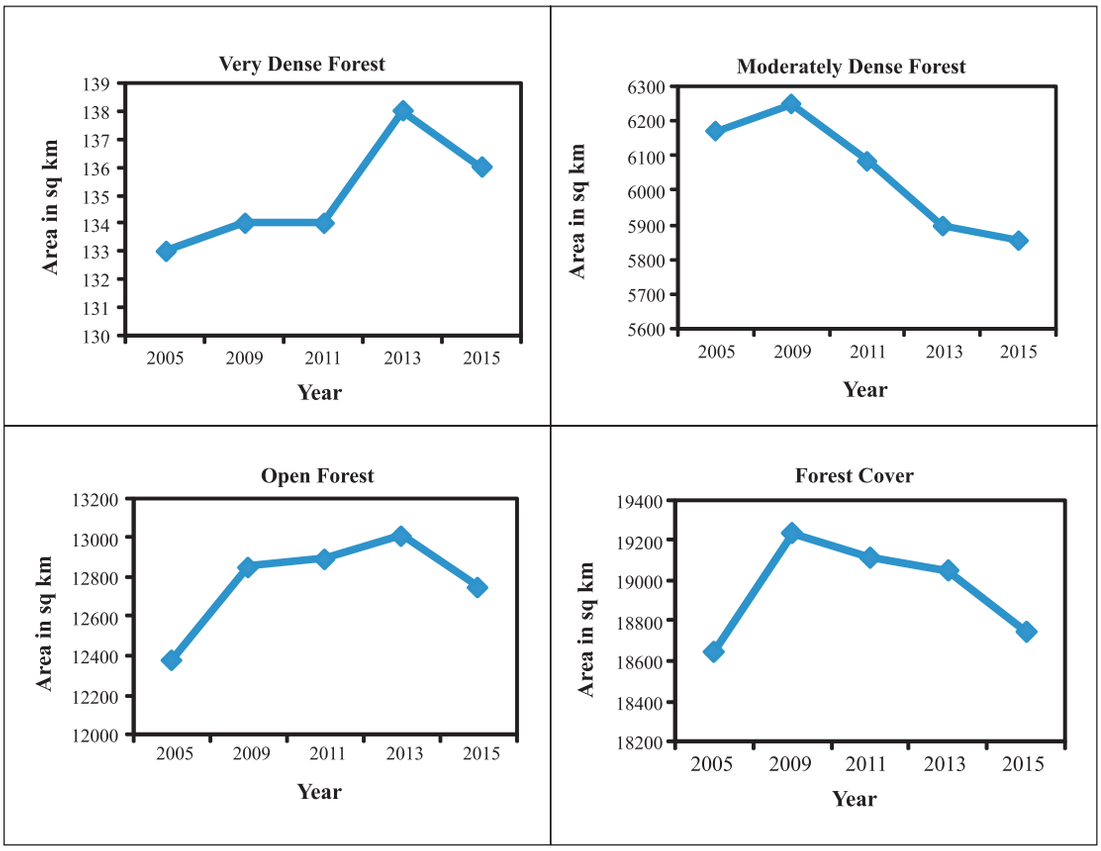


Fig. 4.2. Trend in forest cover of Mizoram (sq.km) since 2005

4.2 Forest Type of Project Area

The proposed REDD+ project area constitute the total forest area of 42288.96 ha along with the four major forest type group according to Champion and Seth (1968) forest type of India classification (Table-4.3) and forest types map of the project area is given in Fig. 4.3.

Table-4.3: Sub-forest Type group of Project Area

S. No.	Forest Type	Area (ha)
1	2/2S1 Secondary Moist Bamboo Brakes	16220.15
2	2B/2S1 Pioneer Euphorbiaceous Scrub	80.69
3	2B/C2 Cachar Tropical Semi-Evergreen Forest	22691.43
4	3C/C3b East Himalayan Moist Mixed Deciduous	3296.69

(1) 2/2S1 Secondary Moist Bamboo Brakes: The project area is dominated by this forest type with total area of 16220.15 ha. *Melocanna bambusoides, Dendrocalamus hamiltonii* etc are the dominant species of this forest type. Due to the disturbances caused by the shifting cultivation, the majority of area in the state is predominated by the bamboo species.

(2) 2B/2S1 Pioneer Euphorbiaceous Scrub: This forest type is generally found in the degraded forests and exposed lands present on the higher slopes and on top of the hills. Vegetation has stunted and species like *Macaranga* spp., *Mallotus* spp. which grows as comparatively fast rate generally found there.

(3) 2B/C2 Cachar Tropical Semi-Evergreen Forest: Species like *Dipterocarpus turbinatus, D. tuberculatus, Terminalia chebula, Emblica* spp., *Careya arborea* etc are the major species of this forest type.

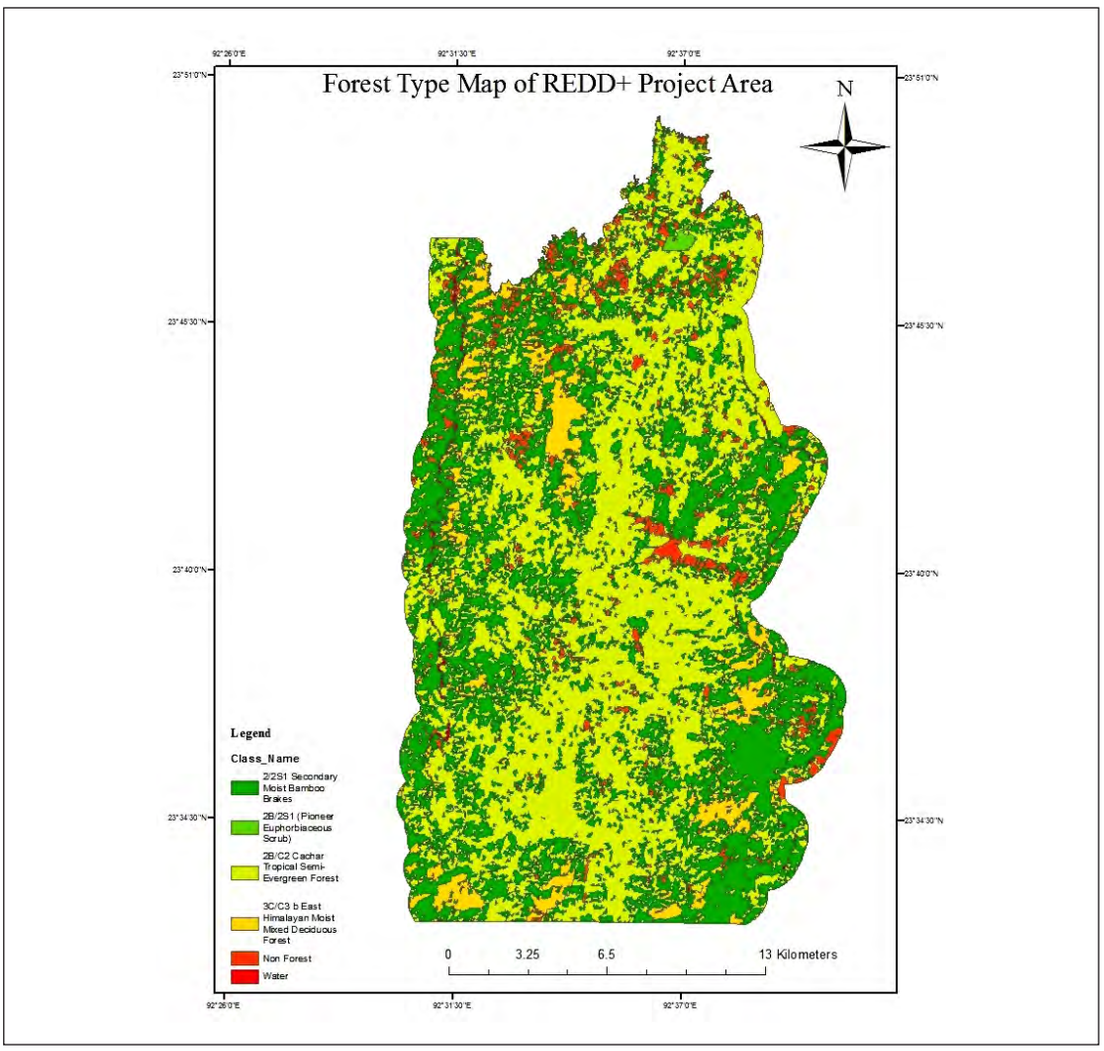


Fig. 4.3. Forest type map of REDD+ project area

(4) 3C/C3b East Himalayan Moist Mixed Deciduous: The dominant species of this forest type are *Schima wallichii, Syzigium cuminii, Albizia procera, Dillenia pentagyna, Artocarpus lakoocha, Albizia stipulata, Terminalia bellerica, Terminalia chebula, Lagerstroemia parvifora, Salmalia malabarica, Neolamarckia cadamba, Aglaia spectabilis* etc.

4.3 Drivers of Deforestation and Forest Degradation

Globally, it has been observed that anthropogenic reasons and the changes caused by various human activities are the major reason towards forest transitions and the drivers of land use changes in forest ecosystem varies from country to country (Rudel *et al.,* 2005, Lambin and Meyfroidt, 2010). In India, developmental activities and the rapidly growing economy have implications on forest cover and the land use pattern of the country (IIASA, 2009; MoEF, 2009). The dependency of local communities in the rural communities is highly influenced by the forest resources. Further, Gulati and Sharma (2000) stated that substantial growth in population is increasing the demand for forest produce continuously and low productivity of forests are playing a major role towards the degradation of forest throughout the country. Hence the majority of drivers in deforestation

and forest degradation are induced by the livelihood activities of the forest dependent communities.

In this study, the drivers of deforestation and forest degradation have been identified in the REDD+ project area of Mamit District for the further implementation of project activities to address those drivers. Majority of population living near to forest areas are highly dependent on the forest for a variety of resources e.g. food, fodder, agriculture, housing, and non-timber forest produces which are potentially contributing towards the deforestation and forest degradation. According to Davidar *et al.* (2010); Mishra *et al.* (2008); Arjunan *et al.* (2005), it has been observed that this dependency of local communities living near the forest areas in rural parts of country are resulting in forest degradation. Hence on a broad scale the drivers of deforestation and forest degradation were discussed through the consultation process with forest department, village council members and then house hold survey was conducted to observe the people's perception on drivers of deforestation and forest degradation in their respective areas. However, after the collection of data from the household survey a correlation was made for better understanding of drivers of deforestation and forest degradation with various socio-economic parameters. Fig 4.4 represents the proximate and underlying drivers of deforestation and forest degradation observed during the consultation meeting with forest department and local village council members. Further, the enumerators were asked to directly inquire the drivers of deforestation and forest degradation at household level. Further, the percent contribution of each observed drivers of deforestation and forest degradation was analyzed on the basis of people's perception highlighted during household survey.

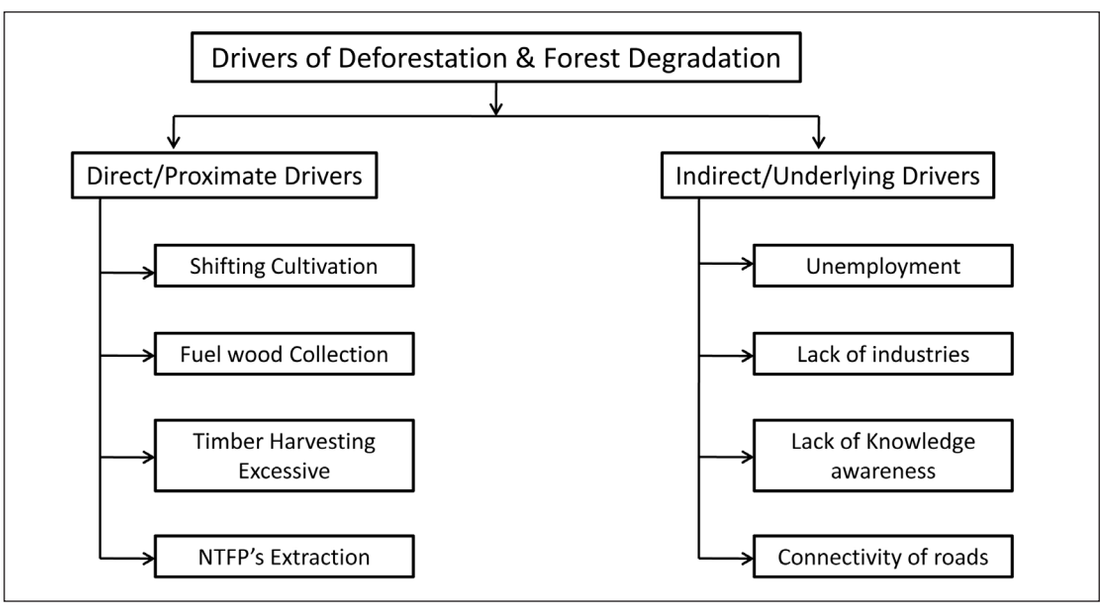


Fig. 4.4. Observed drivers of deforestation and forest degradation in the project area

4.4 Socio-economic profile highlighting the drivers of deforestation and forest degradation in study area

Analysis of household data reveals that 59 per cent of the overall population of surveyed villages constitutes the female population above 18 years followed by 22 per cent from 8 to 18 years and 19 per cent up to 8 years. In males, 58 per cent of the overall population of the households is above 18 years followed by 23% up to 8years and 19 per cent from 8 to 18 years (Table-4.4).

Table-4.4: Percentage of Age wise family distribution

Gender	Up to 8 yrs (%)	From 8 to 18 years (%)	Above 18 year (%)
Male	23	19	58
Female	19	22	59

Figure 4.5 represents that the education status of majority of individuals (i.e. approximately 55 per cent) was only upto primary standard and nearly 35 per cent of the individuals have metric standard. None of the female was post graduate and even only 1 per cent of male population holds post graduate university degree (Table-4.5).

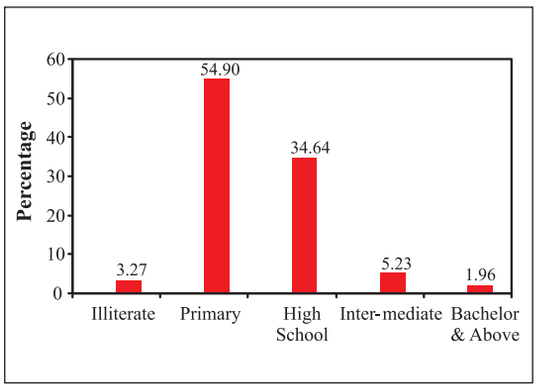


Fig. 4.5. Education status of the respondents

Table-4.5: Family-wise education status (%)

Gender	Illiterate	Primary	Metric	Inter-mediate	Gradua-tion	Above Graduation
Male	7	41	35	11	5	1
Female	7	42	36	12	4	0

The survey reflects that's the agriculture is the main source of livelihoods among the most of the local communities. 72 per cent of the individuals were involved in agriculture and other 28 per cent were engaged in government/private jobs, self employed/ business and daily wages workers (Fig 4.6). The average per capita landholding was 2.71 hectare although there were 22 per cent of the families were landless. The landless families are engaged in other occupations like local kitty business, labour works etc. The average annual income of the individual was approximately Rs.1, 00,601.30 (Table-4.6). Among all the respondents it has been found that about 61 per cent of the population have annual income ranges from Rs. 10,000 to Rs. 60,000. There is only 13 per cent population which has annual income above than Rs. 1,50,000 with maximum of Rs. 12,00,000.

Table-4.6: Percentage of annual income from all assets

Annual Income	
Rs 10,000-30,000	28%
Rs 31,000-60,000	33%
Rs 61,000-90,000	16%
Rs 91,000-120,000	6%
Rs 1,21,000-1,50,000	4%
Above Rs 1,50,000	13%
Maximum Income	1200000
Minimum	10000
Average Annual Income	100664.60
Standard Error	12404.20

Table-4.7: Percent distribution of types of houses

Village	Katcha	Semi-Pucca	Katcha
Reiek	18	18	6
Ailawng	11	19	2
West Lungdhar	11	8	0
Khawrihnim	12	12	
Lengte	1	10	0
Chungtlang	14	15	1
Total	**67**	**82**	**9**
Percentage	43%	51%	6%

Survey revealed that the standard of living in the surveyed villages is not so high. Majority of the individuals have *semi-pucca* (semi-strong) house (52%) followed by *kutcha* (not strong) house (43%) and only 9% of the population have *pucca* (strong) house (Table-4.7).

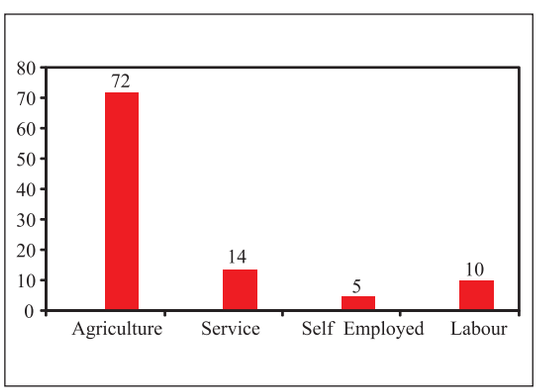


Fig. 4.6. Percent distribution of primary occupation of the individuals

Analysis of the data revealed that 69.62 per cent of the average population is involved in the shifting cultivation which has been the major driver of deforestation and forest degradation from the decades while other 2.37 per cent of the population is practicing permanent / terrace farming on their own land. The land pass has been given by the representative of the village

Traditional type of houses in Mizoram

council to each family for the span of 2-3 years for shifting cultivation. The total area allotted for shifting cultivation to a particular family varies from family to family depending upon the family size. The minimum average land holding for shifting cultivation is 1.30 ha/family. The personnel communication with the village council members revealed that a family of 4 persons approximately got one hectare of land for shifting cultivation. The average income from shifting cultivation is Rs 32,076 per annum. Fig 4.7 represents the percent distribution of the crops grown by the local communities under shifting cultivation practices. It has been observed that 110 household (70%) out of 158 households are involved in shifting cultivation and about 1461 ha of land is under shifting cultivation in the pilot area under Mamit district. Majority of the households are growing rice (40%) as a major crop under shifting cultivation. Turmeric is also growing as a major crop by the households of Reiek and Ailwang villages at their shifting cultivation farms. The turmeric cultivation is playing an important role in Reiek and Ailawng area towards income generation activities among the local communities. In consultation with Mr. Kima, Member of Multi-farming Cooperative Society, Reiek informed that 200 household are involved in cultivation of Lakadong variety of Turmeric and they are earning a sum of Rs 20,000 to 30,000 per annum from 0.40 ha (1 Tin) of land. Further, in Chungtlang, it has been found that the villagers are shifting towards the cultivation of oil palm. Some villagers are growing orange, banana, ginger and other seasonal vegetables on their shifting land.

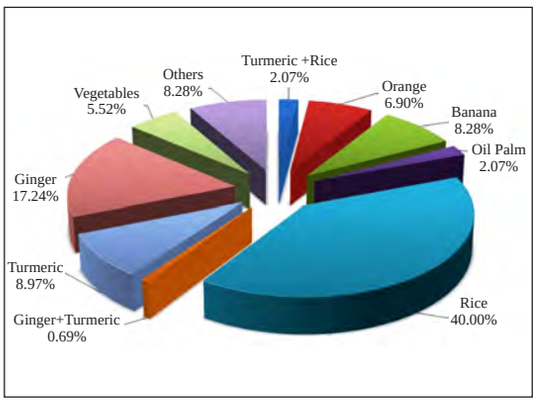


Fig. 4.7. Percent distribution of households growing different crops under shifting cultivation

Clearing of forests for shifting cultivation




Turmeric powder production




4.5 Source of Energy

During the household survey, it has been found that the local communities are using fuel wood on large scale for meeting their energy requirement for cooking purpose. Out of total household surveyed in the pilot area, 130 households (82%) are using fuel wood as a major source of energy for cooking as well as heating purpose. Only 27 households (12%) households are using LPG and one household is using electricity (induction plate) for cooking purpose (Fig 4.8). The reason for more dependency on fuel wood in spite of LPG is attributed to irregular supply of LPG and easy availability of fuel wood, poverty and lack of awareness are other reasons.

Fuel wood contribution at local level

Box-4.2

A case of LPG distribution

During the survey in Reiek village it has been found that the government had distributed the LPG to each household, but some villagers has sold their LPG, and they still prefer fuel wood for cooking purpose. The main reason behind this was the low income of those families. The families who have sold their LPG stoves were not in position to afford the cost of using the LPG and they informed that the supply of LPG is also not regular. (Source: Personnel Communication of the Local Communities)

In terms of source of fuel wood, community forests contributes approximately 38% of the total fuel wood collection followed by own/private lands (18.24%) and government forests (17.61%). Fig 4.9 represents the percent distribution of source of fuel wood from six villages. Survey revealed that on an average approximately 31.42 kg of fuel wood is being collected per day per household of the surveyed villages of pilot area. Hence, in whole pilot project area the total fuel wood collection is 40.92 tonnes per day and this shows that the fuel wood collection is one of the major drivers of forest degradation. The total economic value of the fuel wood extracted from all sources by the local communities of the project area is estimated to Rs 3,73,42,745 annually. After shifting cultivation, the fuel wood collection is also playing a major role as an active driver towards deforestation and forest degradation in the pilot area. The major species used by community for fuel wood purpose are given in Table-4.8.

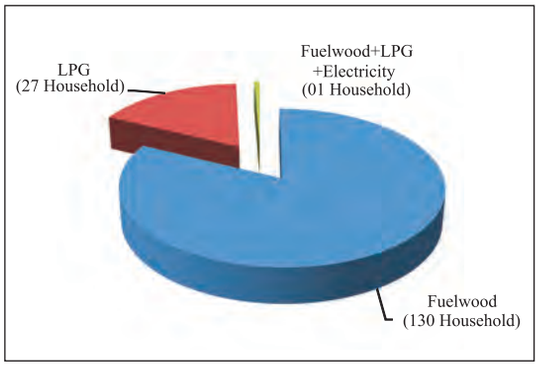


Fig. 4.8. Distribution of households with different source of energy for cooking and heating

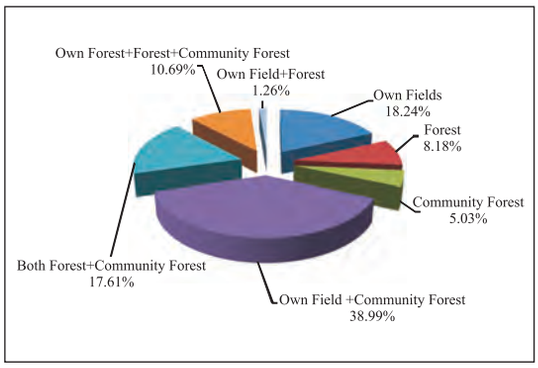


Fig. 4.9. Percent distribution of different source of fuel wood collection

Table-4.8: Common fuelwood species of Mizoram

S.No.	Botanical Name	Common Name
1	*Adina cordifolia*	Lungkhup
2	*Albizia procera*	Kangtekpa
3	*Anogeissus acuminata*	Zairum
4	*Castanopsis tribuloides*	Thingsia
5	*Derris robusta*	Thingkha
6	*Mesua ferrea*	Herhse
7	*Schima wallichii*	Khiang
8	*Vitex peduncularis*	Thingkhawihlu
9	*Albizia odoratissima*	Kangteknu
10	*Albizia chinensis*	Vang
11	*Lobelia nicotianaifolia*	Berawchal

(Source: Lalfakzuala *et al.,* 2006)

The correlation matrix (Table-4.9) shows the correlation between eight socio-economical parameters shows that maximum positive correlation ($r = 0.448$) was observed between land assets and land under shifting practice. This was followed by the correlation between land asset and number of family members ($r = 0.360$). The matrix represents that total income of a family is also influenced by either education level or by the shifting cultivation practice i.e. the shifting cultivation is playing an important role towards the economic conditions within a family. Hence by adopting the cash crops and major horticultural crops on the shifting cultivation farms has

Table-4.9: Correlation matrix between various observed parameter

	Age	Sex	Total Family Members	Literacy Index	Total Income	Land Assets	Fuel wood Collection	Land Under Shifting Cultivation
Age	1	-0.036	0.251**	0.039	-0.046	0.159*	-0.042	0.053
Sex	-0.035	1	0.016	-0.041	0.004	-0.113	-0.097	-0.149
Total Family Members	0.250**	0.016	1	0.108	0.098	0.360**	0.132	0.091
Literacy Index	0.039	-0.041	0.108	1	0.196*	0.069	-0.124	0.091
Total Income	-0.045	0.004	0.098	0.196*	1	0.096	-0.129	0.192*
Land Assets	0.158*	-0.113	0.360**	0.069	0.096	1	0.085	0.448**
Fuel wood Collection	-0.042	-0.097	0.132	-0.124	-0.129	0.084	1	0.152
Land Under Shifting Cultivation	0.053	-0.149	0.091	0.091	0.191	0.448**	0.152	1

** Correlation is significant at the 0.01% level * Correlation is significant at the 0.05% level

potential of enhancing the economic condition of the pilot area and also encourage the individuals for use of LPG for cooking purposes. In the survey it has been found out that the only 12 per cent of the households are using LPG and 50 per cent of the individuals stated that the family's economic conditions doesn't allow them to adopt LPG as a major source of energy for cooking purposes.

Box-4.3

Livestock an alternative livelihood option

In terms of livestock, 80% of the household are engaged in piggery and poultry. About 30% of the household are engaged poultry farming as a source of their income while 100% of rearing of pigs is only for the selling purpose

Box-4.3

Promoting Cash Crop

Department of Soil and Water Conservation in Mizoram is working on terrace farming, bunding, trenching, water conservation (water harvesting, farm ponds, percolation tanks, stream bank, erosion control works, series of check dam across the drainage line), cash crop plantation (rubber, coffee, broom) with establishment of nurseries for making availability of planting stocks. Thus Department is giving importance to the extensive cash crop plantation of coffee, rubber and brooms in order to increase the productivity and production from the shifting cultivation farms. This will also be helpful in reducing the extent shifting cultivation area in the state.

The Department of Soil and Water Conservation in Mizoram has also created rubber nurseries to increase the production of rubber polypot for rubber planters in the state during 2013-14 and maintained during 2014-15 in the districts of Mamit, Aizawl, Lunglei, Serchhip, Kolasib & Lawngtlai whereas construction/ installation of coffee processing unit has also been initiated in Hriphaw Village, Mamit District.

Source: https://soil.mizoram.gov.in/uploads/files/approved-rfd-2015-16.pdf

4.6 Dependency on Forest Produces

Local communities are highly dependent upon forest produce for their day to day needs. The forest provides the major livelihood option for the local communities. Local communities are getting timber for the construction of their house from the forest, and wild fruits and other plants as a source of their food as well as medicine. Hence by observing the dependency of local communities on the forest produce it has been concluded that it is contributing towards both deforestation as well as forest degradation. Among all, in whole north east India bamboo has its own significance in the daily life. Table-4.10 represents the common species of bamboo and their uses based on the people's perception observed during the survey.

Table-4.10: Bamboo species available in the project area

S.No.	Species	Local Name	Common Uses
1	*Bambusa bambos*	Rawhling	• Construction of houses and huts • Fencing around the agricultural fields • Bamboo shoots (fresh and dried) as a food source. • Baskets and hats • Curtains and chicks • Small houses for livestock • Furniture at house (stools and benches) • Bamboo brooms
2	*Bambusa tulda*	Rawthing	
3	*Schizostachyum munroi*	Nat	
4	*Dendrocalamus hamiltonii*	Phulrua	
5	*Schizostachyum polymorphum*	Chal	
6	*Dendrocalamus longispathus*	Rawnal	
7	*Melocanna baccifera*	Mautak	
8	*Bambusa mizorameana*	Talan	

Apart from bamboo there are other common species which has been used as a source of food available in the forests. The common species available in the forests which has been used by the local communities as a source of food are given in Table-4.11 and plants used by rural households for their health care needs are given in Table-4.12.

Table-4.11: Plants available in the forests for food

S. No.	Scientific Name	Local Name	Plant Part Used
1	*Homalomena aromatica*	Anchiri	*Stem*
2	*Calamus erectus*	Hruizik	*Young Stem*
3	*Zanthoxylum budrunga*	Chingit	*Leaf*
4	*Musa superba*	Saisu	*Young Shoot*
5	*Trevesia palmata*	Kawh-te-bel	*Young Shoot*
6	*Schizophyllum commune*	Pasi	*Complete Plant*
7	*Amomumde albatum*	Aidu	*Tuber*
8	*Musa* spp.	Tumbu	*Young inflorescence*
9	*Protium serrata*	Bil	*Fruit*
10	*Acacia* sp.	Khanghu	*Young Leaf*
11	*Dysoxylum gobara*	Thingthupui	*Leaf*
12	*Mikania micrantha*	Japanhlo	*Leaf*

Table-4.12: Medicinal plants and their local use

S.No.	Scientific Name	Local Name	Plant Part Used
1	*Calamus tribuloides*	Thingsia	Leaf used in stomach pain
2	*Oroxylum indicum*	Archangkawn	Bark used in fever
3	*Aporusa octandra*	Chhawntual	Bark used for stomach ulcer
4	*Blumea lanceolaria*	Buarze	Leaves used for stomach ulcer
5	*Hedyotis cepitellata*	Lawminutuibur	Whole plant used for stomach pain
6	*Phyllanthus fraternus*	MithiSunhlu	Plant for Liver ailments and fever

7	*Artemisia indica*	Sai	Whole plant is used for diarrhea, dysentery and abdominal pains. Paste of plant is used to treat wounds
8	*Alstonia scholaris*	Thuamriat	Bark is used for malaria, diarrhea, heart diseases and hypertension.
9	*Hedyotis scandens*	Laikingtuibur	Infusion of leaves is good for removal of kidney stone and treating urinary tract infection.
10	*Dysoxylum gobara*	Thingthupui	Leaf & bud decoction in diarrhea & dysentery.
11	*Mikania micrantha*	Japanhlo	Leaf juice for dysentery, as haemostatic. Leaves boiled with Vitex peduncularis are taken against fever.
12	*Eupatorium odoratum*	Tlangsam	Antiseptic
13	*Schima wallichii*	Khiang	Fruit decoction used against snake and insect bites

4.7 Gender and Governance

The development of certain group/community at household level as well as community level depends on the level of participation in the developmental activities by its overall population including women participation. In Mizoram, the contribution of women in every developmental activity at village council level as well as household level provides an important role towards the income generation which further improves the quality of life. In terms of using forest resources by the women, it has been observed that the women are involved in collecting fuel wood and other forest resources for the purpose of food, income and as well as for medicinal purpose. Further highlighting the aspect of women and economy in the project area, it has been found that most of the shops in the project area are run by women. Women are also involved in small cottage industries e.g. broom making. During the survey it has been found that women are equally contributing their role in income generation activities at household level i.e. 50% of the overall household income is generated by females. Guha and Adak (2014) also stated that in state of Mizoram the entrepreneurship activities lie in the hands of women. In Mizoram, the women are involved in higher percentage in the income generation activities in comparison to the women of other part of India. Apart from household level, the women are playing their active role in village councils as well. Women have equal representation in the village council and play equal role in the village council functioning. Because of this dominant role of women in the Mizo society the issue of deforestation and forest degradation can be highly influence by the roles of women at household as well as local level.

Hence by acknowledging the roles of women in use of forest resources and their contribution in the economic well being at household level, active participation of women in capacity building programmes and orientation programmes for entrepreneurship development specially focusing on women self help groups and marginal communities can help to achieve the objectives of REDD+ project in the North-eastern part of the country.

Women in different roles: women play an active role in mizo society

Civil societies, NGOs, Young Mizo Association (YMA) linked with traditional and cultural value system of the Mizo society have strong visible impact on governance at local level. The village councils act as a local body which works under the guidance of local administration and facilitates to take the voice of the communities to the government. The YMA have done lots of developmental work in every village of the state. In consultation with the local communities it has been found that the communities are satisfied with their tribal rights and they are getting each and every benefit in fair and equitable manner.

4.8 Significant contribution of each drivers of forest degradation on people's perception

People perception revealed that shifting cultivation and fuel wood collection from forests are the major drivers of forest degradation. Other observed drivers of forest degradation on people's perception are given in Table-4.13.

Underlying drivers of forest degradation

Table-4.13: Percent distribution of identified driver of deforestation and forest degradation as per people's perception

S. No.	Drivers	Percentage of Individuals
1	Shifting Cultivation	89.24
2	Fuelwood Collection	84.81
3	Fuelwood+Shifting Cultivation	91.77
4	Unemployment	59.49
5	Excessive extraction of NTFPs	36.08
6	Lack of Industries	37.34
7	Lack of knowledge and awareness	49.37
8	Connectivity of Roads	28.48

Way Forward / Recommendations

During survey and interaction with the local communities, it was revealed that there are certain activities which are playing their roles directly or indirectly towards deforestation and forest degradation. The drivers of deforestation and forest degradation, proposed activities to enhance livelihoods of local community and to check the drivers of deforestation and forest degradation from the pilot area are given below:

(1) Shifting cultivation: Shifting cultivation is also known as slash and burn practice which is the traditional type of agricultural practice in Northeast India. As per survey, it has been found that majority of individuals are submitting their views about the shifting cultivation that it is the major cause of forest degradation in their areas. The farmers use the specific allocated area for a period of 2-3 years and after that period those areas become abandoned. Farmers further shift to new forest area which is causing land degradation and increasing the availability of degraded land in the state. According to the people's perception the solution to abate the extent of shifting cultivation is the wet rice cultivation. The rice is the major crop of the state and wet rice cultivation is the most favorable type of cultivation technique to increase the production of rice. The total area under the wet rice cultivation in the state has also been increased from last few years which have also increased the rice production in the state.

Further some individuals suggested that terrace farming and permanent farming can also decrease the extent of shifting cultivation in the state. Terrace farming and allotment of land on permanent basis to the farmers can increase their interest and responsibility towards it.

Restoration of the shifting patched can also play an important role, because of shifting cultivation the famers give attention to land for 2-3 years and after that there is no any provision towards the maintenance of that particular patch. The area has been left abandoned by the local communities without using any scientific method of eco restoration. Hence at the village council level, a team with the active participation of local communities can be formed which can work towards the restoration of that abandoned patches of land under the guidance and support of State Forest Department and other Forestry Research Organizations.

From the survey it has been found that introduction of horticultural crop can also play an important role. Promoting horticultural crops can increase the income from a particular patch of land. This can further encourage farmers for opting a regular source of income. Oil palm, ginger, turmeric, coffee and tea plantation can play an important role in reducing the extent of shifting cultivation from the project area.

(2) Fuel wood collection: Promoting high density energy plantation of local fast growing species can also ease pressure on forests for fuel wood collection. During the survey it has been found that the villagers are using traditional type of cook stoves in their houses which is using large quantity of fuel wood with poor efficiency and also causing the indoor smoke problem and respiratory health diseases. Not even a single household was equipped with improved fuel efficient cook stove. The fuel wood collection can be reduced by introducing the fuel wood efficient improved cook stoves in the project area.

Further the individuals who can afford to pay for LPG are not getting the regular supply of LPG refills. Hence continuous supply of LPG can play an important role to switch the local communities towards the use of LPG cook stoves instead of traditional cook stoves. From The field survey reveals that economic as well as education status of a family can also help to reduce the extent of fuel wood collection in the villages. Alternate livelihood opportunities will help in improving economic status of the families/local communities. The additional income will further encourage them to meet cost of LPG usages. Awareness generation programmes, seminars and training programmes can also play an important role in checking the problem of shifting cultivation.

(3) Lack of employment opportunities and industries: Employment status is also playing an important role towards the degradation of forests. The employment opportunities are very less and most of the people depend on farming practices and collection of forest produces. During the survey, it has been

found that majority of farmers (72%) are involved in farming practices and only 13% of the population are in government and private jobs. The villagers pointed out that the introduction of cottage industry for example bamboo industry, improved processing of locally available raw material and entrepreneurship, handicraft industry etc. can play an important role towards generating the alternative employment opportunities for local communities. Hence by acknowledging the traditional knowledge and skills of the local communities, emphasis should be given to promote various livelihood activities on traditional and indigenous knowledge based in improving their livelihood options and ultimately provide positive incentives for improving their economic status.

(4) Excessive extraction of non-timber forest products (NTFPs): Non-timber forest products play an important role towards local livelihood and economy. Individuals are spending more hours of their daily time in collecting NTFP from their nearby forest areas and selling them in the town markets. During the interaction with local communities, it has been observed that there is not enough control of government agency towards collection as well as sale and purchase of the NTFPs from the forests. In Mizo society the local communities are very fond of NTFPs and on weekends the town markets are full of local vendors selling variety of wild food at very low and fluctuating prices. With the active participation of forest department and village council members, scientific harvesting of NTFPs, and a block level market of NTFPs can be established in which the records for demand and supply of NTFPs can also be maintained.

Lack of knowledge and awareness

Overall, we can say that dependency of local communities on forest produce is one of the factors affecting the rate of forest degradation. There is a need for the local communities to sensitize the issue of deforestation and forest degradation by providing the seminars and awareness campaigns highlighting the various Government programmes/ incentives, negative impacts of the using forest resources in unsustainable manner. The involvement of local communities in every project activity can catch their interest and this can become more success if there is some financial gain at individual level by implementation of the project activity. Hence there is need to give more emphasis on income generation activities of the local communities by ensuring sustainable use of forest resources and conservation of local biodiversity.

Coordination between the local communities and state forest department for management of forests can provide an alternative for reducing the forest degradation. The capacity building of local communities on various conservation strategies and measure, sustainable harvesting of NTFPs and by increasing the economic status of the local communities can decrease the dependency of indigenous communities on the forest produce.

Alternate uses of forest produce

Overall, 25% of the individuals suggested that there is need of industrial growth and infrastructure development so that the villagers can become self sufficient thus reducing their dependency on the forests. In infrastructure development connectivity of roads can also play an important role towards improving the economic status of area.

Project activities for addressing drivers of deforestation and forest degradation

In consultation with the local community members of Reiek Village under Mamit District (Mizoram) during the project inception workshop, it has been highlighted that the farmers are cultivating organic turmeric and they suggested that solar drier can be better option for drying turmeric which will also contribute in income generation activity in pilot area. Solar drier can reduce the time taken by the raw turmeric to dry up completely before processing it into powder form otherwise it takes one month time for complete drying. This will promote the local communities to grow more turmeric on their agricultural land and can also play a significant role in improving the economy at household level. Such activity can help in reducing the extent of shifting cultivation from the area because the natural regeneration capacity of turmeric plantation is comparatively very high and this can be helpful for the local communities to grown turmeric on same piece of land.

On the other side, with active support of Mizoram State Department of Environment and Forests, it has been found that the some of the farmers are converting the shifting farms to the coffee garden which is providing an alternative source of income generation. Hence to raise the alternative livelihood options, the coffee plantation has also been proposed in the project area as one of the activity to improve the livelihood and economic status of the local communities as well as to reduce the extent of shifting cultivation.

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Annexure - I

Questionnaire for Socio-Ecological Survey of Forest Adjoining Village

INFORMED CONSENT

Please read the following that explains this research study including the associated risks and benefits, if any. You are being asked to take part in the research being conducted by ICFRE under the guidance of Assistant Director General (Biodiversity and Climate Change), ICFRE, Dehradun. This should help you decide whether or not you want to participate in the study. Agreeing to this will confirm that you have been informed about the study and you want to participate. Taking part in this study is completely voluntary and anonymous.

Research Description

This research is about the preparation of project development document for REDD+. REDD+ stands for countries' efforts to reduce emissions from deforestation and forest degradation, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks. It is desire to facilitate incentivisation against REDD+ financial mechanism. Ultimately we hope this survey result will provide synergy between climate change mitigation and financial benefits against carbon enhancement and other co-benefits of the forests to the local communities. Roughly 250 households will be invited to participate in this research study.

Risks and Benefits

There are no foreseeable risks or discomforts for participating in this study. You may not receive any direct benefit from taking part in this study. However, by participating in this study you support the research community about the informed decisions and for assisting appropriate plans for addressing potential consequences for mitigation of climate change. Data that we collect detailing household forest dependency can be used to inform and direct future research, besides facilitation for REDD+ mechanism in the area.

Ending your Participation

You have the right to withdraw your consent or stop participating at any time. You have the right to refuse to answer any question(s) or refuse to participate in any procedure for any reason. Refusing to participate in this study will not result in any penalty or loss of benefits to which you are otherwise entitled.

Description of Procedures

If you agree to take part in this study, you will be asked to complete a survey that will last approximately 45 minutes.

Confidentiality

We will make every effort to maintain the confidentiality of your responses. Only the team of the project will have

access to the data and information about participation and will not be shared with others, except for scientific publication and community necessities.

The researcher can be reached through email to ADG (BCC):adg_bcc@icfre.org

Authorization

I have read this information about the study or it was read to me. I, ...solemnly declare that the information provided by me are correct to best of my knowledge and belief, and is for research purpose only.

Signature of respondent

Questionnaire No. Date:

Geographical Information of Village

1. Name of Village:.....

2. GPS Location: Latitude: .....º.....'.....'' N Longitude: .....º.....'.....'' E

3. Altitude :.....(m) amsl

4 Landmark:.....

Socio-Demographic Profile of Household

5. Name of Respondent : .....

6. Age:.....years 7. Sex M ☐ F ☐

8. Education: Illiterate ☐ Primary ☐ High School ☐ Intermediate ☐ Bachelor and above ☐

9. Religion: 10. Caste: General / OBC / SC /ST

11. What type of house do you have?

a) Kachha House b) Semi-pakka House c) Pakka House

12. Age wise distribution of household members:

Gender	below 8 years	between 8 to 18 years	above 18 years
Male			
Female			

13. Family Education Status:

Educational Level	Illiterate	Primary	High School	Intermediate	Bachelor	Above Bachelor
Male						
Female						

14. Profession:

Primary Profession:

Agriculture ☐ Service ☐ Self Employed ☐ Labour ☐ Any Other .....

Secondary Profession:

Agriculture ☐ Service ☐ Self Employed ☐ Labour ☐ Any Other .....

Approximate Annual Income (Rs.).....

15. Land Asset:

a. Cultivable Land (Unit): i) Irrigated Land: ii) Unirrigated

b. Uncultivated Land (Unit):

16. Major energy sources used:

Purpose	Kerosene	Fuelwood	Dung cakes	LPG	Bio Gas	Electricity	Crop Residue
Cooking							
Heating							

17. General Characteristics

Availability of fuel efficient stoves:

Preferred source of energy for cooking:	Ist		IInd		IIIrd	

Farming Practices

18. Agriculture Practices:

a. Crop Cultivation

Major Crop	Area (unit)	Production Quantity		Expenditure in Cultivation	Income
		For Self Consumption	For Selling		
Wheat					
Rice					
			Total		

- Do you grow traditional variety of crops: Yes/ No Reason: …….
- Do you grow high yielding variety of crops: Yes/ No Reason: …….
- Do you use seed from outside for cultivation: Yes/ No Reason: …….

b. Horticulture

Major Fruit Crop	Area (unit)	Number	Production Quantity		Expenditure	Income
			For Self Consumption	For Selling		
				Total		

- Do you grow High Yielding Variety of Fruit Tree: Yes/ No Reason: …….

c. Agroforestry

Major Tree Crop	Area (unit)	Number (Planted/Natural)	Product		Expenditure	Income
			For Self Consumption	For Selling		
				Total		

d. Livestock Resources

Livestock	Number		Product		Expenditure	Income
	Desi Breed	Cross Breed	For Self Consumption	For Selling		
				Total		

e. General information about farming practices.

- Type of fertilizers used: Chemical ☐ Organic ☐ Both ☐
- Annual quantity of chemical fertilizer for cultivation: …….....……Expenditure: Rs….....
- Annual quantity of organic manure used for farming practices:…….....……Expenditure: Rs….....
- Use of chemical insecticide: Yes / No…….....Expenditure: Rs….....

Dependence on Forest Resources

19. Fuel wood collection:

Season of Collection	Winter	Summer
Quantity of Collection (kg/day)		
Own field (kg/day)		
Forest (kg/day)		
Community Forest (kg/day)		
Any Other (kg/day)		
Major fuelwood species		
Time spent (hr/day)		
Distance Travelled (km/day)		

Collector of fuelwood	No of Male		No of Female		No of Children	

20. Fodder collection:

Season of Collection	Winter	Summer
Quantity of Collection (kg/day)		
Own field (kg/day)		
Forest (kg/day)		
Community Forest (kg/day)		
Any Other (kg/day)		
Major fodder species		
Time spent (hr/day)		
Distance Travelled (km/day)		

Collector of fuelwood	No of Male		No of Female		No of Children	
Fodder Cultivation at farm	Yes/No					

21 Grazing

a. Livestock feeding practiced: Stall fed: Yes / No Grazing: Yes / No

b. Time of grazing (Hour/day):

c. Quantity of grazed stock, if possible:

d. Place of grazing: Own field ☐ Forest ☐ Community Forests ☐ Others ☐

22 Leaf Litter/Understory collection for manuring and bedding:

Season of Collection	Winter	Summer
Quantity of Collection (kg/day)		
Own field (kg/day)		
Forest (kg/day)		
Community Forest (kg/day)		
Any Other (kg/day)		
Major Plant species		
Time spent (hr/day)		
Distance Travelled (km/day)		

Collector of bedding materials	No of Male		No of Female		No of Children	

23 Timber Logging:

a. Source of timber: Forest ☐ Community Forest ☐ Own Land ☐ Forest Right ☐

b Amount of timber logged annually:

c Use of Timber Extracted, if any.....

24. Plants from forest used for food or food stuff

Common Name	Useful Plant Part	Source	Remark

25. Plants from forest used for medicinal purposes

Common Name	Useful Plant Part	Source	Remark

26. Status of Shifting Cultivation

a) Total Land use for Shifting Agriculture…….....……..

b) Maximum Time period for which one place of land is cultivated…….....….

c) Major species grown under this practice…….....……

d) Traditional method for restoration of the land under shifting cultivation…….....…..

27. Bamboo consumption and craft industry:

a) Are you involved in bamboo cultivation…….....…….

b) If yes, what is the main specie of bamboo used in cultivation…….....……

c) What is the approximate annual income from the bamboo…….....……..

d) What is the major use of the bamboo (i.e. craft industry/ own consumption)…….....…..

e) Personal Recommendation for bamboo cultivation and craft industry…….....…

28. Status of Roads and other construction activities:

a) What is the status of the roads and infrastructure (Developed/ Need Development)…….....…

b) What is the major loss on the forest area caused by the construction activities…….....…..

c) How the loss caused by the construction activities can be compensated in terms of biodiversity conservation activities…….....

29. Governance:

a) What is the status of tribal rights…….....

b) How the local Communities are benefited by those rights…….....

c) What are the main activities under those rights related to forest and its produces…….....

30. Gender Perspective

a) What is the contribution of females towards income generation at house hold level….....

b) Involvement/Contribution of females in decisions making at community level……If yes, define their roles and responsibilities…….....

c) Are females involve in local handcraft industries and wood based enterprises….....

d) If yes. Then elaborate their roles and percent participation…….....

Please elaborate your opinion on causes of deforestation and forest degradation:

Investigator:

Annexure - II

List of Respondents

S. No.	Respondent Name	Gender	S. No.	Respondent Name	Gender
Reiek Village					
1	Mr. Pahlira	M	22	Mr. Tlanzova	M
2	Ms. Zosiani	F	23	Mr. Lalnuntluanga	M
3	Ms. Zolawnii	F	24	Mr. Lalchhanchhuaha	M
4	Mr. Lalsawia	M	25	Mr. M. Thangsira	M
5	Mr. Muana	M	26	Mr. Mangkaia	M
6	Ms. C. Hmingthanmawii	F	27	Mr. Lalrintluanga	M
7	Ms. Lalthansangi	F	28	Mr. Gina Singson	M
8	Mr. C. Lalsangpui	M	29	Ms. Zolawmi	F
9	Ms. Biaknungi	F	30	Mr. R. Lalmuankima	M
10	Mr. Lalrinmauria	M	31	Mr. R. Lalduhawma	M
11	Ms. Lalsangliani	F	32	Mr. Lalsawia	M
12	Mr. Lalrammauria	M	33	Mr. Lalsawta	M
13	Mr. Rochhingpuia	M	34	Ms. Lalhmachhuana	F
14	Ms. Lalmuanpuii	F	35	Ms. Biakmawii	F
15	Ms. Lalramhmuaki	F	36	Ms. Lalremliani	F
16	Ms. Lalzuiliani	F	37	Ms.Vanlalhriati	F
17	Mr. Lalliankapa	M	38	Mr. Lal Rinnunga	M
18	Mr. C. Lalduhkima	M	39	Ms. Lalzuiliani	F
19	Ms. Lalchhanchhuaha	F	40	Mr. Tlangchangliana	M
20	Ms. Lalparmaurii	F	41	Mr. Zarzokima	M
21	Mr. Rinnunga	M	42	Mr. C. Vanlalsawma	M
Ailawng Village					
1	Ms. Lalnipuii	F	17	Mr. Lalrintluanga	M
2	Ms. Lalchhandami	F	18	Mr. K. Zosanglura	M
3	Mr. H. Lallanpuia	M	19	Mr. Lalmalsawma	M
4	Mr. K. Zodingliana	M	20	Mr. Lianvela	M
5	Mr. R. Laltanpuia	M	21	Mr. F. Lalliansawia	M
6	Mr. VanlallianaRoyte	M	22	Ms. Lalhmuaki	F
7	Mr. Lal Sangzuala	M	23	Mr. P. Lalsangzela	M
8	Mr. Lalherliana	M	24	Mr. Lalthanzuala	M
9	Mr. Lianzauva	M	25	Mr. Darkunja	M
10	Ms. Zothanmawii	F	26	Mr. R. Lalduhawma	M
11	Mr. P.C. Zarzokima	M	27	Mr. P.C. Lalbiakliana	M
12	Mr. R. Lalsiama	M	28	Mr. Lalthlamuana	M
13	Mr. R. Denghmingthanga	M	29	Mr. H. Laldawngliana	M
14	Mr. K. Ralkapzauva	M	30	Mr. R. Dengthuama	M
15	Mr. Lal Rinawma	M	31	Mr. Daniala	M
16	Ms. Lalthatpuii	F	32	Mr. Lalroneiha	M

West Lungdar Village					
1	Ms. Chawngthanthuami	F	11	Ms. Kungi	F
2	Ms. Zaithangpuii	F	12	Ms. Rohlui	F
3	Mr. Lalrodinga	M	13	Mr. R. Lalhruaitlwanga	M
4	Mr. ZohinngThanga	M	14	Mr. Lalsamliana	M
5	Mr. Vanlalzama	M	15	Mr. Pathianga	M
6	Mr. Lalhmangaihthanga	M	16	Ms. Lalkhawchhiari	F
7	Mr. Lalramthiama	M	17	Ms. Thangchuangi	F
8	Mr. Lalnunzira	M	18	Ms. Lalnunmawii	F
9	Mr. Thanmawia	M	19	Mr. R. Lalduhanna	M
10	Mr. Kapzawna	M			
Khawrihnim Village					
1	Mr. Lallianmauria	M	13	Mr. Lalremruata	M
2	Mr. Lalchhanchhuaha	M	14	Mr. Lawmsanga	M
3	Mr. Zoramthara	M	15	Ms. Vanlalthlani	F
4	Mr. Lalrinawma	M	16	Mr. R. Vanlalvena	M
5	Mr. C. Zirliana	M	17	Ms. Lalkingruii	F
6	Mr. Lalduhsaka	M	18	Ms. Lalhmangaihi	F
7	Ms. Thanchungnungi	F	19	Mr. Hrangzuala	M
8	Ms. Biaklluangi	F	20	Mr. Vanlalthana	M
9	Mr. H. Lalmingthanga	M	21	Mr. Ralthansanga	M
10	Ms. Ngurchhawni	F	22	Ms. Zamani	F
11	Mr. B. Lalramthara	M	23	Mr. Thianchlima	M
12	Mr. Lalzawna	M	24	Ms. Lalrammawii	F
Lengte Village					
1	Lalrinkimi	F	7	Laltanpuia	M
2	Ralramliana	M	8	Lalchamliana	M
3	Lalsangliani	F	9	Lalmeihkima	M
4	Lalmunsiani	F	10	Vanlalfela	M
5	Chanchinmawia	M	11	Darrothuami	F
6	Dinchhuahmawia	M			
Chungtlang Village					
1	Ms. Vanlalhruaii	F	16	Mr. Lalrammawia	M
2	Mr. Lalremruata	M	17	Ms. Lalnuntluangi	F
3	Mr. Lawnamia	M	18	Mr. P.C. Vanlaldika	M
4	Mr. Vanlalhmangaiha	M	19	Mr. Lalramnghaka	M
5	Mr. Zoramdinsanga	M	20	Mr. Kapkunga	M
6	Mr. Lalramthara	M	21	Mr. P.C. Lalbiakltuanja	M
7	Ms. Lalthazuali	F	22	Mr. Lalbiakhiana	M
8	Mr. R. Laltanpuia	M	23	Ms. Laltamkimi	F
9	Mr. Lalchhuanawma	M	24	Mr. Lalthantluanga	M
10	Mr. Lalramthanga	M	25	Mr. Huntharnghaka	M
11	Ms. Vanlalruati	F	26	Ms. Vanlalnghaki	F
12	Mr. Lalngurliana	M	27	Mr. Lalzawmliana	M
13	Ms. Zorempuii	F	28	Mr. Vanlalnunsanga	M
14	Mr. H. Lalawnpuia	M	29	Mr. Lalramliana	M
15	Mr. Abrahama	M	30	Mr. Lalnuntha	M

Acknowledgement

- International Centre for Integrated Mountain and Development (ICIMOD), Kathmandu Nepal
- Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ), Germany
- Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany
- Rain Forest Research Institute (RFRI), Jorhat, Assam
- Advance Research Centre for Bamboo and Rattan (ARCBR), Aizawl, Mizoram
- Department of Environment Forest and Climate, Aizwal, Mizoram

Guidance and Support

- Dr. Suresh Gairola, Director General, ICFRE
- Dr. Neelu Gera, Deputy Director General (Research), ICFRE
- Dr. R.S.C. Jayaraj, Director, RFRI
- Dr. Bhaskar Singh Karky, Resource Economist, ICIMOD
- Mr. Kai Windhorst, Chief Technical Advisor, GIZ
- Mr. M.Z. Singson, Head, ARCBR
- Mr. Saurabh Sharma, DFO, Aizawl
- Mr. Karma Phuntsho, Senior NRM Specialist, ICIMOD
- Mr. Muhammad Sohail, REDD+ Specialist, ICIMOD
- Mr. Basant Pant, Programme Associate, ICIMOD
- Mr. Nabin Bhattarai, Consultant, ICIMOD
- Dr. Mohd. Shahid, Consultant, ICFRE

Field Support

- Mr. Umang Thapa, Junior Consultant, ICFRE
- Mr. Clement, ARCBR
- All respondents from villages Reiek, Ailawang, West Lungdhar, Kwarihnim, Lengte, Chungtlang of District Mamit, Mizoram

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