

# DEGRADATION OF FORESTS IN LUNGLEI DISTRICT, MIZORAM

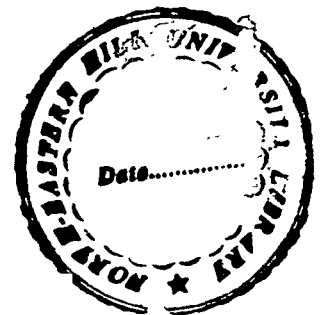
BY

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DEPARTMENT OF GEOGRAPHY

A Dissertation

Submitted in Partial Fulfilment of the Requirement of the Degree of Master of  
Philosophy in Geography of North-Eastern Hill University, Shillong

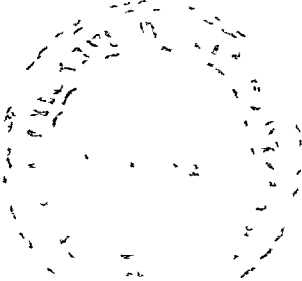


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# North-Eastern Hill University - Shillong

June - 2005

## DECLARATION

I, **C. Ramhnehzauva**, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other university/institute.

This is being submitted to the North-Eastern Hill University for the degree of Master of Philosophy in Geography.

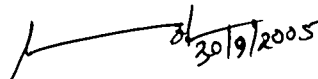


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Date: 20<sup>th</sup> June, 2005

Place: Shillong

  
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**CHAPTER – I**  
**INTRODUCTION**

## 1.1 INTRODUCTION

Forests are not only essential for ecological balance of an area but they are also an important component of our natural environment and a source of various resources. They also play an important role in enhancing the quality of environment by influencing the life supporting system. Apart from providing direct use values, forests provide numerous environmental benefits such as watershed protection, nutrient cycling, pollution control, micro-climatic regulation, carbon sequestration, etc. The valuable forests resources are under great threat due to various forms of degradation. In fact, degradation of forests could become a major constraint on future growth and development in most of the developing countries like India. The real costs of such degradation are increasingly felt in terms of declining productivities of interlinked natural resources such as land, water, grass lands, etc. Though, the impacts in terms of loss of production are not realised at the macro level the problem is of very serious concern at the regional level.

The forests of the world, particularly of the tropical zone (where the study area is located) have been degraded rapidly which has created one of the most burning environmental problems in the present day world. Degradation of forests is one of the outcomes of various developmental activities having the character of extensional development and it is true that degradation is a havoc wreaked by thoughtless destructive activities of development. A forest clearing was made not only for village settlement but also for cultivation and pastures. With the increase of human population more and more forested area is cleared for various uses. Commercial exploitation of forests is also the main causes of degradation of forests. The world's tropical forests are disappearing faster than ever. Every succeeding study shows a startling acceleration of the process. For many years the baseline figures accepted for rates of degradation of forests were those prepared by the Food and Agriculture Organisation (FAO) in 1980. The study demonstrated that, globally, the total loss of forest cover area was proceeding at some 1,14,000 square kilometres per year. Therefore, degradation of forests has now become one of the most

challenging problems throughout the world. Each year, over 4 million hectares of virgin tropical forest are harvested and becoming '*Secondary Forests*' (Melillo *et al.* 1985). Some process of forests degradation has been going on in Northeast India, which can still boast for its large tracts of virgin forests. But having large areas of forest has itself become destructive for it, for it attracts the people area involved in removal this precious 'green gold'. In this way the natural thick forests of Lunglei district have also been degraded, where proximity to international border is an additional factor responsible for forests degradation. Hence, an attempt has been made here to study '*Degradation of Forests in Lunglei District, Mizoram*'.

## **1.1 LITERATURE SURVEY**

It is a matter of serious concern that the present economic man forgotten the environmental and ecological significance of natural vegetations (mainly forests and grassland). The forests have destroyed so rapidly and alarmingly that the forest area at global, regional and local levels has markedly decreased. A lot of literature is available on it. Relevant literature had been reviewed here to understand the problem in proper perspective. Literature survey has been done according to important themes.

### **Forest**

Before we talk about degradation of forests, we need to answer the question "What is a forest?" Most people think they know a forest when they see one. A forest is a lot of trees growing together. That may be true, but is a plantation, with lines and lines of trees growing like a giant wheat field, a forest? If a forest has been severely logged, leaving only a few trees here and there, is it still a forest? And if a forest contains many areas cleared for slash and burn agriculture, when does it stop being a forest and become farm land with groups of trees growing on it? These questions may seem academic, but arriving at clear answers is essential to understanding the condition of the world's forests. Food and Agriculture Organisation (FAO) have been publishing assessments of the state

of the world's forest for many years. These reports have become a world standard for forestry researchers. FAO defines forest as land of more than half a hectare with a tree-canopy cover of more than 10 percent that is not under mainly agriculture or urban use. These may seem clear, but they mean that areas used for agro-forestry with crops and trees growing together are not classified as forest because they are used mainly for agriculture, even though the canopy cover might be more than 10 per cent.

The TREES project (*Tropical Ecosystem Environment Observations by Satellite*) financed by the European Union, calls areas with more than 70 per cent canopy cover is '*Dense forests*' and those with 40-70 per cent cover is '*Fragmented forests*'. On the other hand, The United Nations Environment Programme (UNEP) uses more than 40 per cent cover for '*Closed forests*' and 10-40 per cent covers for '*Open*' or '*Fragmented forests*'. Several international organisations have adopted standards that are different to those used by FAO. The total forest cover area is grouped into three categories, namely, '*Dense forests*' (crown density more than 40 per cent), '*Open forests*' (crown density between 10 and 40 per cent). Forest canopy with less than 10 per cent is included in the '*Degraded forests*'.

Which standard is used affects estimates of forest cover, and so the degree of degradation. For example, FAO's 10 per cent coverage criterion gave forest cover in India as 19 per cent, but the 40 per cent figure reduced that to 11 per cent. Another factor complicating estimates of forest coverage is the way it is measured. Most estimates are made from satellite photographs. Recently, very high resolution photographs have become available from new satellites. These can distinguish more clearly between the tree crowns and the vegetation between them, both of which are usually green. Older satellite images are not as clear or precise as the latest ones are. Higher-resolution photographs usually give a lower estimate of forest cover than lower-resolution pictures.

Ecologically speaking, forest is a plant community, predominantly of trees and other woody vegetations with a closed canopy. In fact, the word forest is derived from the Latin word '*Foris*' meaning outside, the reference being to a village boundary or fence, and it must have included all uncultivated and uninhabited land (Sagreiya 1997). Environmental Encyclopaedia (Eblen 2000) described forests are not only stands of trees, but also complex ecosystem of plants, animals and micro-organisms.

Several international organisations considers the FAO definition of forest, as the basic one but acknowledges that many other useful definitions of "forest" exist in published form. The fact that 'forest' has been defined in many ways in a reflection of the diversity of forests and forest ecosystems in the world and of the diversity of human approaches to forests. In this document, a forest is a land area of more than 0.5 hectares, with a tree canopy cover of more than 10 per cent, which is not primarily under agricultural or other specific non-forest land use. In the case of young forests or regions where tree growth was climatically suppressed, the trees should be capable of reaching a height of 5 metres in situ, and of meeting the canopy cover requirement (Reppeto *et al.* 1988).

Forest includes natural forests and forest plantations. It is use to refer to land with a tree canopy cover of more than 10 per cent and area of more than 0.5 hectares. Forests are determined both by the presences of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 metres. Young stands that have not yet but are expected to reach a crown density of 10 per cent and tree height of 5 metres are included under forest, as are temporarily unstocked areas. The term includes forest used for purposes of production, protection, multiple-use or conservation i.e. forest in national parks, nature reserves and other protected areas, as well as forest stands on agricultural lands e.g. windbreaks and shelterbelts of trees with a width of more than 20 metres, and rubber wood plantations and cork oak stands (Rudel, Bruce, Roper 1997).

Forest as an area (within the notified forest boundary) bearing an association predominantly of trees and other vegetation types capable of producing timber and other forests products. Evergreen forest is described, as a forests comprising thick and dense canopy of all trees, which predominantly remain green throughout the year. It includes both coniferous and tropical broad-leafed evergreen trees. Deciduous forest is described as a forest predominantly comprising deciduous species and where the trees shed their leaves once in a year. Degraded forest is described as a forest where the vegetation density is less than 10 per cent of the canopy cover. Forest blank is described as openings amidst forests without any tree cover. It includes openings of assorted size and shapes as seen on the imagery. Mangrove is described as a dense thicket or woody aquatic vegetation or forest cover occurring in tidal waters, near estuaries and along the confluence of delta in coastal areas. The word forest has many meanings but, nowadays it usually refers to an association of plants and animals in which trees are dominant (Hummel 1984). Forest is 'closed' if the trees cover most of the ground and 'open' if they trees are scattered. Small area of forest is commonly referred to as 'woodlands'.

### **Degradation of Forests**

Degradation of forests is a part of the broader environmental degradation, which means lowering in the environmental potential. Husain (1996) described environmental degradation as "qualitative and quantitative decline/impooverishment/decrease/devaluation in the ecosystem potentiality affecting habitat of man, plant and animal". According to ✓Singh (1997) environmental degradation is the deterioration in the physical components of environment brought in by the biological processes, particularly by human activities to such an extent that it cannot be set right by the self regulatory mechanism of the environment. Environmental degradation simply means overall lowering of environmental qualities because of adverse changes brought by human activities in the basic structure of the components of the environment to such an extent. These changes have adversely affected all biological communities and human society.

Although, the term degradation of forests is sometimes used in forestry, existing definitions are generally inadequate to capture actions that change carbon stocks because they lack specificity. Degradation of forests commonly refers to reductions in the productive capacity of the forests. As an example, the FAO definition states “changes within the forests class that negatively affect the stand or site and, in particular, lower the production capacity”. Notably, this includes selective logging, which reduces forest canopy cover, but normally not below the 10 per cent minimum threshold. Therefore, degradation of forests is the changes within the forests class, i.e. when a forest cover, and so production capacity, is reduced (FAO).

Like most terms, degradation is subject to misunderstanding. Often it is used in a pejorative sense to represent something that is undesirable. Indeed, desertification (another misunderstood term) refers to land degradation in dry areas. However, degradation is used here in a purely descriptive sense, following the path finding work by Food and Agriculture Organisation and United Nation Environment Programme refers to changes in the quality and quantity of forest which are an inevitable consequence of most forms of cultural forest modification. Degradation of forests involves the processes which result in the loss of forest cover, change in forest canopy density and loss of biodiversity.

Degradation of forests can be viewed from two angles, i.e., quantitative and qualitative. Hitherto, quantitative aspects in terms of forest cover, its distribution, demand and supply of forests products (Matthew 1983, Kalla 1988, Ramakrishna 1981) were given priority over qualitative aspects by researchers as well as policy makers. Little attention was paid to the qualitative side of the forest, which is mainly due to lack of data on degradation. It is necessary to understand various aspects of degradation of forests in order to formulate meaningful policies for checking degradation and improving the quality of forests. Further, while the area under forest is determined historically, quality of forests (degradation) depends on the day-to-day human use and misuse of forests.

Degradation means non-sustainable forests use, so future forests harvests are being affected. Historically, shifting agriculture did not have a major effect on forests quality but when it becomes more widespread or the recovery time under fallow is too short, then the area can begin to degrade. Forest fires, fuelled by dry debris from logging or slash-and-burn practices may also be damaging, as is extracting too many non-timber forests products and over-hunting. Taking too much firewood and seasonal livestock overgrazing can badly affect dry forests (Moran 1983).

World Resources Institute (1990) analysed forest loss from different literature sources. Witte (1992) point out that FAO and WRI estimates are similar (differing by only 10-15 per cent when the definitions are made compatible). Jepma (1995) describes the FAO and WRI data sets as the 'forestry sector view', with forest loss defined as the complete clearance of tree formations and their replacement by other land uses i.e. forest loss is land that is lost to forest sector's control.

A degraded forest is a secondary forest that has loss through human activities, the structure, function, species composition or productivity normally associated with a natural forest types expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the under canopy vegetation (FAO 2000). Moreover, degradation of forests is changes within the forests which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products or services.

Degradation of forests continues rapidly in many parts of the world. The factors that affect forests conditions and changes in the livelihoods of forests-dependent people are the foundation for developing policies to minimise negative social and environmental impacts. The most basic problem in conserving forests is the complexity of the situation.

## Causes of Degradation of Forests

Most world forestry organisations recognise the current loss of forests as a significant problem. This problem is expressed in terms of loss of resources, in loss of ecological function (e.g., carbon sequestration, hydrological function) and in terms of biodiversity. Worldwide recognition of degradation of forests as an environmental issue rose dramatically in the 1980 to 1985 period, when developing country governments and donor agencies came under pressure to exercise greater control. The total forest cover area of the world in 1900 was nearly 7,000 million hectares, but by 1975, it reduced to 2,890 million hectares, it means that within the periods of 70 years, the percentage of total loss of the forest cover area was 58.71 per cent (Brewbaker 1984 cf. Sharma 2000). Based on the NRSA report, in 1972 the total forest cover area in India was 5,51,886 square kilometres which came down to 4,5,046 square kilometres in 1982. Consequently, during 1972 to 1982, the total depletion of forest cover area in Northeast India is 1,492.5 thousand hectares, in other words the Northeast India has lost 186.5 thousand hectares per year (NRSA 1982). According to the *State Forest Report* published by Forest Survey of India, in 1991 the total forest cover area in Mizoram was 1,885.3 thousand hectares. In the year 1997, the forest cover has come down to 1,877.5 thousand hectares, therefore, within 1991 to 1997 the total loss of forest cover area was 1.41 per cent to the total geographical area. In addition, in 1971, the total percentage of forest cover area in Lunglei district was 95.06 per cent, while in 2001 the percentage has come down to 87.21 per cent to the total geographical area.

Sharma (1992) summarises information on potential distribution of forest and woodland resources, suggesting that in the period 1850 to 1980, 15 per cent of the world's forests and woodlands were cleared, in Asia by 43 per cent. In 1980 to 1985 the forest was loss at an annual average rate of 11.4 million hectares or 0.6 per cent to the total geographical area in Asia. Now, it has almost doubled to 18.5 million hectares or 1 per cent per annum. It is the rate of acceleration of forest loss that is critical, are we still losing forests at an ever-increasing rate?

Degradation of forests, particularly in developing countries, are influenced by an array of structural problems related to the international economic regime (Tarasofsky 1995), as well as the underlying socio-economic features of the country itself. There are a number of clear causes of degradation of forests and countries differ greatly in the social factors affecting forests. Macro-economic policies, economic crises, infrastructure development and other factors can inadvertently but dramatically contribute to degradation of forests. In south-east Asia, the profit motive drives most deforestation through organised and illegal logging, both for lumber and wood pulp as well as land clearing for cash crops like coffee and oil palm by small holders, large private commercial estates and state-owned plantations. Other causes include ill-considered granting of concessions to log huge areas of forest. Widespread corruption in the government, police and military make it almost impossible to control logging in many countries (Gautam/Gupta 2001).

Conventional wisdom suggests that growing populations and consumerism lead to forest loss and degradation. Population growth compounded with other factors, such as landlessness, increasing poverty and government corruption, does add to the rates of deforestation. This is emotively expressed by Witte (1992) writing on Zaire. Deacon (1992) provides a detailed analysis of forest loss associated with both population growth and with a variety of political factors which affect resource tenure and access rights

The forest ecosystems are drastically affected in areas where degradation has been carried out for want of wood and for raising of plantation crops. Rao (1990) wrote that the rapid growth of population, industrialisation and urbanisation are not only disturbing the natural ecosystem but brought forth changes that led to soil erosion, siltation and ecological imbalance. In pre-independence in India the basic philosophy of life was to live in harmony with nature but in post-independence in India it has changed to live in conflict with nature. India has marched on the road of industrialisation without affective

check on the population explosion and hence there has been environmental degradation. Sinha (1990) emphasised the quality of environment and the ecosystem in India is declining at an alarming rate as the country tries to bridge the gap between the statuses of developing and developed in the field of agriculture, industries and economy. Increasing population is one of the factors to degrade the forests. Due to high population pressure on land, more and more forestlands were brought under cultivation. Rai (1993) mentioned the principal factors of degradation of forests have been population explosion, both human and livestock. Leading to enhance the requirement of fodder, timber and fuel wood. The natural thick forests of Mizoram comprising of heterogeneous and valuable species have been degenerated and became an almost barren land. Traditional *jhum* system, lumbering and fuelling are the major factors that accelerate the degeneration and degradation of forests in Mizoram. Pachuau (1994) wrote that the forest of Mizoram has undergone a serious change due to continuous onslaughts by man on forest, clearance for *jhumming*, heavy exploitation and maltreatment by burning and over grazing at scattered places.

The first and most vital causes of forests depletion is human interference and natural disaster. Bhattacharya (1998) described with the onset of civilisation man has tried to satisfy the different objectives of livelihood at the cost of natural vegetal covers. The affect of human interference without having scientific knowledge has distorted the vegetal set up to a greatest extent. The next important causes of forests degradation is the natural and human induced calamities like cyclone storms, forest fires etc. Many trees are cut and the area are clear-cut, the forest is not capable of re-establish it. Moreover, even, if only a small proportion of the trees are selected for cutting, this may degrade the forests. Chauhan (1998) mentioned that thousand of years the action of man has been gradually diminishing the forests resources by burning, clearing and felling trees for fuel or to make way for agriculture, settlement or industry resulting to slow process of degradation.

Shifting cultivation has been degraded a large area of forest in every year. Even the forests are used for cooking purposes and also exploited for commercial purposes it led to the decrease of forest cover. According to Datta Ray and Alam (2000) the increase pressure on forests by wood based industries and unplanned and indiscriminate felling of trees for various purposes are primarily held responsible for the degradation of forests in Northeast India. Along with wood based industries, the shifting cultivation and denudation are responsible for the destruction of forest covers. Due to population pressure, more and more land brought under cultivation for increased food supply. The demand for fuel wood is increasingly steadily. Virgin forest is being exploited for commercial abuse.

Amita and Chakrabarti (2000) have also described the rich stock of natural forests in Northeast region traditionally contributed to the maintenance of atmospheric balance of the whole country and this was congenial to the livelihood of the native people. The unplanned and unrestricted flow of population from different states as well as from the neighbouring countries told upon the health of the region as such exodus involved destruction of the natural resources, especially forests. Forests are a major natural resource of India approximately one fifth of our landmass is under forest. Degradation stem from two main sources that are intertwined. First, the commercial demand for timber drives the felling of trees, either legally or illegally. Second the land under forest may be needed for alternative economics purpose (Gautam and Gupta 2001). Collection of fire-wood for cooking purposes, reduction of wetlands due to reclamation for agriculture, illegal tress cutting for timber trade are prevalent in Northeast India, it has led to the declined of forest cover. Kalita (2002) said that the factors responsible for the rapid reduction of forest cover in Northeast India are expansion of cultivation, encroachment of the forest land for agriculture land use and human habitat. Singh and Datta (2002) mentioned in their article the causes of degradation of forests in Northeastern hill region of India are expansion of agriculture land, demand for timber and fuel wood, animal grazing, forest fires and other minor factors.

## **1.2 STATEMENT OF THE PROBLEM**

Age-old practice of *jhumming* (Shifting cultivation), has been widely practiced for long, leading to degradation of forests. In addition, majority of the people is dependent upon forests for fuel, fodder, lumbering, other forests products and excess exploitation of forests for these products also the causes of degradation of forests. Continuous onslaught by man on forests, heavy exploitation, and maltreatment by burning and over grazing have also affected the health of the forests. Moreover, the forests are under heavy pressure of increasing population to meet their requirements in various forms and that has also created degradation of forests. All these have led to not only change in forest cover but also change in forest canopy density and loss of biodiversity in the forests. Such problems and processes have also been occurring in the forests of the study area. Therefore, the researcher has studied the degradation of forests in Lunglei district, Mizoram.

To study the degradation of forests in Lunglei district, four main aspects have been taken in to consideration. These are related with temporal variation of forest cover from 1970 to 2000, spatial variation in the loss of forests cover area on the basis of Block wise forest cover area, negative changes in the forest canopy density, loss of biodiversity and causes of forests degradation. The year 1970 has been taken as a cut off year, because detailed data are not available prior to that.

## **1.4 OBJECTIVES OF THE STUDY**

The main objectives of the study are as follows:

- (i) to find out the forest cover area of different time periods in Lunglei district from 1970 to 2000,
- (ii) to investigate spatial variation in the degradation of forests, and
- (iii) to find out the causes of degradation of forests in the study area.

## 1.5 RESEARCH QUESTIONS

To meet the requirement of the objectives and to derive some conclusions about the degradation of forests the research issues dealt with in the study include: (i) the rate and extent of change in forest cover area during 1970 to 2000, (ii) spatio-temporal variation of degradation of forests, and (iii) the causes responsible for the degradation of forests. The main issue is to find out temporal variation of forest cover from 1970 to 2000 and spatial variation in the degradation of forests during the study period. The factors responsible for degradation of forests in the study area are also investigated.

## 1.6 STUDY AREA

Lunglei district falls between 92°35'E to 93°55'E longitudes and 22°35'N to 23°35'N latitudes (Figure 1.1) the *tropic of cancer* just touching its northern end. It covers an area of 4,538 square kilometres. It is bounded by Myanmar in the east and Bangladesh in the west. It is also bounded by Serchhip, Aizawl and Mamit districts in the north and Lawngtlai and Saiha districts in the south. The area comprises predominantly of difficult hilly terrain with narrow valleys in between. In fact, it is part of the north-south running Indo-Myanmar or Arakan-Yoma Ranges. The hill ranges of the district are higher in the east than in the west. The average height is about 900 metres. The highest peak is *Purun* (1,749 metres), located in the northeastern corner of the district. Whereas the lowest peak *Rangte* (519 metres) is located in the west of Lunglei town. The difference of elevation from the valley floors to the hill tops varies from 232 metres in the western part of the area to 507 metres in the west central part and 720 metres in the central part, and 660 metres in the eastern part of the district. The drainage system comprises of the river Kolodyne (*Chhimtuipui*), river Dhaleshwari (*Tlawng*) and river Karnaphuli (*Khawthlangtuipui*). In the central part, the watershed of river *Chhimtuipui* and river *Tlawng* is clearly demarcated by Lunglei hills.

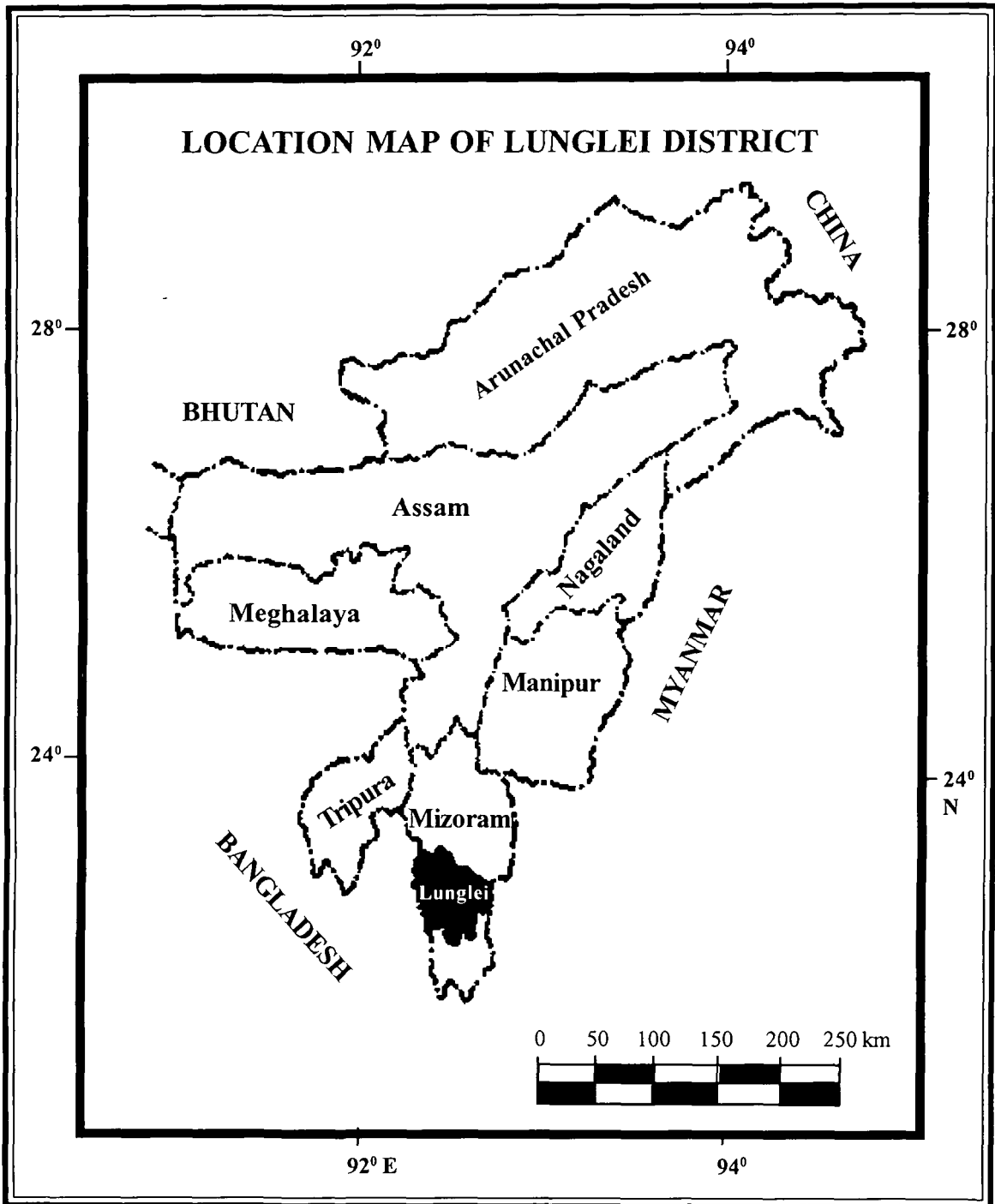


Figure 1.1.

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## 1.7 DATA BASE AND METHODOLOGY

The present study is mainly based on the secondary data collected from various sources/departments. The study heavily depends on the forest cover area generated by the Mizoram Remote Sensing Application Centre, Aizawl, on the basis of satellite imagery interpretation. Data has also been culled from the *State Forest Report* prepared by the Forest Survey of India for the study. Primary data has also been collected through field work mainly including on-the-spot assessment of the existing density of vegetation under different forest canopy categories. Personal interviews with the forest officials and some elderly people have also been of great help in collecting relevant information. Data have also been collected from the various published books.

As it is a well-known fact that huge discrepancy is found in data on forest cover area provided by different departments working forest, agriculture and revenue. This is mainly due to adoption of different definitions of forest by these departments. Moreover, after setup of the Remote Sensing Application Centre in Aizawl, the demarcation of forest cover area has no doubt become easier and accurate, but in that case also, the skills of the interpreter can lead to two different sets of data from the same air photo or satellite imagery. For instance data provided by NRSA and Forest Survey of India, based on satellite imagery at a particular area, also do not match each other. Therefore, it becomes very difficult for the researcher to acquire the correct information about the forest cover area. The researcher has faced a lot of difficulty in collection of time sequence data (from 1970 onwards) about the forest cover area. There was no change shown in the forest cover area during 1970 to 2000 provided by the Department of Agriculture. But, the data provided by the Forest Department did show some changes in the forest cover area. However, the researcher relied on the data given by the Remote Sensing Application Centre, Aizawl as more accurate is possible to come from the latest tools of data acquiring, i.e., with the help of remote sensing. From this data on forest cover area of the given period some change could be found and decline in forest cover area is clearly

visible from it. But in this case also, another problem has aroused because the remote sensing data is available only for 1990 and 2000 and the data given for 1970 and 1980 is based on the reports of the Forest Department, Aizawl. Technically, both the sources of data can not be compared but in absence of authentic data the researchers has to rely on forest cover area provided by Remote Sensing Application Centre, Aizawl, which also include data from the Forest Department, Aizawl for the previous decades. High resolution satellite imagery are available now on which we can distinguish more clearly between the tree crowns and the vegetation between them, both of which are usually green. Regarding the definition of forest adopted by different departments some clarity is required. The Forest Department, Aizawl has adopted the Dictionary meaning of forest to avoid any confusion, and according to it “forest is a large area of land covered with trees and undergrowth”. It is generally more extensive than woodland, consists of either natural or planted vegetation with tall matured trees, which are often of commercial value and is dense growing forming a continuous canopy. Whereas, the Remote Sensing Application Centre, Aizawl has followed the remote sensing keys to identify types and area of forest in Lunglei district.

Data on forest canopy density has been collected form the Forest Department, Aizawl, for 1970 and 1980. After the statehood in 1987 the Forest Department was renamed as Environment and Forests Department by the Mizoram state government. Therefore, for 1990 and 2000 data on forest canopy density has been taken from the *State Forest Report* prepared by the Forest Survey of India.

Block wise data on forest cover area has been collected to see spatial variation of degradation of forests in the study area and for the studied period. To understand causes of degradation of forests some forest personnel, elder forests dwellers, and officers of different departments were interviewed personally. Photographic coverage of the problematic areas has been done to depict degradation of forests. Various data have also been used to prepare tables, maps and charts for better understanding and showing a clear picture of degradation of forests in the study area.

## **1.8 CHAPTER SCHEME**

The whole study has been divided into five chapters. The first chapter is the introduction of the study and it includes review of relevant literature, statement of the problem, objectives of the study, research questions, study area and data base and methodology. In a sense, this chapter is important as it highlights the purpose of the study and act as an introductory part for a proper understanding of the whole problem. The second chapter deals with the environmental setting of Lunglei district. The third chapter is the crux of the dissertation as it deals with different aspects of degradation of forests in study area. While the fourth chapter focuses on the main causes responsible for the degradation of forests in the study area. The fifth and final chapter contains summary and conclusion along with some suggestions to conserve the valuable forest of the area.

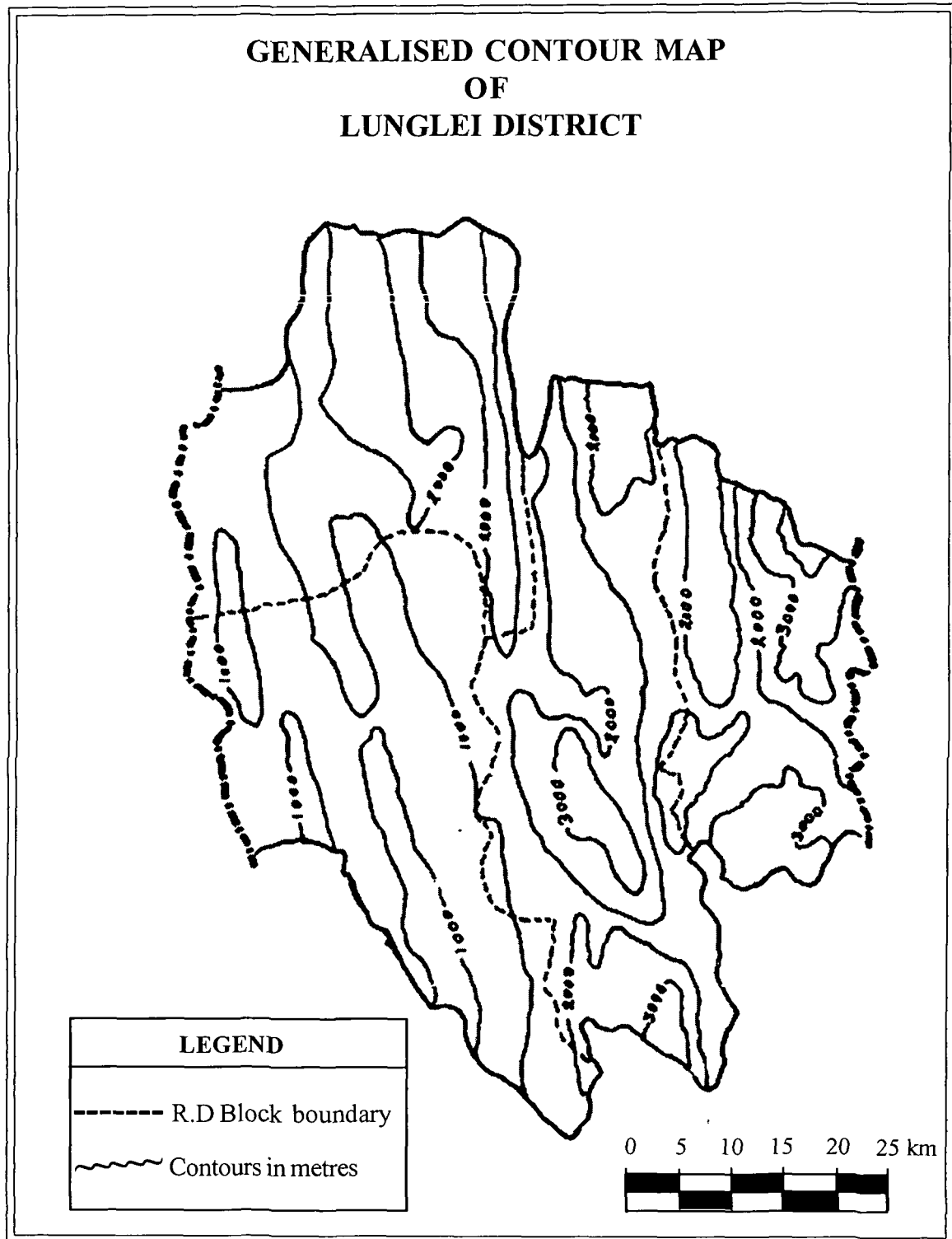
**CHAPTER - II**  
**ENVIRONMENTAL SETTING**

Biophysical environmental conditions of an area actually constitute the environmental endowment of that area. In other words, it represents the over-all natural condition of the area *in situ*. The environmental endowment or biophysical environment may be understood as the integrated study of relief features, drainage, climatic condition, etc. Therefore before the study of the degradation of forests in Lunglei district, it is necessary to highlight the environmental condition of the study area because all the biotic and abiotic factors of the environment are related to each other at a particular place. Obviously, the forest types of Lunglei district are also influenced by different factors of the physical environment. The natural factors that influence the geographical distribution of forest in the study area are latitude, elevation, rainfall and nature of soil. There is a marked difference between vegetation of the western and eastern parts of the district and also between uplands and low lands. Along with biophysical environment the human environment has also been mentioned here as the later interacts and modifies the former in course of its utilisation.

## **2.1 RELIEF FEATURES**

Lunglei district is the largest district in Mizoram. It comprises predominantly of undulating terrain due to almost north-south running hill ranges interspersed by narrow valleys in between. These ranges tend to be higher in the east than in the west. The average height is about 900 metres above mean sea level. Lunglei district relief features and generalised contour map have clearly shown in Figure 2.1 and 2.2. As the terrain is very immature in response to recent tectonism, the topographical features show prominent relief. The major geomorphic elements observed in the area are both structural and topographic 'high and depression', 'flat and slope' sculptured in a linear fashion. In Lunglei district topographic depressions in all cases are in accordance with the normal structural elements, but the topographic high is recorded both in the structural high and depression.

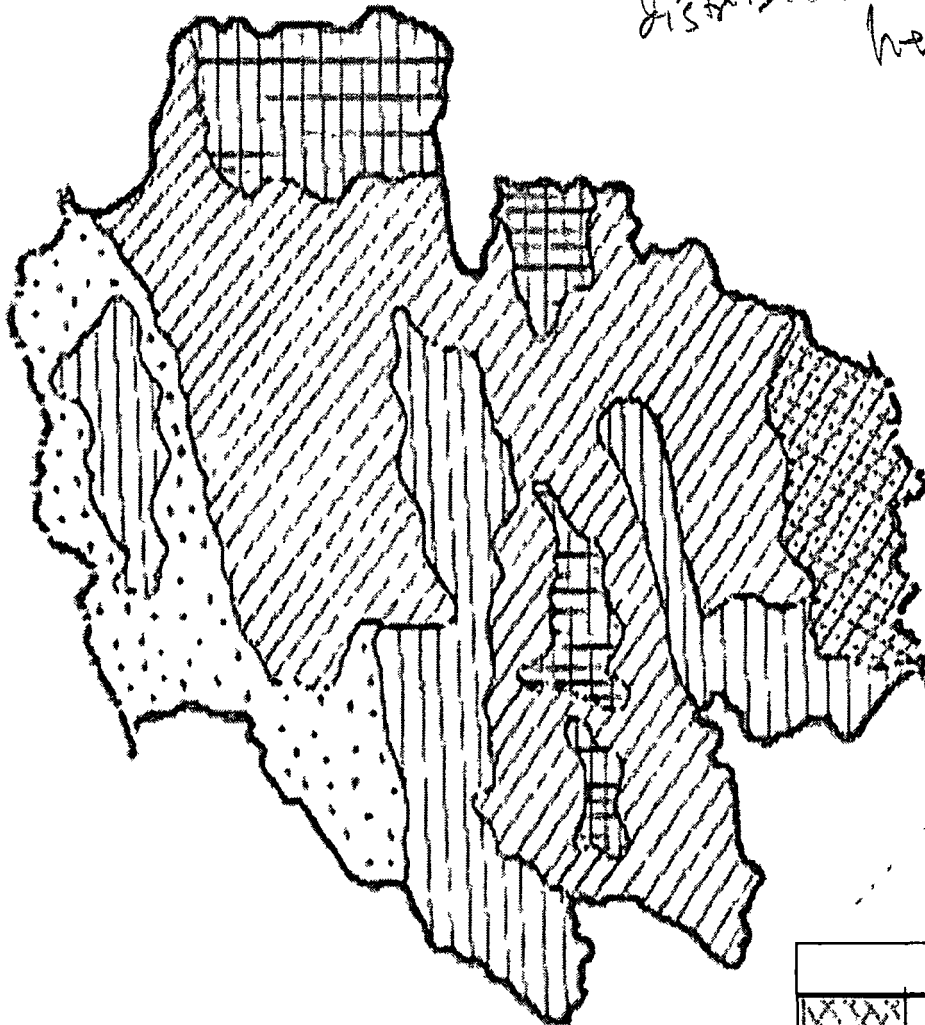
**GENERALISED CONTOUR MAP  
OF  
LUNGLEI DISTRICT**



**Figure - 2.1**

# LUNGLEI DISTRICT RELIEF FEATURES

*Distribution of height*



*in meters*

0 5 10 15 20 kms



LEGEND	
	Above 1350
	900 - 1350
	600 - 900
	300 - 600
	Below 300

Figure 2.2

The physiographic expression of the area is imparted by approximately north-south trending steep, mostly anticlinal, longitudinal parallel topographic high. In general, the western limbs of the anticlines are steeper than the eastern limbs mainly because of fault scarps, especially along the steep dipping fault plane. The other geomorphic features are highly dissected ridges with the formation of deep gorges, spurs, keels and cols, which developed due to intensive erosion during the isostatic adjustment. The difference of elevation between valley floors and hilltops greatly varies from west to east, the range being 200 metres to 600 metres. The harder formation of sandstones forms anticlinal ridges. Their location, shape and direction are determined by the distribution of sandstone, shale and their various interlamination. Due to continuous erosion by various agents of erosion the softer rocks formation are eroded first, while the harder rocks formation putting resistance and thus forming strike ridges. It is believed that during the Miocene period a number of folds and faults were formed which gave rise to the present landforms in the study area (Pachau 1994).

#### (i) Hills

As mentioned above there are a number of parallel hill ranges running from north to south separated each other by deep narrow valleys occupied by sedimentary rocks of conglomerates, sandstones, shales etc. and their various intermixtures. The highest elevation of these hills is 1,748 metres above mean sea level at *Purun* hill (23°3'N-93°2'E) in the north eastern corner of the area and the average altitude being 909 metres. The highest hill range is an extension of *Phawngpui* (Blue Mountain) from the southeast along the Myanmar border in the east and river *Chhimtuipui* (Kolodyne) in the west as far as *Purun* hill in the northeast. The second high hill range starts from *Mualthuam* village at the river confluence of river *Mat* and *Chimtuipui* and extends towards north up to *Bungtlang* village in between river *Mat* and *Tuichang*. The third and the longest hill range runs from *Mamte* village in the southern corner to *Zote* village in the north, between the river *Mat* and *Tlawng*. The fourth hill range extends from *Vaisam* village in the north to *Samang* village in south. The fifth hill range begins from *Ruallung* village in

the south, and extended upto *Lungsen* village in the north. The sixth hill range starts from *Vuakmual* village in the central part of the region at the confluence of rivers *De* and *Kau* and extended towards north upto *Darngawn* village. The seventh hill range extends from *Hruizam* village at the confluence of rivers *Kau* and *Tuilianpui* to *Laisawral* village in the north. The last hill range runs from *Serte* village in south along the Bangladesh border upto *Mauzam* in the north (Rinawma 1986).

### **(ii) Plains**

In Lunglei district there is no single plain area with a considerable size. There are few intermountain flat valleys and river plains in small pockets lying here and there. The largest intermountain flat valley of mere one square kilometre is located at South *Vanlaiphai* village in the source region of *Hnahchang* stream at an elevation of 1,200 metres. Mention may also be made about an intermountain valley plain at the source area of *Ngengrual* stream near *Thingfal* village. In the south a small river plain is also observed near *Lungsen* village at the meeting point of three rivers like *Kau*, *De* and *Phairuang* (Rinawma 1986).

### **(iii) Rivers**

The drainage system of the area is complicated one. The river *Tlawng* originating from *Zobawk* village near Lunglei town flows towards north. Parallel to it is the river *Mat* having its source near *Baktawng* village of Serchhip district and flows towards south in opposite direction of the river *Tlawng*. The rivers *Tuipuilian*, *Kau* and *De* have parallel courses for many kilometres but run in opposite direction of river *Tlawng*. The rivers *Tuichawng* and the *Phairuang* flow from the southern most part of Mizoram towards north till they meet the river *De* and then turns to the west and deliver their combined flow into the river *Khawthlangtuipui* which flows from southwest. The river *Chimtuipui* originates in Myanmar and enters in the south eastern part of Mizoram, flows towards north and turns to the west near *Muallianpui* village and curves towards south near *Hnahthial* town and flows towards south and enter Arakan hill tract. The rivers generally flow either towards north or south direction (Rinawma 1986).

## 2.2 CLIMATE

The climatic condition of Lunglei district is generally cool and wet with very mild summers as it enjoys a moderate climate owing to its tropical location. It is neither very hot in summer nor too cold in winter throughout the year. The western part is warmer than the eastern part due to altitudinal variation. The whole region falls under the direct influence of the south-west monsoon. As such the region receives an adequate amount of rainfall. The climate is humid tropical, characterised by short winter and long summer with heavy rainfall. During autumn, the temperature is usually between 18 degree Celsius to 25 degree Celsius, while winter temperature ranges normally between 11 degree Celsius and 23 degree Celsius. The summer temperature is usually between 21 degree Celsius and 31 degree Celsius. During the last 30 years or so, steady increase in temperature has been noticeable, and it may be seen in the global context of global warming, mainly due to the large scale degradation of forests and mismanagement of environment. Depending on the variation in temperature and general weather conditions, three different seasons are observed in the study area such as (i) Cold season or winter, (ii) Warm season or spring, and (iii) Rainy season or summer.

As the entire area is under the direct influences of monsoon, it rains heavily from May to September, and it continues till late October. Normally July and August are the wettest months, while December and January are the driest as well as coldest months. In Lunglei district more than 80 per cent of rainfall is received during the monsoon period. In the month of April and May violent storm and cyclones sweep over these hills. Lunglei district enjoys abundant rainfall and average rainfall at Lunglei is usually recorded as 327 cms annually. The average annual rainfall, recorded in 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, and 1999 are 2,383 mm, 2,183.2 mm, 3,142.8 mm, 2,909.4 mm, 1,529.4 mm, 2,012.6 mm, 2,652.3 mm, 3,023 mm and 3,326 mm, respectively. Precipitation is heavy in summer, normally from May to September, and last till late October. Normally July and August are the rainiest months, while December and January are the driest months.

## **2.3 POPULATION**

Among the eight districts of Mizoram, Lunglei district is the biggest in terms of geographical area, but it is the second largest in terms of population. The population of Lunglei district has increased rapidly during the last three decades. The population of Lunglei district was 62,136 persons in 1971, 86,511 persons in 1981, 1,11,415 persons in 1991 and 1,37,155 persons in 2001 (Census of India). In the last Census, i.e., 2001 Census, the population of Lunglei district constituted 15.39 per cent of the total population of Mizoram. The percentage decadal variation in the population of Lunglei district for the periods of 1971-1981, 1981-1991 and 1991-2001 are 39.23 (as against 48.55 for All-Mizoram), 28.79 (as against 39.69 for All-Mizoram) and 23.10 (as against 29.18 for All-Mizoram.), respectively. The corresponding national figures are 24.66, 23.85 and 21.3. The growth rate of population experienced by Lunglei district was lower than the growth rate of population experienced in the whole state of Mizoram, while it was higher than the growth rate of population experienced at the national level.

### **(i) Density of Population**

The density of population per square kilometre in the last four successive Censuses has been 14, 19, 25 and 30, which imply that there was a fast increase in the density of population in the district and it has doubled during 1971 to 2001. However, it can be said that the density of population in the district is pretty lower than the All-Mizoram average, which stands as 41 per square kilometres in 2001 Census. Again, comparing these figures with the national average which were 178 per sq.km in 1971, 216 per sq.km in 1981, 267 per sq.km in 1991 and 324 per sq.km in 2001, one can say that the density of population per square kilometre in the district is very much lower than the All-India average, Among the eight districts of Mizoram, Lunglei district ranked fourth in terms of density of population in accordance with the 2001 Census (Census of India).

How does this  
relate to  
fact  
segment?

## (ii) Sex Ratio

The sex ratio in Lunglei District has also increased rapidly and steadily during the last three decades. The numbers of females per 1,000 males in Lunglei district were 842, 881, 910 and 922 in 1971, 1981, 1991 and 2001, respectively. As against these figures, the number of females per 1000 males in Mizoram in 1971, 1981, 1991 and 2001 were 945, 919, 921 and 938, respectively, and the corresponding national figures were 930 in 1971, 934 in 1981, 927 in 1991 and 933 in 2001 (Census of India). The sex ratio in Lunglei district had steadily increasing trend during the entire period of 1971-2001, while it was fluctuating at the state and national levels. It is interesting to note that though the state of Mizoram was having higher sex ratio than the national level in most of the Census, yet, Lunglei district has never had higher sex ratio than the national level. At per with this fact, the sex ratio of Lunglei district has always stood below the sex ratio of Mizoram as a whole. Among the eight districts of Mizoram, Lunglei district ranked fourth from the bottom in terms of sex ratio, the only districts that have lower sex ratio than Lunglei district in 2001 Census are Kolasib district, Lawngtlai district and Mamit district, which stands as 913, 902 and 901 in 2001 Census, respectively.

## 2.4 ECONOMY OF THE PEOPLE

The economy is the ultimate portrait of its geographical environment. The knowledge of a geographical condition and its economic condition is always pertinent to planners and policy makers to devise appropriate schemes for the development of a region. It is indeed, the economic level which depicts the standard of living of the people of the area. The economic study reveals the capacity of growth and man power of the region, their major activities, strength and sustenance. While India's economy stood below average at global context, Lunglei district is one of the least regions of the Indian Union. The people of the district have been practising agriculture (*Jhum*) for their sustenance for centuries in the region. Agriculture is the primary means of livelihood of the indigenous settlers. Due to lack of knowledge about detail geological information and

investigation of mineral deposits, mineral base industry is yet to be established. It is not an easy task to achieve development in the field of industry at present, because of absence of mineral based industry, major trade and commerce and also because of lack of technical skills, deficiency in raw materials, power and other infrastructural facilities. The district economy is based mainly on agriculture along with *jhumming* and forests. In other words, majority of the people are depends on agriculture, mainly shifting cultivation. Forest sector contributes quite high revenue per year in the district. However, actual contribution of forests sector to the economy of the district is many times more if value of fuel wood, timber and bamboos and other non timber forests products removed and used free of charge by the entire tribal population is also taken into account. Revenue mainly comes from sale of bamboos, sand and timber. This section tries to expose the economic characteristics of Lunglei district under the following heads such as occupational structure, agriculture activities, livestock and animal husbandry, development of forest economy and transport and communication network.

#### **(i) Occupational Structure**

The occupational structure represents the economic activities of the people. Occupation is perhaps the most important characteristics influencing man's life. It gives the degree of employment and unemployment and exhibits its influence as one of the major determinants of several social, economic and demographic characteristics of the population. The Census of India classified the population into workers and non workers. Though, it is seen the definition of 'work' kept on changing at every Census until 1981. The main workers have classified into four groups such as cultivators, agricultural labourers, workers in house hold industry and other workers. The details occupational structure of Lunglei district from 1971 to 2001 is presented in Table 2.1. Under this classification, the occupational structure of the people in the study area has been analysed in the following lines.

Lunglei district is an agricultural region and majority of the people are engaged in agriculture activities. The bulk of the working population is cultivators which constitute 64.38 per cent of the total main workers in 2001, while 29.97 per cent of the total main workers are engaged in non-agriculture activities or tertiary occupation. Agricultural labourers accounted for 3.87 per cent of the working population, whereas household industry workers constituted the least population of only 1.78 per cent of the total workers in 2001 (Figure 2.3).

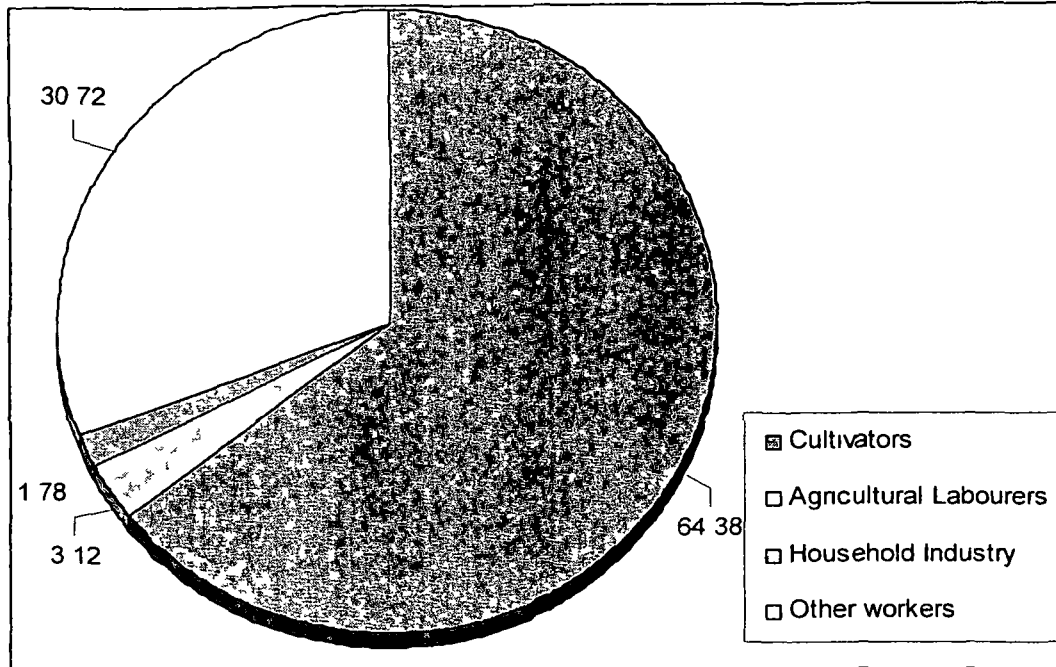
The proportion of cultivators among the main workers in Lunglei district has declined significantly since 1971. Whereas in 1971, as much as 82.67 per cent of the total workers were cultivators, while in 1981 the corresponding figure has declined to 78.23 per cent. In 1991 the percentage of cultivators again declined to 67.28 per cent of the total main workers. Interestingly, the proportions of workers in other categories of occupation other than agriculture have shown definite upward trends. The rising trend of working population generally in non-agricultural sector seems to reflect the diversification of economic activity in the district. The non-agricultural working population increased from 16.73 per cent in 1971 to 30.72 per cent in 2001. This rate of diversification is much faster than the country as a whole.

**Table 2.1 Occupational Structure in Lunglei District**

Occupations	Percentage of workers to total main workers			
	1971	1981	1991	2001
Cultivators	82.67	78.23	67.28	64.38
Agricultural Labourers	0.37	1.87	2.49	3.12
Household Industry	0.29	0.68	0.98	1.78
Other Workers	16.73	19.22	29.25	30.72

Source: *District Research Officer, Lunglei 1971 – 2000*

## Occupational Structure in Lunglei District - 2001



**Figure 2.3**

### 2.5 LAND UTILISATION

Land is perhaps the most basic resource of rural society and the foundation of agricultural economy. Regional land use patterns are after all the geographical expression of a large number of society decisions made at different times and seasons, which are responsible for the expansion of any category of land use at the cost of other. The patterns of land use also reflect physical control arising out of landform diversities, rainfall differences, divergences, etc. (Sing 1974) *NOT in Ref*

The land utilisation of Lunglei district is greatly influenced by the relief features, soil condition and climate. The drainage system also influences the land use pattern. The rivers are mostly streams in nature and volume i.e., very short in length and small as well.

as dry for long period in a year. On the basis of the identification of the satellite imagery the major land use/land cover categories in Lunglei district are built-up-land, agricultural land, forest, water bodies and others (current shifting cultivation). The details different land utilisation of Lunglei district in 2000 has shown in Table 2.2 and Figure 2.4.

#### **(i) Built-up Land**

Lunglei district consists of three townships such as *Lunglei*, *Hnahthial* and *Tlabung*. Lunglei is the largest settlement followed by *Hnahthial*, *Tlabung* and *Lungsen*. The area under built up land, in 2000 is of 4,974.30 hectares or 1.09 per cent of the total geographical area of the study area.

#### **(ii) Water Bodies**

The major rivers within the district are *Tuipui*, *Mat*, *Tuichang*, *Tlawng*, *Khawthlangtuipui*, *De*, *Kau*, *Phairuang* and *Tuichawng*. The total area under this category is estimated to be of the order of 4,974.30 hectares. In other words, it constitutes 0.80 per cent of the total geographical area.

#### **(iii) Forests**

The primary forests of the western part of the district are mainly dominated by Tropical wet evergreen forests, whereas semi – evergreen forests consisting of evergreen species associated with deciduous are mostly found in the central part of the district. The montane sub-tropical broad leaves hill forests are found in the eastern parts of the district. The primary forests of all types are classed as evergreen/semi-evergreen forests. The secondary forests or old abandoned *jhums* in the lower altitude are mostly dominated by bamboo forests and are moist deciduous in nature. However, in some areas old abandoned *jhums* are dominated by miscellaneous species. Forest plantations are also found in small pockets and are predominantly of Teak species. The abandoned *jhums* of approximate upto 3 years old and scrub land are put under the category of young abandoned *jhum*. Depending on the vegetation type of the area before shifting cultivation

the young abandoned *jhums* are dominated by young abandoned *jhums* are dominated by young bamboo shoot or tree seedling and saplings. The total forest cover area in 2000 is of 3,95,621.06 hectares or 87.21 per cent of the total geographical area.

#### **(iv) Agricultural Land**

Wet-land rice cultivation is practiced in the flood plains of some rivers viz. *De, Phairuang, Kau* and *Khawthlangtuipui*, etc. It is also practiced in *South Vanlaiphai*, rice is the only crop cultivated during the Kharif season. During Rabi season some vegetables like mustards, cauliflower, etc. are cultivated in small area of the valley fields in a scattered manner, and could not be delineated due to scale factor. In general, double cropping is not practiced due to lack of irrigation facility and insufficient water supply during the dry season. Agricultural/horticultural plantation like Orange, Banana, Pineapple, etc. have been observed near the villages such as *Hauruang, Pachang, Phairuangkai, Chhumkhum, Lungsen, Hnahthial, Thiltlang, Lunglei*, etc. but in small scale. *Betelnut* plantation has also been observed in the western parts of the district. The total area under agricultural land, excluding shifting cultivation was 5,369.20 hectares i.e. 1.21 per cent of the total geographical area.

#### **(v) Other**

Though, the current shifting cultivation comes under the categories of others, it is the main agricultural system on the hill slopes of the district. In shifting cultivation, *Rice* is the main crop. Besides, *Maize*, vegetables like *cucurbita, Cucumber, Cowpea, Brinjals, Tobacco, Ginger* are also grown. In the western part of the study area oil seeds like *Sesamum* are grown in shifting cultivation, and harvested during winters. The area under current shifting cultivation in 2000 is estimated to be of 44,000 hectares i.e. 9.69 per cent of the total geographical area. Small patches of scrubby vegetation with grasses are found on the very steep slopes and escarpment area where the soil layer is very thin.

In Mizo society land is owned by the community rather than the individual. The basis of land allotment happens to be the family size. So, family size and holding size are likely to be highly correlated. There are two types of land which are *Community lands* and *Private lands*. This community land is mainly used for shifting cultivation. The proportion of this community land to the total geographical area of the region is much more than that of the private lands. Usually the private lands are used for the cultivation of cash crops and horticulture plants. The land of Lunglei district except the area covered by settlements, roads and government-reserved forest belongs to community and the power of allotment of this land for housing, gardening and *jhumming* purposes is vested on the respective village council within their jurisdiction.

**Table 2.2 Land Utilisation in Lunglei District**

<b>Category</b>	<b>Area in Hectares</b>	<b>Percentage to Total Geographical Area</b>
Build – up – Land	4,974.30	1.09
Water Bodies	3,635.44	0.80
Forest	3,95,621.06	87.21
Agricultural Land	5,369.20	1.21
Others	44,000	9.63
<b>Total</b>	<b>4,53,600.00</b>	<b>100</b>

Source: *Remote Sensing Application Centre, Aizawl 2000*

Percentage of Land Utilisation in Lunglei District - 2000

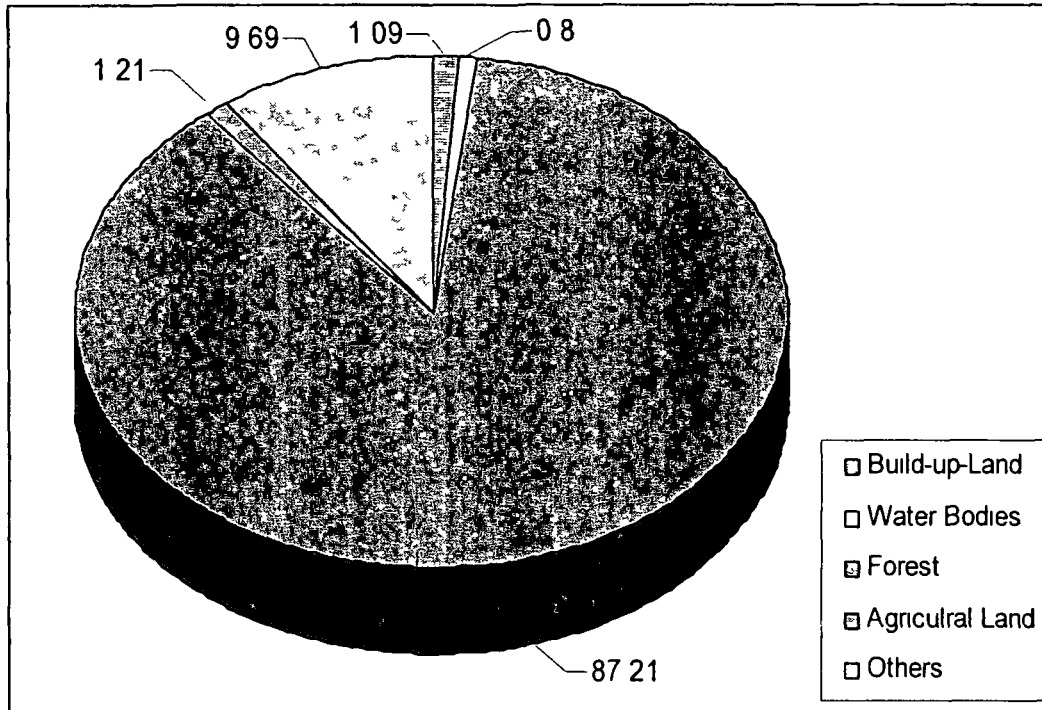


Figure 2.4

2.6 AGRICULTURAL ACTIVITIES

Agriculture is the chief occupation of the Southeast Asian countries. It is regarded as the main stay and basic means of occupation of the people of the monsoon region. It also serves as the main method of occupation in the study area with traditional shifting cultivation method. It is however, seen that the proportion of workers involved in agricultural activities have come down sharply at present.

(i) *Jhum* or Shifting Cultivation

*So you mean jhum is not a part of the area in the study area*

*Jhum* or shifting cultivation is the principal method of cultivation in the study area and its neighbouring hilly tracts. About 44,000 hectares of land or 9.69 per cent of the total geographical area is under *jhum* cultivation in the study area in 2000. The yield in *jhum* system is very low, although, heavy and constant labour input is required. It is estimated that average *jhum* cultivation in the study area is about 12 quintals per hectares.

*Yield from*

In most of the agricultural system, the same piece of land is cropped continuously with occasional fallows. The farmers chooses a patch of vegetated forest, cut down some of the trees by an axe, leaving only the larger and economically useful trees, they also clears the undergrowth with a knife (*Chempui*) and exposed the debris to be dried on the sun. The debris is burnt after they are dried enough. The ashes enrich the soil fertility so long as they are not washed away through erosion. Crops are sown on the clearing land with a minimum preparation and received any cursory attention during the growth. In *jhum* system, variety of crops are grown together, paddy as the staple crop, vegetables and other cash crops as supplementary. Weed-out work is done twice or thrice till harvest, depending on the necessity. The application of fertilizers is normally absent in *jhum* system. *Jhumming* is a wasteful means of cultivation in terms of the vegetation annihilated in the process and in terms of yields. The value of forests destroyed by *jhumming* is estimated to be over 50 cores annually in the study area. Moreover, input of heavy manual labour is necessary, whose workforce could have been much more production if utilised in other economic activities other than *jhum* system.

It has been long realised that the age-old tradition of *jhumming* should be abandoned and the cultivators should switch to permanent land management to get more reliable agricultural products. In this connection, the government has given financial assistance to *jhumia* families for their permanent settlement and economic uplift to abandon the present practices of shifting cultivation under *New Land Use Policy* (NLUP), Government of Mizoram. The New Land-Use Policy started from the year 1985 onwards. This scheme is implemented by Rural Development Department which aims at complete eradication of unproductive and traditional method of shifting cultivation by giving *jhumia* families viable scheme for permanent occupation. Under this scheme, large numbers of families are financed, encouraging them to adopt orchards, piggery, dairy farming, horticulture, teak plantation, pisciculture and other activities in a way to discard *jhum* practices. This scheme has been able to reduce the rapid increase of shifting cultivation in the study area.

### **(ii) Horticulture**

Development of horticulture, perhaps the most feasible project to boost agriculture products in the study area is considered from a geographical point of view. Horticulture has been introduced to reduce *jhumming* and the development of agricultural production. But, only a small area of about 294 hectares was put under horticulture in the year 1991. With the growing importance of horticulture crops, the state government placed a considerable emphasis for the development of horticulture crops. The horticulture crops occupied only 294 hectares in the year 1991, while in 2002 it has increased to 2,754 hectares. Looking to the importance and utility of horticulture crops, the government is placing a considerable emphasis on the development of horticulture crops mainly fruits, vegetables and spices. The government has undertaken a programme to promote horticulture development by giving top priority on construction of link roads in rural areas to connect the orchard/gardens as well as the potential areas with the main roads and villages through direct participation of the villagers.

### **(iii) Wet - Rice Cultivation**

To curtail the practice of devastating *jhum* cultivation and to increase agricultural productivity the government has introduced wet rice cultivation in the district. Yet the scope of medium irrigation in the study area is very limited due to the hilly nature of the region, all irrigation project are confined to minor irrigation scheme. Flat land for such cultivation is possible only along the river valleys where water facility is available normally these areas are fertile lands. In the study area only few areas are used for Wet-Rice Cultivation due to lack of water resources. Out of the total area in the study area only about 1.4 per cent has brought under Wet Rice Cultivation till today.

### **(iv) Livestock and Animal Husbandry**

Among the allied activities related to agriculture, Animal husbandry is another important sector. In an agrarian economy the importance of livestock can not be denied, therefore, various departmental schemes and programme like breeding, feeding, dairy

development have been undertaken by the state government in the -successive five years plan programmes visualising self-sufficiency in the production of food of animal origin to uplift the economic status. The development of livestock is important for economic development of the region of the rural areas. In fact, livestock and animals husbandry has been given importance by the state government as an alternate to *jhumming*.

## **2.7 DEVELOPMENT OF FOREST ECONOMY**

Traditional shifting cultivation, widespread lumbering and mismanagement of forestry have been the main drawbacks in keeping the forests wealth intact. Therefore, the state government has made various efforts to regenerate the forests either naturally wherever there occur good seed bearers in particular area, or artificially through plantation. Till today the Forest Department has brought an area of 216.24 square kilometres under different plantations. About 33 per cent is under economic plantation, 34 per cent under fuel wood and 30 per cent under social forestry.

The importance of forestry also lies with its capacity to prevent soil erosion and maintenance of ecological balance. The government have therefore, imposed ban on illegal felling of trees in the district and also been undertaking massive afforestation programmes through plantation of utility tree species in wasteland and degraded areas. The state Forest Department is executing the afforestation programmes through centrally sponsored schemes. The destruction of habitat of plants and animals by various detrimental factors has rendered many species of rare plants and animals to the extent of becoming endangered and extinct. Preservation and management of wildlife has therefore assumed great importance in view of the dwindling habitat of wildlife. The state government is aware and active to the needs of the conservation of wildlife. Government of Mizoram introduced Joint Forest Management (JFM) scheme in the year 1991 for rehabilitation of degraded forest. This scheme mainly aims at conservation, improvement and increasing the production of non-timber forests products and medicinal plants, it also

aims at providing additional income to the tribal and rural poor living in and around forest. Under the JFM a long standing requirement is fulfilled in which the involvement of forest dwellers is considered necessary for the sustainable conservation of forests in any part of the earth, more so in the tribal areas like the northeast India.

## 2.8 TRANSPORT AND COMMUNICATION NETWORK

*2 mls with 1 cell  
to provide deforestation  
in forests*

Development of transport and communication network is very essential for proper and speedy development. Transport and communication lines are the basic necessity, an indispensable infrastructure and essential prerequisite for any form of development. In fact, transport routes are integral part of nation economy and these are the index of prosperity. The northeast region of India is still very backward in transport and communication system. A geographical factor, especially physiography is a major constraint of the region. In hilly area of the study area, all other means of transport such as railways, airways and waterways are insignificantly developed or almost absent. The only means of transport available is road transport which is also beset with numerous problems like landslides. Due to precipitous physiography and undulating terrain, development of roads in the study area is of great difficulty. As a result of the north - south running ranges, there is a wider scope in construction of roads in the same direction, while construction in the east to west direction is not only difficult but also costly affair as it entails to overcome the construction of blind curves, steep gradients and bridges at most places. The Border Road Development Organisation and the State Public Works Department are the main agencies involved in the development of road network in the study area. The roads in Lunglei district can be broadly classified into three types such as (i) National highway, (ii) State highway and (iii) District road. Lunglei district is connected only with one national highway i.e. National Highway No.54.

## **2.9 INDUSTRY**

In Lunglei district the traditional industries were cloth weaving and black smithy, the first was a home industry for respective home consumption only and the second was for making weapons and implements for war, hunts, agriculture and domestic use. None of the industries came up for marketable products. Lunglei district has plenty of raw materials for industry mostly from forest, agriculture and horticulture.

Attempts at promotion and development of small and household industries were made through the community development Blocks in the district. But progress was not much in the industrial sector. There was lack of trained manpower and absence of adequate policy direction. In 1989, the state Government formulated an industrial policy for the state. Under the policy priority will be given to agro and forest based industries followed by handloom, electronic and consumer industries. Lunglei district is an industrially backwards area and the whole district has been declared no-industry district. This attracts various facilities for promotion of industry. Some ginger and fruit processing plants have come up in the district. A state government undertaking Mizoram Food and Allied Industries Corporation, has been set up to develop industries based on agro-horticultural products. Apart from the ginger maize and fruit juice plants have already set up or under construction, there is potential for setting up different industrial projects based on locally products fruits, tea, coffee, chillies, oilseeds, sugarcane, meat, milk etc.

## **2.10 RURAL DEVELOPMENT BLOCK**

Lunglei district is divided into four Rural Development Blocks (RDB) viz. *Lungsen* Rural Development Block, *Hnahthial* Rural Development Block, *Bunghmun* Rural Development Block and *Lunglei* Rural Development Block. Lunglei district covers an area of 4,538 square kilometres. Out of the total area *Lungsen* Block covers the largest

area of 1, 36,029 hectares, followed by *Bunghmun* having 1, 13,949.93 hectares. *Lunglei* Block and *Hnahthial* Block cover an area of 1, 07,951.36 hectares and 95,669.71 hectares, respectively. The demarcation of boundary of these four Rural Development Blocks is more or less guided by the natural courses of the rivers and the hills. The descriptions of the boundary of the Block justify the role of geographical features in shaping the boundary.

Among the four Blocks *Lunglei* Block has the highest population concentration as per the 2001 Census, it has 64,863 persons followed by *Lungsen* Block which has 30,704 persons, *Hnahthial* Block 24,146 persons and *Bunghmun* Block 16,508 persons, respectively (Table 2.3, Figure 2.5). There are 67 inhabited and 13 un-inhabited villages in Lungsen Block, 39 inhabited and 9 un-inhabited villages in Lunglei Block, Bunghmun Block constituted 34 inhabited and 6 un-inhabited villages and Hnahthial Block has 25 inhabited and 1 un-inhabited villages (Table 2.4). Map of Lunglei district rural development Blocks clearly shows in Figure 2.6.

**Table 2.3 Block Wise Houses, Households and Population**

Name of Blocks	No. of Houses	No. of Households	Population		
			Male	Female	Total
Bunghmun	3, 106	2, 763	8, 366	8, 142	16, 508
Hnahthial	4, 883	4, 524	12, 046	12, 097	24, 146
Lungsen	6, 000	5, 689	15, 821	14, 883	30, 704
Lunglei	14, 320	12, 448	32, 856	32, 007	64, 863
<b>Total</b>	<b>28, 309</b>	<b>25, 424</b>	<b>69, 092</b>	<b>67, 129</b>	<b>1, 36,221</b>

Source: District Research Officer, Lunglei 2001.

### Block Wise Number of Population - 2001

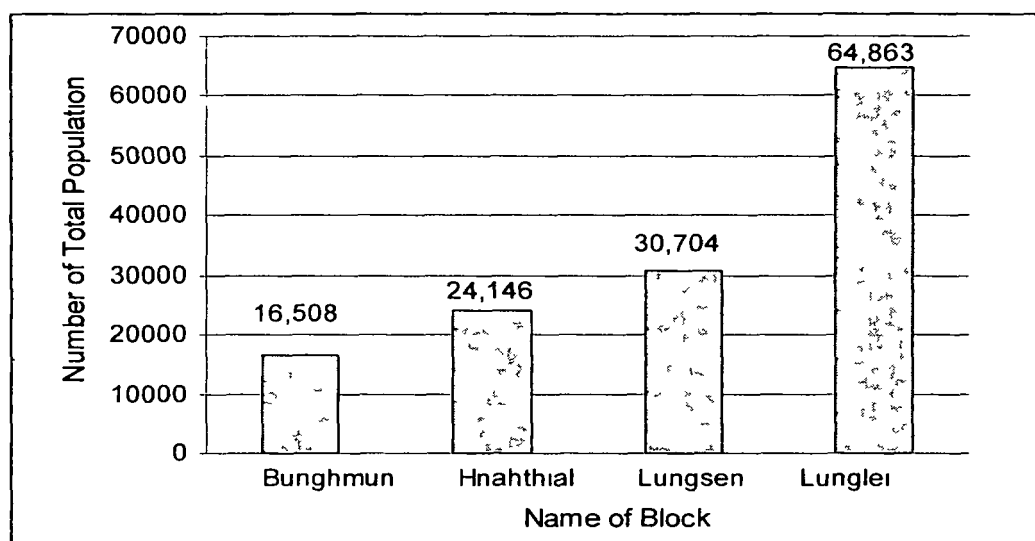


Figure 2.5

Table 2.4 Block Wise Number of Villages

Name of Block	Inhabited	Uninhabited	Total
Bunghmun	34	6	40
Lungsen	67	13	80
Lunglei	39	9	48
Hnahthial	25	1	26
<b>Total</b>	<b>165</b>	<b>29</b>	<b>194</b>

Source: District Research Officer, Lunglei 2001

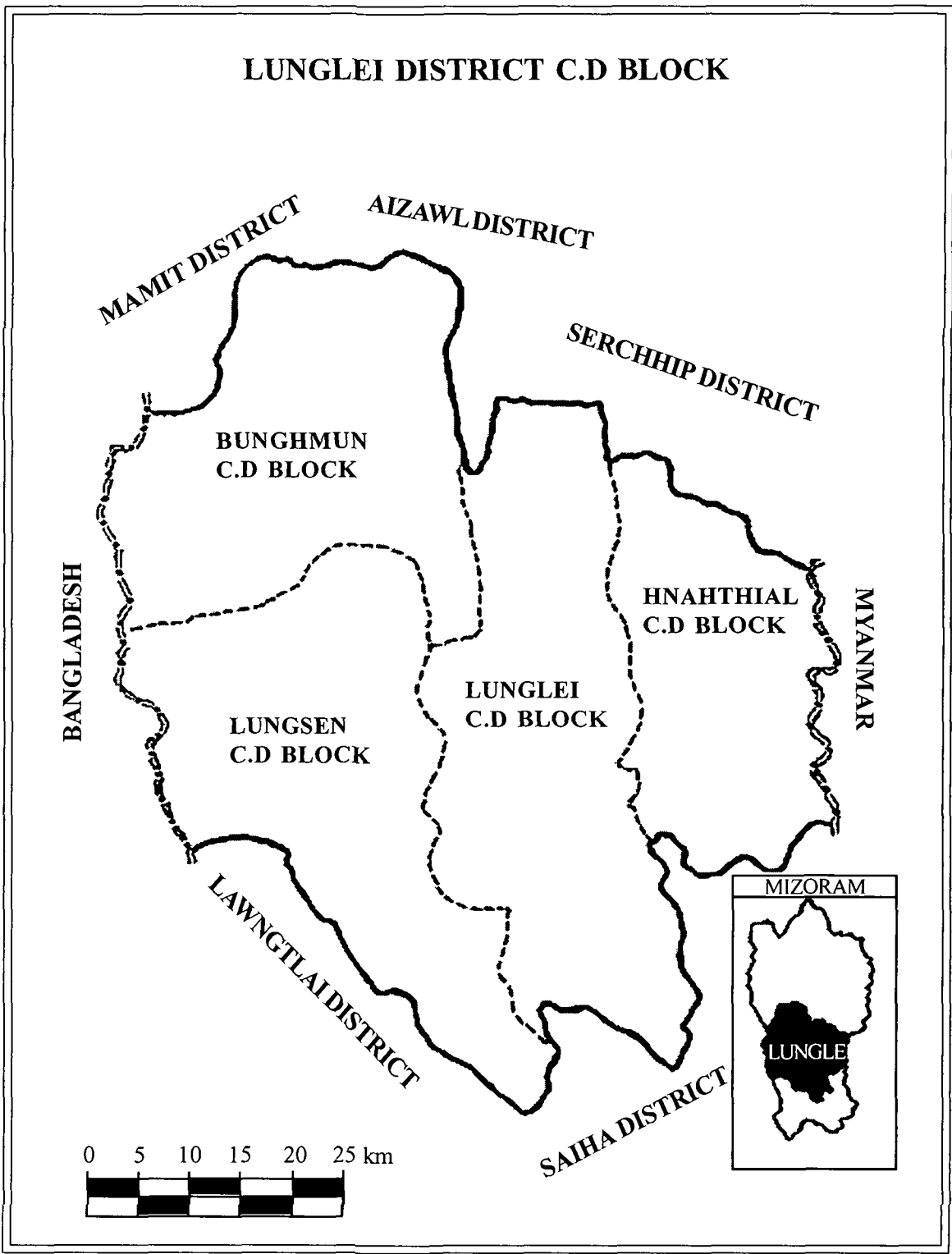


Figure - 2.6

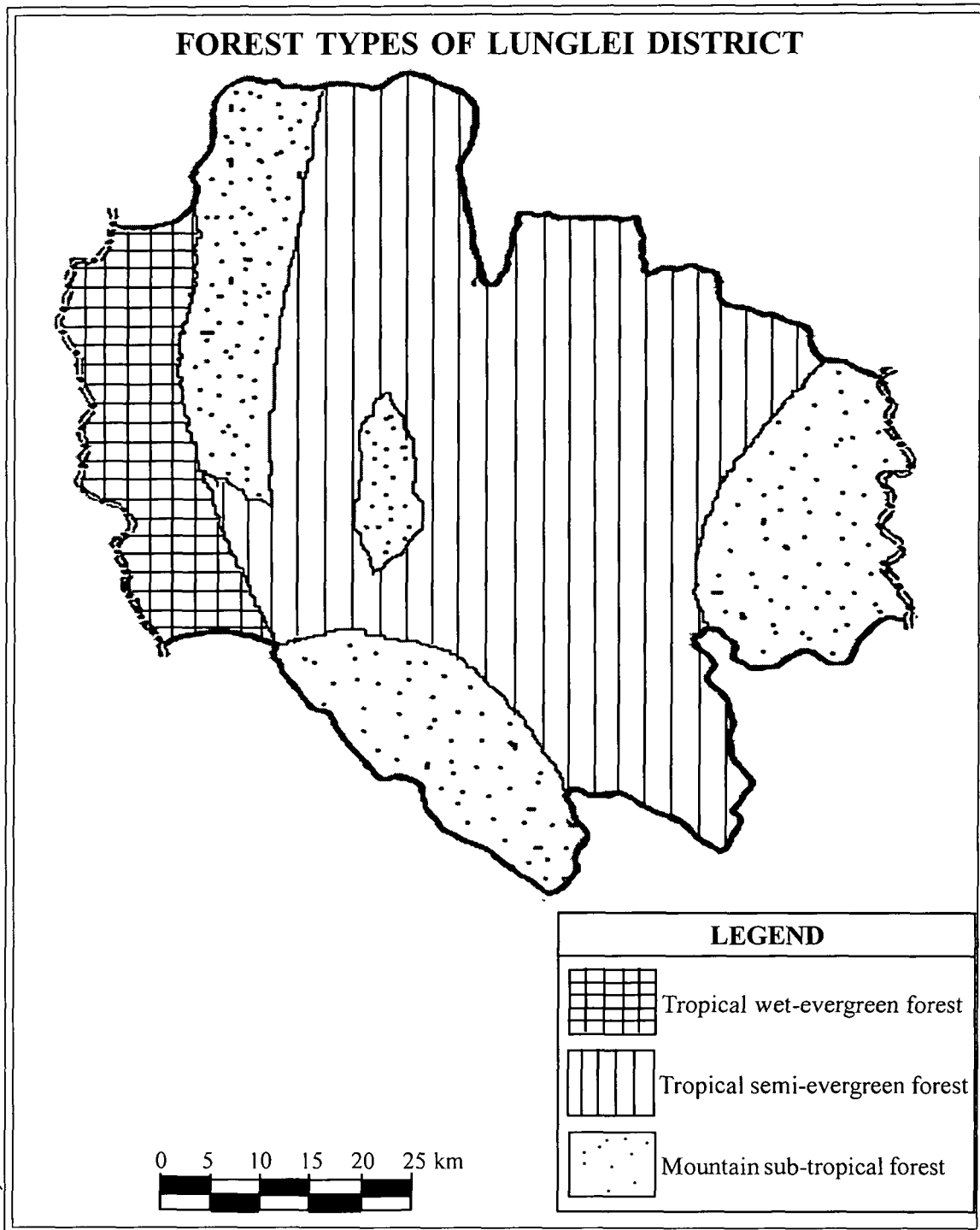
**CHAPTER – III**  
**DEGRADATION OF FORESTS**

Before coming to the main topic of degradation of forests, it is worthwhile to have a brief account of the types of forest of the area. Lunglei district known for its diverse and most extensive lush green forest cover has also been facing degradation due to one or more factors. The forests in this area are unique in structure and species composition. The flora composition is assemblage of plant species of temperate east Himalayan flora, Palearctic flora of Tibetan highland, wet evergreen flora of south-east Asia, and that is responsible for the formation of a rich biodiversity in the study area. The altitudinal variation and rainfall patterns of southwest and northeast monsoon play a significant role in the development of ecological niches in the region where vegetation growth is abundant. Its tropical location provides conducive climatic condition such as adequate rainfall, moderate temperature etc. which favour the luxuriant growth of vegetation. The types of vegetations which thrive in Lunglei district ranges from tropical to sub-tropical forests. They comprise valuable species of timber, lumber, medicinal herbs and domestic resources.

### **3.1 MAJOR FOREST TYPES AND THEIR DISTRIBUTION**

On a broad scale, the forests of Lunglei district could be simply described as wooded forests in the lower ridges - normally below 600 metres including riverine lowlands. However, according to Botanists they could be further classified into six types such as (i) Tropical evergreen forests, (ii) Sub-Himalayan semi-evergreen forests, (c) Sub-tropical pine forests, (d) Sub-tropical hill forests, (e) Mixed forests, and (f) Overlapping bamboos. Champion and Seth (1964) have classified the forests types of Lunglei district into three broad types such as (i) Tropical wet - evergreen forests, (ii) Tropical semi-evergreen forests, and (iii) Mountain sub-tropical forests. The distribution of forest types (Champion and Seth) in Lunglei district has clearly shown in Figure 3.1.

Year!



**Figure 3.1**

### **(i) Tropical Wet-Evergreen Forests**

This type of forests is found at places where precipitation is high. It is found abundantly in the western part adjoining Bangladesh. Important timber species of this forests type are *Gemelina arborea* (Thlanvawng), *Michelia champacca* (Ngiau), *Dysoxylum binectariferum* (Sahatah), *Dipterocarpus turbinatus* (Lawngthing), *Cordia wallichii* (Muk), etc. Important bamboo species of this classification are *Melocana bambusoides* (Mautak), *Bambusa tulda* (Rawthing), *Dendrocalamus longispathus* (Rawnal), *Dendrocalamus hamittoni* (Phulrua) and *Neohouzeua dulloa* (Rawthla). Some species of ecological importance are *Bischofia javanica* (Khuangthli), *Eugenia jambolona* (Lenhmui), *Tavena odorata* (Theivawkmit), *Sapium insigne* (Thingvawkpui), *Anthocephalus maculate* (Banphar), *Podocarpus neirifolia* (Tufar), *Acrocarpus fraxinifolius* (Nganbawm), *Artocarpus lokoocha* (Theitat), *Fiscus benghalensis* (Hmawng), etc. Other common species found in the tropical wet evergreen forests are *Artocarpus chaplasha* (Tatkawng), *Myristica longiflora* (Thingthi), *Mahoma borealis* (Pualleng), *Derris robusta* (Thingkha), *Bombax insigne* (Pang), *Albizia procera* (Kangtek), *Anogneissus acuminata* (Zairum), *Echinocarpus assamicus* (Phaithing), *Leea sambucina sanguinea* (Kawlkar) and *Baccaurea sapida* (Pangkai). Species of the undergrowth such as *Phrynium capilatum* (Hnahthial), *Cargotaurens* (Tum) or (Meihle), *Punanga gracilio* (Tartiang) thrive under the thick jungles. *Thysonoloena agrestis* (Hmunphiah) is also abundant and it is used as broomsticks which provide one of the main sources of revenue (Champion and Seth 1964).

### **(ii) Tropical Semi-Evergreen Forests**

Tropical semi-evergreen forests cover a vast area in the central part of the district. Apart from timber species, the species which thrive well in Tropical evergreen forests are *Schima wallichii* (Khiang), *Cedrela toona* (Tei), *Tarminalia mycriocarpa* (Char), *Duabanga sonneratioides* (Zuang) and *Tetrameles nudiflora* (Thingdawl). Valuable domestic species available are *Hibiscus macrophyllus* (Vaiza), *Samecarpus subpan duriformis* (Kawhtebel), *Parkiaroxburghii* (Zawngtah), *Protium serratum* (Bil), *Quercas*

*pachyphyllum* (Thil). The most common tree species found in this category of forests include *Lyonia oralifolia* (Tlangham), *Quercus helferiana* (Hlai), *Saurauja punduana* (Tiar), *Erythrina stricta* (Fartuah), *Helica exela* (Sialhma), *Albizzia stipulate* (Vang), *Stereo spermum chelonoides* (Zihngal), *Eloeocarpus lanceoefolius* (Kharuan), *Quercus dilatata* (Thal), *Castonopsis tribuloides* (Thingsia), *Bauhinia variegata* (Vaube), *Bombox malabaricum* (Phunchawng), *Sterculia colarata* (Khaukhim) and *Sapidus barak* (Thingsir) (Champion and Seth 1964).

### **(iii) Mountain Sub-Tropical Forests**

This type of forests is found on the higher elevation, mostly confined in the eastern fringe of the district. They also found as strips on the north-south running ranges in the western part around Bungmun area and in the southern part. This forests is dominated by *Rhododendron* (Chhawkhlei), *Quercus dealbata* (Fah), *Prunus ceracoides* (Talizawng), *Myrica nagi* (Keifang), *Quercus icana* (Phen), *Emblia officinalis* (Sunhlu), *Rhus javanica* (Khawmhma), *Butea minor* (Tualthu). Only few species like *Pinus kesiya* (Far), *Quercus xylocarpa* (Then), etc. are also found. Other common species of this classification are *Eurya symplocina* (Sihneh), *Celerodendron* (Phuihnam), *Rubus ellipticus* (Hmutau), *Derris wallichii* (Hulhu) and *Rubus sirmanicus* (Sialinuchhu), *Didymo chlaenatruncatula* (Katchat), etc. (Champion and Seth 1964).

### **(iv) Other Forest Types**

The secondary forests or old abandoned *jhum* fields in the lower altitude are mostly dominated by bamboos which are moist-deciduous in nature. These bamboos cover an area of 38.95 per cent of the total geographical area of the district. However, in some areas old abandoned *jhum* lands are dominated by miscellaneous species, which account for 11.92 per cent of the total geographical area of the district. The old-abandoned *jhum* field and bamboo forests have clearly shown in Plate 3.1 and 3.2.

Forests plantations (i.e., forests coming up after planning trees by the government agencies and the local people) are also found here and there in small pockets, having predominantly of *Tectona grandis* (Teak) species, for instance, *Tectona grandis* (Teak) plantations near *Phairuang* village, *Lungsen* village, *Hnahthial* town, *Tlabung* town and river *Mat* etc. The *Gmelina oblongifolia* and *Gmelina arborea* plantations are also found on the roads side near *Phairuang* village, *Leite* village, *Lungsen* village etc. However it is very difficult to identify and delineate the plantation area on the satellite imagery due to the fact that the very young plantation show similar tone with the young abandoned *jhum* fields and old plantation are always associated with some other tree species. Therefore, only pure patches of plantations located along the road could be identified. The total area of forests plantations, which could be identifying, is of the order of 0.15 per cent of the geographical area. The abandoned *jhum* fields of approximately 3 years old and scrubland are put under the category of young abandoned *jhum/scrub*. The young-abandoned forests show in Plate 3.3. Depending on the vegetation types of the area before shifting cultivation the young abandoned *jhum* fields are dominated by young bamboo shoots or tree seedling and saplings. The other dominant species are *Eupatorium adoratum*, *Thysonalaena maxima*, *Erianthus longisetosus*, *Osbekia chinensis*, *Imperata cylindrical* etc, (Remote Sensing 2000).

### 3.2 IMPORTANCE OF FORESTS

Forests play an important role in the development and well-being of the study area. Besides being a source of material progress, it is also the basis of spiritual and moral inspiration. Forests products constitute the major economic resources on which depends the rural people's sustenance from birth to death. They derive their entire material requirements from forests such as - construction materials, food, fodder, fibre, medicine etc. The past and present uses of forests products in the study area have briefly been given below under the major resources.

### **(i) Timber Resources**

Timber resources constitute round and sawn timber, fuel wood, charcoal, poles and posts along with bamboo materials for construction of houses, furniture, decoration, canes and other ethno-material culture. The local forests based small scale industries are run by the timber resources collected from the forests.

### **(ii) Bamboo and Cane Resources**

At present, only a small percentage of bamboo resource is utilised for the purpose of tiny handloom and handicraft production and for consumption (as bamboo shoots- a delicacies among the Mizo). There is little proper management of the bamboo resource in Lunglei district. However, almost 30 per cent of the Forest Department's income comes from bamboo. The *Mahal system* is the main system of selling bamboos by the Forest Department. Harvesting rights are sold annually to *Mahaldars* (Contractors) from the western part of the district and they have rights to remove any quantity of bamboo from the forest. Although culms are mature after three years, regulation exists to limit cutting to four years old culms to provide some safeguard for future culms availability.

The value of bamboo in the life of the people of the district is very difficult to determine since most uses are non-market based. Bamboo culms harvested by the *Mahaldars*, whose earnings from this activity go outside the district or state. The main use of bamboo by the local people is for house construction. Bamboo pipes prevalently used to irrigate vast tracts of agricultural land in different agro-ecological settings. Bamboos are also widely used in woven products as umbrella handles and traditional hats (*Khumbau*), water piping etc. Nevertheless, there is no information on the economics of trading such items or on the income derived by individual weavers or their costs and returns. Some local companies have been established to process bamboo and these provide some employment for the local people. Ply board factories have been established in some villages. A local NGO's is actively investigating the potential for specific bamboo products such as hanger, broomstick and handles for wall and ceiling cleaners.

There is also a government fruit and vegetable processing factory, which processes. Cane production came along with bamboo and can work in the industrial sector. Generally chairs, tables, stools, hats, umbrella sticks etc. are made of canes. Other ethno- material culture of bamboos and canes include fences, outdoor benches, utensils, vessels, conduits, guard-rails, bamboo torches, bamboo storehouses, weaving and tying purposes etc (Environment and Forest Diary, 2001-2002).

### **(iii) Source of Fodder**

Forests are an important source of fodder. Many of the cattle are dependent on the forest for their food. They either graze on the forest land or are fed by the fodder collected by the local people from the pastures and the cattle are stall-fed in the village itself.

### **(iv) Source of Food and Medicine**

Mizoram receives low priority for scientific investigation of medicinal plants in the country, although it is rich in bio-diversity. An ethno-botanical research study conducted by Lalramnghinglova during 1994-1998 has recorded 72 wild food plants and around 400 ethno-medicinal plants in Lunglei district. The montane-sub-tropical hill forests in the eastern part of the district are yet to be fully covered ethno botanically.

### **(v) Source of Revenue**

Forests are an important source of revenue for the state exchequer. Actual contribution of forests sector to the economy of the district is many times more if value of fuel wood, timber and bamboos and other non-timber forests products removed and used free of charge by the entire tribal population is taken into account. Revenue mainly comes from sale of bamboos and timber.

Apart from the economic importance, forests are also significantly important for the environment. It is important to prevent floods by controlling the flow of rain water and also significant to prevent fast evaporation of water and land and increase the humidity of air by transpiration. It also plays a vital role in maintaining the ecological system. Forests assist in the essential global cycling of water, oxygen, carbon dioxide and nitrogen. It also influences solar radiation reaching the earth's surface, wind, humidity and temperature and thus moderates the climate, especially the rainfall. Hence, forests have two important roles, they are- long term ecological security and production of goods and services for the benefit of mankind.

### **3.3 DEGRADATION OF FORESTS**

Before the arrival of man on the surface of the earth there were existing large tracts of forest for millions of years. Along with the growth of human population and civilisation a lot of changes (most of them negative ones) took place. The process of degradation of forests is synonymous with the development of agrarian civilisation. The problem has only aggravated in the last couple of centuries due to rise in population, intensification of agriculture for food and industrial raw material production world over. Degradation of forests arose from four principal causes, in combination with each other, i.e. excessive felling of trees for timber, over grazing, fires and clearance of land for cultivation, pastures and settlements. The most disastrous level of degradation of forests occurred in areas that witnessed the birth of the earliest civilisation (Francois 1981).

In the developing countries, the issues are more intense because for hundreds of millions the struggle is for survival. Growing rural populations invade the forests in search of land for raising crops, fuel for cooking and fodder for domesticated animals. Governments impelled to raise foreign exchange earnings and employment and to finance economic development programmes turn to the forest as a resource that can readily be exploited. So is the case of people who wish to become millionaire overnight at the cost

of the green gold. Under this relentless assault forests in the third world countries are not only retreating but degrading also. Every year in the tropical zone more than 11 million hectares of forest are cleared for various uses, out of which 7.5 and 3.8 million hectares belong to the closed and open forests, respectively. It is heartening to note that in most developing countries degradation of forests is accelerating. The most unfortunate aspect is that the world's tropical forests are disappearing faster than ever. Every succeeding study shows a startling acceleration of the process. For many years, the baseline figures accepted for rates of degradation were those prepared by the Food and Agriculture Organisation (FAO). The study demonstrated that in 1980, globally degradation of forests was proceeding at some 1, 14,000 square kilometres per year (FAO 1980). More studies that are recent have shown that forest loss is speeding up. According to Norman Myers, in a study completed for Friends of the Earth some 1, 42,000 square kilometres of tropical forests destroyed in 1989.

Earlier, the population in the study area was very scanty, the area was highly inaccessible, and there were forest all over the district where unrestricted *jhumming* was practised for centuries to produce food crops. None was concerned with the forests except the villagers. Village Chief was the supreme and undisputed controller of forest area within his jurisdiction. However, after the Chieftainship was abolished the government machinery took possession of the land including the forests. The 'Village Safety Reserves' were constituted adjacent to villages in the interest of health, water supply and protection of village from *jhum* fires. Utilisation of any portion of land inside these reserves by any person without permission is prohibited. The 'Village Safety Reserves' have also been constituted for the supply of forests products to meet the basic needs of the villagers. Any person residing in the village may cut trees, bamboos and collect other forests products for his household/domestic consumption, and not for commercial purposes. Apart from it, reservation of a half mile tract on both sides of the rivers in the district was done with a view to conserve soil and water and also to keep the vital line of communication open. Thus, development strategy in the past was mainly protection

oriented and development aspect was not given adequate attention. However, in absence of proper survey, demarcation of settlements and maps of forest land the health of forests has deteriorated and this condition is prevailing in the district for long. In the following lines an account of degradation of forests in the study area has been given by taking different aspects of forests degradation into consideration.

#### **(i) Decrease in Forest Cover Area During 1970 to 2000**

Lunglei district was once very rich in flora and fauna covered with thick forests of gigantic dimensions. However, with the passage of time due to degradation the forests have lost their original character. Only up to a few years back, most of the forest area was covered by dense forests but due to the onslaught by man on forests only a small portion of dense forests is left now. This is because of a number of main and minor reasons like dependence of people upon forests for timber, fuel wood, lumbering and other forests products, encroachments, illicit removal of forests products, fires, various developmental activities and the most devastating is shifting cultivation (*jhumming*).

To find out the temporal variation of forest cover area in the study area firstly, decrease of forest cover area has been investigated from 1970 to 2000. The comparative status of the forest cover area of Lunglei district from 1970 to 2000 has been shown in Table 3.1 and Figure 3.2. As per the report of Forest Department, Aizawl, in 1970 the forest cover area in the district was 4, 31,218.5 hectares, i.e. 95.06 per cent of the total geographical area. Consequently, in 1980 the forest cover area has decreased to 4, 23,145.8 hectares or 93.28 per cent of the total geographical area. Hence, within a period of ten years, forest area has decreased by 8,072.7 hectares, in other words, the percentage loss of forest area within 1970 to 1980 was 1.78 per cent. Based on the satellite imagery interpretation the Mizoram Remote Sensing Application Centre, Aizawl the total forest cover area was 4, 09,542.2 hectares in 1990 i.e. 90.30 per cent of the total geographical area. Within a period of ten years, forest cover area has declined by 13, 603.6 hectares or 2.98 per cent. Ultimately, in 2000 the forest cover area was come

down to 3, 95,621.06 hectares, accounting for 87.2 per cent of the total geographical area. Hence, during the last decade, the percentage of forest cover area has come down by 3.09 per cent. Comparatively, during 1970 to 2000 the total loss of forest cover area was 35,597.44 hectares. In other words, the total percentage loss of forest cover area within thirty years (1970 – 2000) constitutes 7.85 per cent of the geographical area of the district.

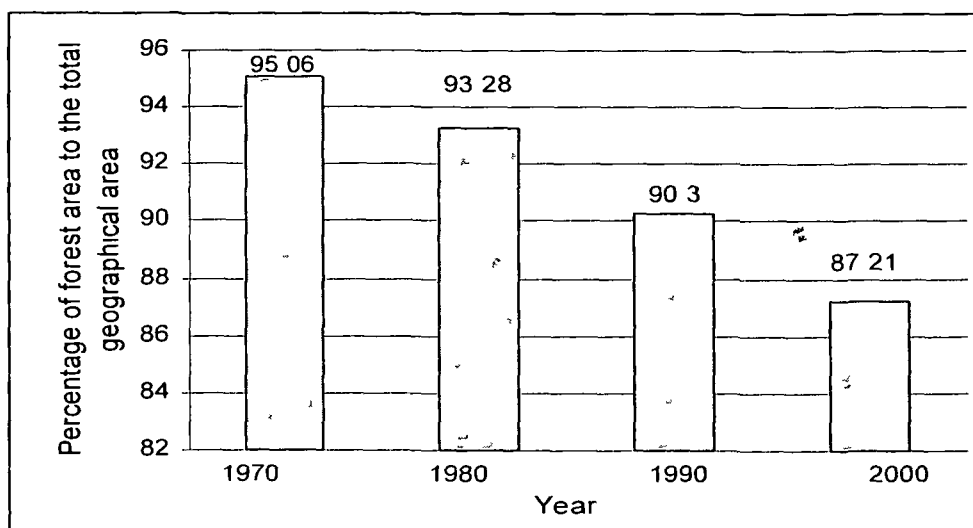
**Table 3.1 Forest Cover Area in Lunglei District**

Year	Area (in Hectares)	Percentage to Total Geographical Area
1970	4,31,218.50*	95.06
1980	4,23,145.80*	93.28
1990	4,09,542.20**	90.30
2000	3,95,621.60**	87.21

Source: \*Forest Department, Aizawl 1970, 1980

\*\*Mizoram Remote Sensing Application Centre, Aizawl 1990, 2000

**Percentage of Forest Cover Area in Lunglei District from 1970 to 2000**

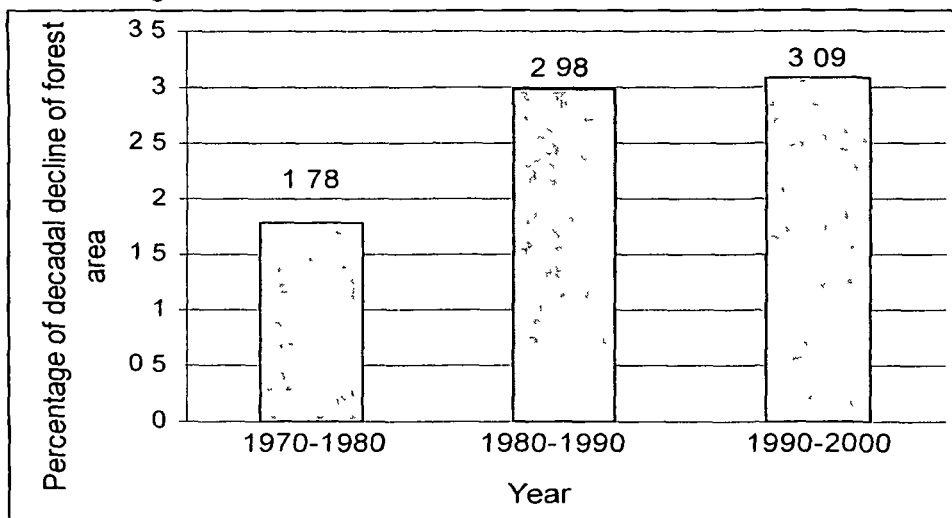


**Figure 3.2**

**Table 3.2 Decadal Decline of Forest Area from 1970 to 2000**

Year	Area (in Hectares)	Percentage to Total Geographical Area
1970 – 1980	8, 072.70	1.78
1980 – 1990	13, 603.60	2.98
1990 – 2000	13, 921.14	3.09
1970 - 2000	35, 597.44	7.85

**Percentage of Decadal Decline of Forest Area from 1970 to 2000**



**Figure 3.3**

From the above Table 3.2 it is quite clear that during the study period i.e. 1970 - 2000 the total loss of forest area is of 35,597.44 hectares which accounts for 7.85 per cent of the total geographical area of the district. Though loss of forest area during thirty years may appear very small when compared with the loss of forest area in the tropical zone, it is undoubtedly a significant decline keeping in mind that the loss is of primeval or climax forests of the tropical zone of the world and hence, it is a serious loss indeed. In case of the study area clearance of 35,597.44 hectares, in thirty years (i.e., about 1186.58 hectares per year) of original forests is definitely a great loss because such forests are a rare commodity today and such loss is irreversible for the time being. It is also to be noted that during the study period, the rate of degradation of forest area differs from time

to time. From the Table 3.2 and Figure 3.3 it is evident that the rate of degradation has gradually increased over the decades. The trend of decline in forest cover area shows that maximum degradation took place during 1990 to 2000. Moreover, the trend of decline of the original tropical forests is itself a dangerous sign not only for the environment of the district, but of the tropical belt and of the world as a whole. Under the influence of various developmental activities the dangerous trend may turn worse in future and that is the point of great concern for the environmentalists.

There was a time when 96 per cent of the total geographical area of the district was covered with thick forests and in 2000 the total forest cover area has shrunk to 87.21 per cent of the total geographical area. The rate of annual cutting of forest has been gradually increasing in the study area and may become a problem to the environment and ecosystem. Degradation of forests has become an ever increasing phenomenon due to anthropogenic interference in the ecosystem leading to ecological balance which has far reaching environmental consequences. The biosphere is a vast life support system whose different components are mutually interactive in such a way that the whole system operates in a state of dynamic equilibrium. Forests play a crucial role in the stability and viability of the biosphere or ecosystem. The loss of forest cover will, therefore, start a chain reaction and the cumulative changes, which if not checked in time, may lead to the collapse of the entire system and occurrence of ecological disaster. Yet, in spite of all this, forest destruction still goes on wantonly in the study area. What nature took million of years to build and provide and what sustained the viability of terrestrial ecosystems is fast disappearing due to man's misuse and over use of this vital resource.

The degradation activities like shifting cultivation clear felling of forests for timber and mining has altered the natural landscape of the study area to a great extent. This has also resulted in fragmentation of the landscape and loss of many endemic species of the district. There has been significant increase in landscape variability during 1970 to 2000. The land transformations result in the alternation of natural habitats. These changes have brought in impacts like fragmentation, loss of biodiversity and degradation

of sites. Deforestation permanently destroys the biodiversity that a forest contains, and degraded forests may not be able to support species adapted to the specialised conditions in, for example, a moist tropical forests species. Forests support many species that are only found within a small geographical range, so any disruption can result in the loss of a species or the loss of genetic variability within species. The impact of degradation on biodiversity extends beyond the area directly cleared because of the impact of fragmentation of the formerly continuous forest.

Taking an overall view of the on-going degradation of forest in the study area it can be summarised that this degradation may have serious consequences in terms of the radiation, moisture, heat budget and carbon dioxide and nutrient cycle destabilisation of sufficient magnitude to alter the climatic balance. Most climatologists agree that potentially very harmful consequences will follow with the increasing concentration of atmospheric carbon dioxide due to the clearance of forest cover. Clearing or thinning forest inevitably releases much of the carbon the wood holds into the atmosphere, usually as carbon dioxide. The forests play a major role in a region's water cycle and any significant forest degradation will affect the water cycle. About half of the rainfall on a large area of forest is water that has been lost by the trees themselves. The rest comes from clouds blown into the region by climatic conditions. The rest of the water is being held in the soil or flowing out of the region in rivers. Reducing the area of forest cover or its density reduces rainfall, which can seriously affect local livelihoods, agriculture, water flows as well as the health of the forest itself. Besides these, many local people are depends on forests for their livelihoods, and degradation processes directly affect the livelihoods of forests-dependent people.

The impact of forest degradation on the environment can be seen in the form of micro-climatic change, increased in temperature and decrease in humidity/rainfall, decreasing water resources, soil erosion in the form of sheet, increase of landslides, loss of soil fertility, etc. The study is in the line of expectations that fragmentation reduces

diversity. The nature of forest fragmentation in these landscapes is mainly attributed to shifting cultivation, illicit felling and deforestation for creating agricultural lands. All these have led to unaccountable destruction and also pose serious ecological problems. Therefore, serious efforts have to be made to protect and conserve forests both at government as well as public levels. Moreover, loss of forest cover area is often the only one of the aspects of degradation of forests and the real picture shall emerge when the quality of forests will be seen through the canopy density.

### **(ii) Change in Forest Canopy Density**

Apart from the loss of forest cover (see above), there are many other human interventions in forests that drastically change the structure or canopy cover. These processes degrade forests but do not convert it. The forest remains in same form. Though this degradation necessarily causes the loss of forest cover area, it is frequently the first step in a chain of events that can lead to permanent deforestation. The forest canopy density of 1970 and 1980 has been collected from the report of the Forest Department, Aizawl, whereas 1990 and 2000 data has been taken from the *State Forest Report* of Forest Survey of India. From the Tables 3.3 to 3.6 and Figure 3.4 to 3.7 about the forest canopy density of different time periods of the study area is clearly discernible. In 1970 dense forests (density above 40 per cent) was covered about 1, 50,163.25 hectares i.e., 34.82 per cent of the total forest cover area, whereas the open forests (density of 10- 40 per cent) has covered about 2, 61,483 hectares i.e., 60.63 per cent of the total forest cover area. While, the degraded forests (having less than 10 per cent canopy density) existed on only 19,572.25 hectares or 4.53 per cent of the total forest cover area. In addition, in 1980, the dense forests cover area come down to 31.89 per cent of the total forest cover area, while 2,64,672.90 hectares i.e. 62.61 per cent and 23, 500.30 hectares or 5.48 per cent were under the open forests and degraded forests, respectively. Thus, within ten years i.e., 1970 to 1980, the dense forests area had declined by 2.93 per cent. Contrary to it, the open forests cover area has gone up by 1.98 per cent, even the degraded forests cover area has also jumped by 0.93 per cent. The dense forests area has decreased again

to 1,03,501.10 hectares, i.e. 25.27 per cent of the total forest area in 1990, whereas the open forests cover area also increase again to 2, 72,041.10 hectares, in terms of percentage it has gone up to 66.42 per cent in 1990. The degraded forests area also shot up in 1990 to 34,000 hectares or 8.30 per cent. Heartening to note that between 1980 and 1990, the dense forests area declined by 6.62 per cent, in contrast to it, the open forests area increased by 3.81 per cent and that of the degraded forests jumped up by 2.82 per cent during 1980 to 1990. The dense forests cover has declined again in 2000, from 25.27 per cent to 17.49 per cent i.e.71, 634.20 hectares, contrarily, the open forests area has jumped up to 2, 94,621.40 hectares which is 71.93 per cent. The degraded forests area has also increased to 43, 286.60 hectares i.e. 10.94 per cent at the same time as well. During 1990 to 2000, the dense forests cover area was decrease by 7.78 per cent. The open forests and degraded forests cover areas have also increase by 5.51 per cent and 2.26 per cent, respectively.

**Table 3.3 Forest Canopy Density in Lunglei District**

Category	Area (in Hectares)	Percentage to Total Forest Area
Dense forests – above 40%	1, 50,163.25	34.82
Open forests – 10-40%	2, 61,483	60.63
Degraded – below 10%	19, 572.25	4.53

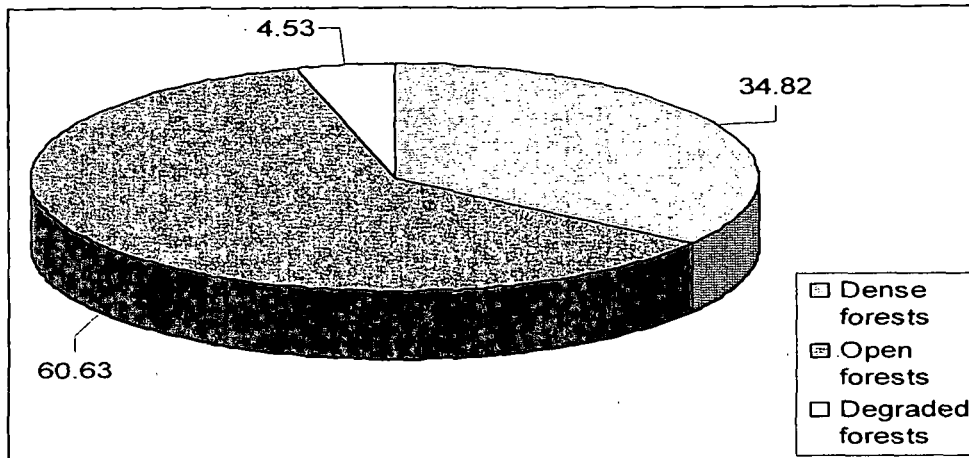
Source: *Forest Department, Aizawl 1970.*

**Table 3.4 Forest Canopy Density in Lunglei District**

Category	Area (in Hectares)	Percentage to Total Forest Area
Dense forests – above 40%	1, 34,972.60	31.89
Open forests – 10-40%	2, 64,672.90	62.61
Degraded – below 10%	23, 500.30	5.48

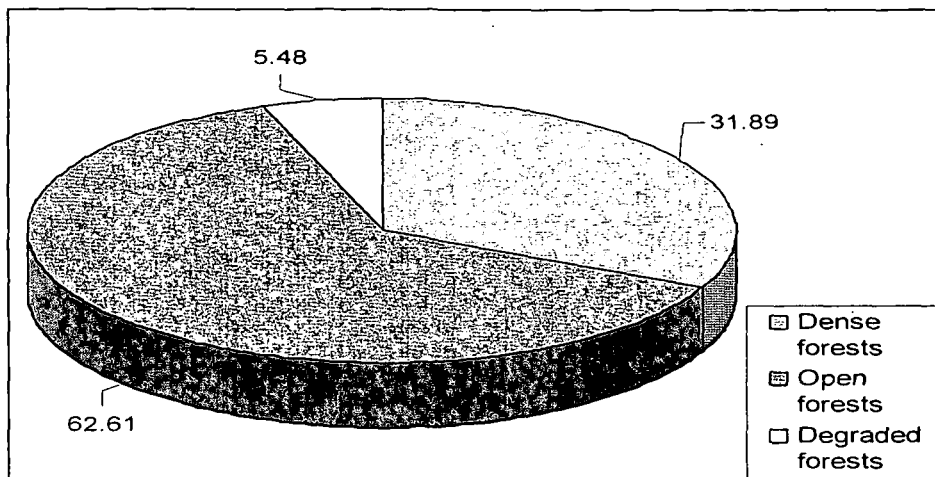
Source: *Forest Department, Aizawl 1980.*

**Percentage of Forest Canopy Density in Lunglei District - 1970**



**Figure 3.4**

**Percentage of Forest Canopy Density in Lunglei District - 1980**



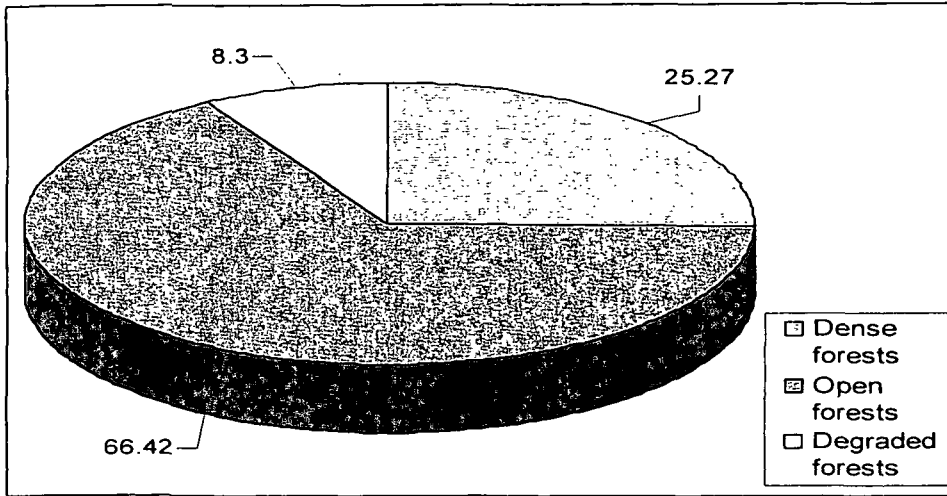
**Figure 3.5**

**Table 3.5 Forest Canopy Density in Lunglei District**

Category	Area (in Hectares)	Percentage to Total Forest Area
Dense forests – above 40%	1, 03,501.10	25.27
Open forests – 10-40%	2, 72,041.10	66.42
Degraded – below 10%	34, 000	8.30

Source: *State Forest Report 1990.*

**Percentage of Forest Canopy Density in Lunglei District - 1990**



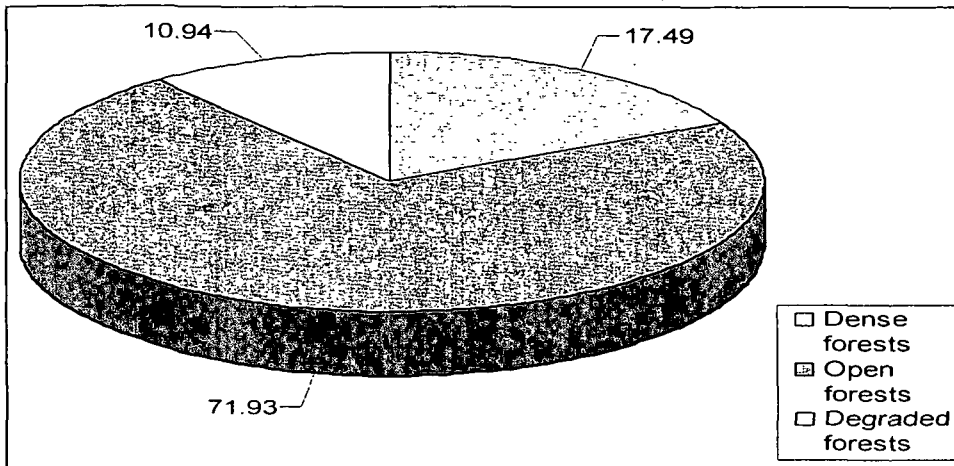
**Figure 3.6**

**Table 3.6 Forest Canopy Density in Lunglei District**

Category	Area (in Hectares)	Percentage to Total Forest Area
Dense forests – above 40%	71, 634.20	17.49
Open forests– 10-40%	2, 94,621.40	71.93
Degraded – below 10%	43, 286.60	10.94

Source: *State Forest Report 2000.*

**Percentage of Forest Canopy Density in Lunglei District - 2000**



**Figure 3.7**

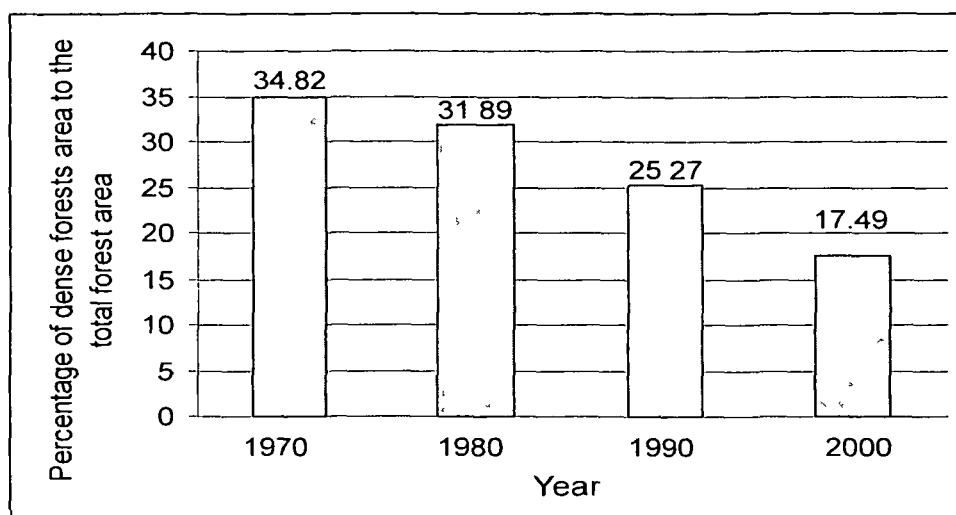
All these clearly indicated that change in any category may be a result of improvement somewhere and degradation elsewhere. A change matrix gives a quantitative estimate of net change category-wise and also the flux of change among the categories. Two major reasons of flux in the change matrix are (i) degradation of dense forests into open forests and degraded forests, (ii) improvement of open forests into degraded forests at some places. There is an urgent need of policy measures to undo the massive losses to the green cover of this region. A large part of the forest in this area fall under the category of open forests at present and the percentage of open forests is of 71.93 per cent (2000) of the total forest cover area. The open forests in the study area have shown in Plate 3.4. In 2000, only few areas qualify as to be dense forests area and their percentage is 17.49 per cent of the total forest cover area. Today the dense forests are found in a small pocket mainly in the river valley. The dense forests of the study area have shown in Plate 3.5 and 3.6. The increasing degraded forests area has also revealed that the forests of the study area are in a depleted condition. Within thirty years (1970-2000) the rate of changes of forest canopy density has gradually increased in all the categories. The gradual increase rate of changes is certainly a cause of worry for the environmentalists, because the rate of changes is expected to continue and rise due to the increase demand of various forests products. If the rate continues to rise, after sometimes the entire dense forests area may turn to either open or degraded forests. Thus, large areas of dense forests are prone to convert in to open forests or degraded forests. The reduction of the dense forests canopy may lead to torrential rainfall and destabilisation of water flow in the rivers of the study area, which will lead to siltation of the channels, reservoirs and irrigation system. Besides these, it may also result depletion of ground water aquifers and intensified flooding.

The site quality of such forests is subjected to *jhum* cultivation year after year causing further deterioration of the already degraded forests. The quality of the standing forests growth has also undergone a change, particularly in case of tree forests which have become thinner in density due to over exploitation and the proportion of tall and big

trees is gradually decreasing. The proportion of mal-formed, diseased and hollow trees is also increasing in the forests due to removal of the best available trees. Although the bamboo crop is in surplus, the tree crop is subjected to over exploitation posing difficulties in sustaining the supply of the required quantity of timber. Forest is the biggest user of land, but productivity of the forests is quite low in terms of timber and quite high in terms of biomass.

For better understanding of the changes of forest canopy density, the different categories of forest canopy density of 1970 to 2000 have been compared to clearly show the changes of canopy density of different categories within the studied period. The decline percentage of dense forests area from 1970 to 2000 clearly shows in Figure 3.8. In 1970 the dense forests covered was 1, 50,163.25 hectares or 34.82 per cent of the total forest area, while in 2000 the area has come down to almost half, it has left only 71, 634.20 hectares in 2000, in other words the dense forest has declined from 34.82 per cent to 17.49 per cent of the total forest area. Hence, during 1970 to 2000, the percentage loss of dense forests was 17.33 per cent, a large area indeed.

**Percentage of Dense Forests Area in Lunglei District from 1970 to 2000**

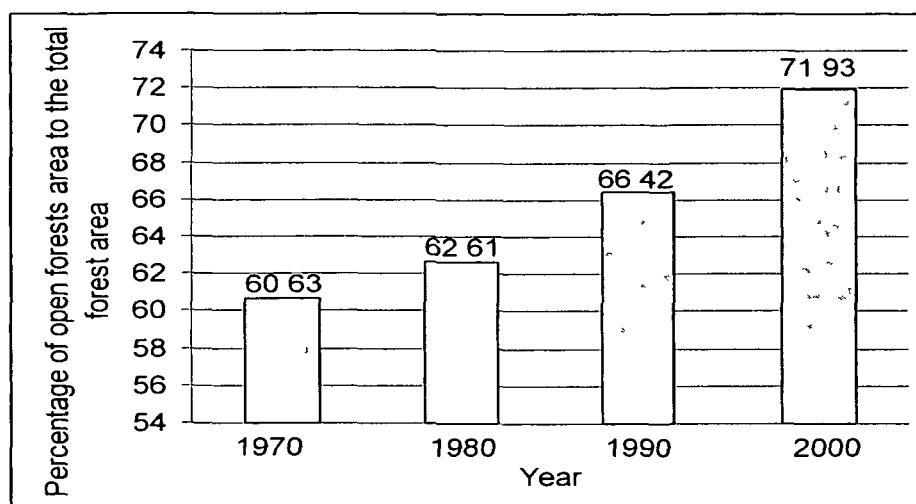


**Figure 3.8**

The open forests area covers 2,61,483 hectares or 60.63 per cent of the total forest cover area in 1970, whereas in 2000, the area has increased to 2, 94,621.40 hectares, i.e. 71.93 per cent of the total forest cover area. The percentage increase of open forests area from 1970 to 2000 has shown in Figure 3.9. Within thirty years, the open forests area has jumped up by 11.30 per cent, which indicated decline in dense forests cover area affected the increase of open forests area. Therefore, this data has clearly shown that in 2000 the open forests has covered more than two third of the total forest cover area in the study area.

From the above discussion it is clear that during the study period the dense forests area has decreased to almost half of the total area, contrarily, the open forests area has increased and the degraded forests area has been increasing as well, at the same period.

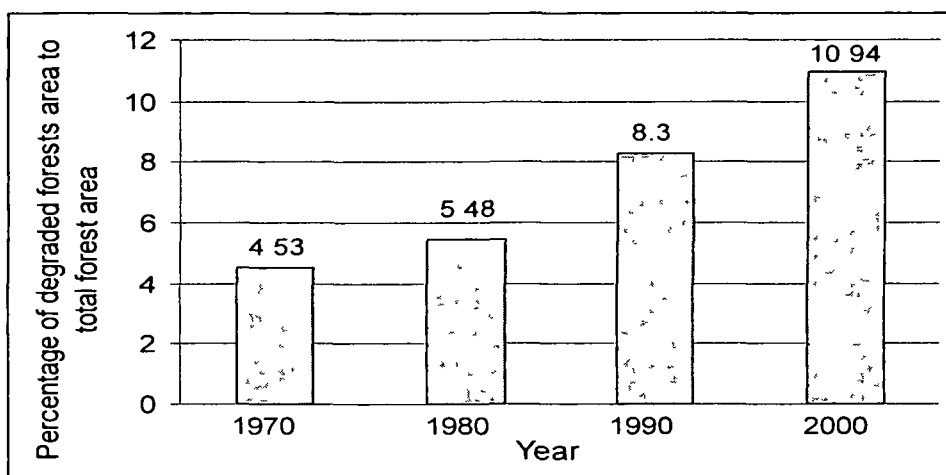
**Percentage of Open Forests Area in Lunglei District from 1970 to 2000**



**Figure 3.9**

During thirty years, the degraded forests area has increased from 19, 572.25 hectares i.e. 4.53 per cent to 43, 286.60 hectares, which is 10.94 per cent of the total forest cover area (Figure 3.10). Comparatively, during the study period the degraded forests area has increased more than doubled, which is 6.41 per cent. Degraded forests areas of the study area have shown in Plate 3.7 and 3.8.

### Percentage of Degraded Forests Area in Lunglei District from 1970 to 2000



**Figure 3.10**

The present density of various plants under different categories of forest canopy is shown in Table 3.8. In the degraded forests tall trees are absent, but there is predominance of bushes here. Number of medium trees also declines from dense to open and then to degraded forests. The case of small trees is interesting. Number of small trees is more in open forests than the dense forests and degraded forest as well. It means open forests are dominated by the growth of small trees. The presence of bushes naturally shows an increasing trend form dense forests to degraded forests. The tall trees definitely represent climax vegetation of an ecosystem, while the small trees and bushes are secondary growth, and thus secondary in value to the climax vegetation. All these clearly indicate degradation of forests in terms of their quality or value. The loss of dense forests is almost an irreversible loss as these forests represent the climax vegetation which is always valuable from the points of view of ecology, environment and economy as well.

**Table 3.7 Density of Plants in Different Types of Forest**

Types of Forest	Number of Plants Per Square Metre			
	Tall Trees	Medium Trees	Small Trees	Bushes
Dense Forests	1.00	2.60	0.90	0.20
Open Forests	0.70	0.90	1.80	1.50
Degraded Forests	0	0.20 – 0.30	0.60	2.80

Source: *Field Study 2005*.

### **(iii) Spatial Variation in the Degradation of Forests**

The rate of degradation differs from place to place during the study period. Therefore, spatial degradation of forests is necessary to study for understanding the rate of degradation of forests in different parts of the district. The Spatial variation of degradation has studied from the analyst of the Block wise forest cover area data. However, only two times period of Block wise forest cover area data is available, hence, comparison has been made between the two periods to ascertain the spatial variation in the degradation of forests in the study area. The forest cover area was quite encouraging in each Block in 1970 (Table 3.8, Figure 3.11). For example, Bunghmun Block had 1,10,804.62 hectares i.e., 97.23 per cent of its total geographical Block area, whereas Hnahthial Block had about 91,304.63 hectares i.e., 95.43 per cent of its total geographical Block area. The forest cover was 1, 29,804.64 hectares or 95.42 per cent and 99, 304.63 hectares or 91.99 per cent of its total geographical Block area in Lungsen and Lunglei Blocks, respectively.

Between 1970 and 2000, the forest cover areas have decreased in all the Blocks. Table 3.9 and Figure 3.12 has shown that the forest cover area of all the blocks in 2000. The data has shown that, in 2000 Bunghmun Block forest area has declined to 1,02,478.26 hectares or 89.94 per cent of its total geographical Block area, while Hnahthial Block has also came down to 84, 251.77 hectares or 88.06 per cent of its total geographical Block area, at the same time. Consequently, the forest cover area of Lungsen Block has also decreased to 1, 18,765.26 hectares that is 87.30 per cent of its total geographical Block area. Lastly, Lunglei Block forest cover area has reduced to 90, 125.77 hectares. In other words in 2000 Lunglei Block forest cover area has come down to 83.49 per cent of its total geographical Block area.

**Table 3.8 Block Wise Forest Cover Area in Lunglei District**

Category	Area (in Hectares)	Percentage to Total Geographical Block Area
Bunghmun	1, 10,804.62	97.23
Hnahthial	91, 304.63	95.43
Lungsen	1, 29,804.62	95.42
Lunglei	99, 304.63	91.99

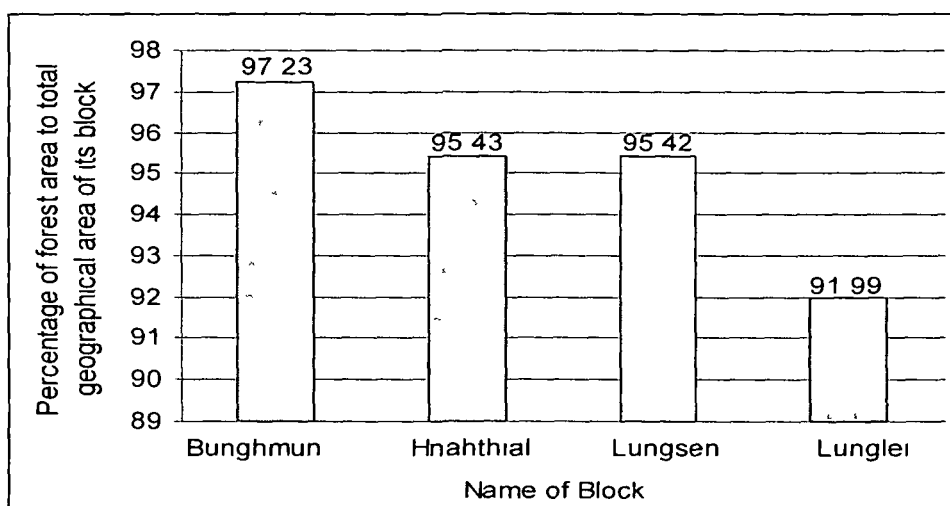
Source: *Forest Department, Aizawl 1970*

**Table 3.9 Block Wise Forest Cover Area in Lunglei District**

Category	Area (in Hectares)	Percentage to Total Geographical Block Area
Bunghmun	1, 02, 478.26	89.94
Hnahthial	84, 251.77	88.06
Lungsen	1, 18, 765.26	87.30
Lunglei	90, 125.77	83.49

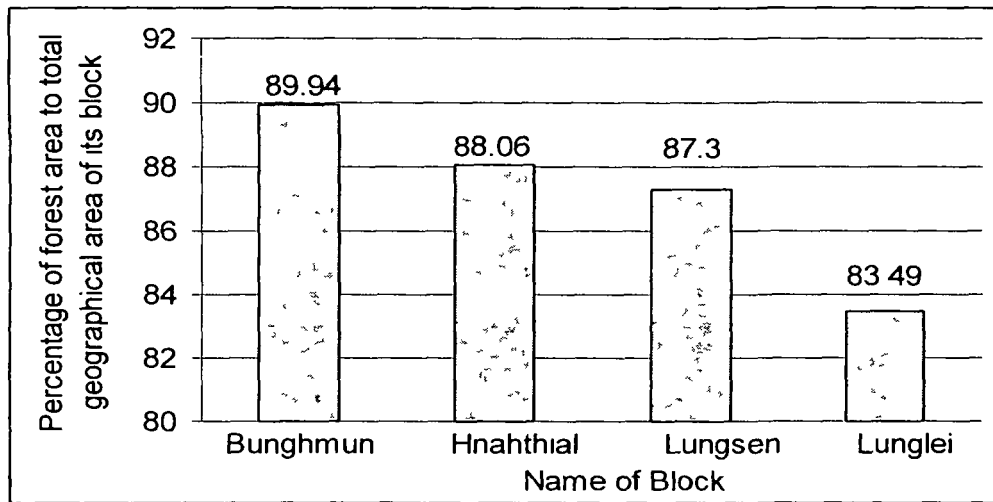
Source: *Mizoram Remote Sensing Application Centre, Aizawl 2000*

**Block Wise Percentage of Forest Cover Area -1970**



**Figure 3.11**

### Block Wise Percentage of Forest Cover Area - 2000



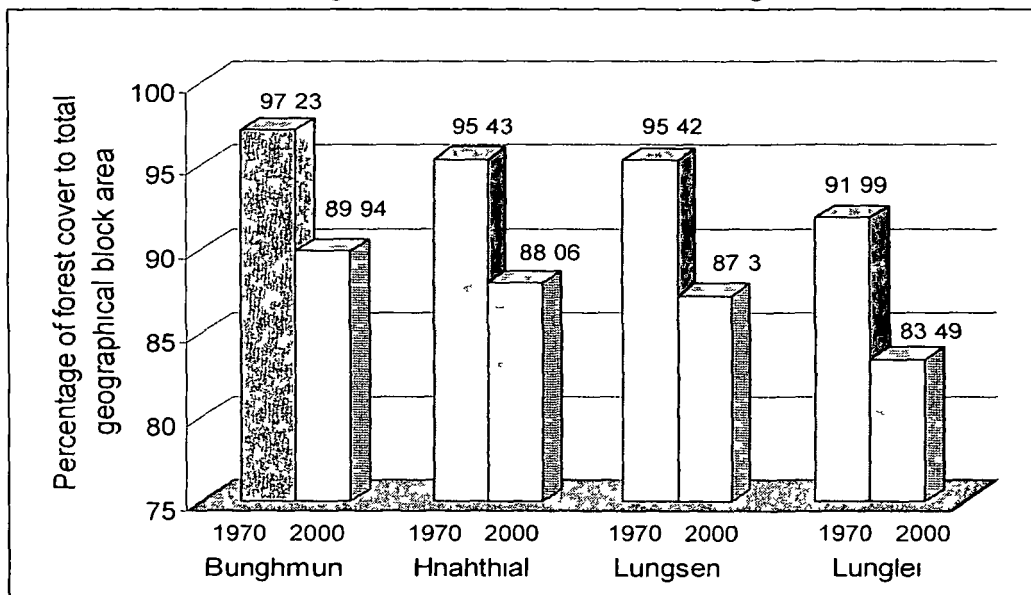
**Figure 3.12**

The forest covers area are quite large in each block in 1970, Bunghmun Block has the highest percentage of forest cover area, which is 97.23 per cent of its total geographical Block area, comparatively high in the district as a whole. Whereas, Lunglei Block has the lowest percentage of forest cover area only 91.99 per cent of its total geographical Block area, comparatively low in the district as a whole. During 1970 to 2000, degradation has taken place in all the Blocks, but the rate of degradation is not the same in all the Blocks. The details Block wise forest cover change is presented in Table 3.10 and Figure 3.13. Within the study period, the loss of forest cover area in Bunghmun Block was 8,326.36 hectares that is 7.29 per cent of its total geographical Block area, while in Hnahtial Block the loss of forest cover area was 7,052.82 hectares or 7.37 per cent of its total geographical Block area at the same periods. Within thirty years Lungsen and Lunglei Block have lost 11,039.36 hectares or 8.12 per cent and 9,178.86 hectares or 8.50 per cent of its total geographical Block area, respectively. The Block Wise percentage loss of forest cover within 1970 and 2000 has clearly shown in Figure 3.14. Hence, during the study period, Lunglei Block has lost the maximum forest cover area, whereas Bunghmun Block is the less affected area as far as degradation of forests is concerned.

**Table 3.10 Decadal Decline of Block Wise Forest Area from 1970 to 2000**

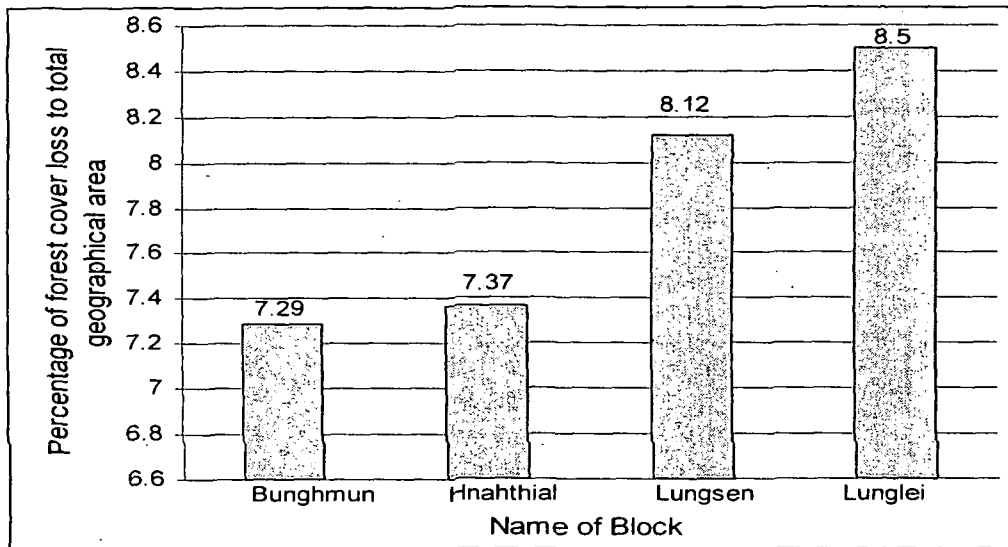
Category	Area (in Hectares)	Percentage to Total Geographical Block Area
Bunghmun	8, 326 36	7.29
Hnahthial	7, 052 82	7.37
Lungsen	11, 039 36	8.12
Lunglei	9, 178.86	8.50

**Block Wise Percentage Decline of Forest Area during 1970 to 2000**



**Figure 3.13**

### Block Wise Percentage Loss of Forest Area from 1970 to 2000



**Figure 3.14**

From the above mentioned it is cleared that population pressure has play a major role to the degradation of forests in all the Blocks, increasing population alone can not created the degradation, however increasing population has been lead to increasing demand of *jhumland* and forests products. As per the 2001 Census Lunglei Block has the highest population followed by Lungsen Block and Hnahthial Block. Lastly, Bunghmun Block has the least population. Therefore, highest rate of degradation has taken place in the highest concentration of population. On the other hand, lowest rate of degradation has taken place in the least population concentration area of Bunghmun Block. Hence, the percentage loss of forest cover area has been high in Lunglei (8.50 per cent) and Lungsen Block (8.12) in compared with the district as a whole, within the study period.

**Plate 3.1 Old-Abandoned *Jhumland***



**Plate 3.2 Bamboo Forests**



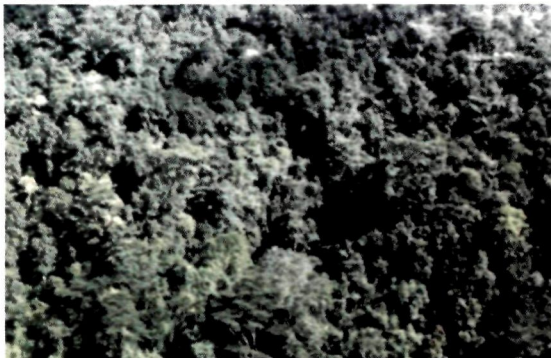
**Plate 3.3 Young Abandoned *Jhumland***



**Plate 3.4 Open Forests**



**Plate 3.5 Dense Forests**



**Plate 3.6 Thick Forests in River Valley**



**Plate 3.7 Degraded Forests Area**



**Plate 3.8 Forests Degraded by *Jhumming*  
Can clearly be seen**



#### **(iv) Loss of Biodiversity**

All over the world, due to a heavy pressure on fast shrinking forests to meet the growing demands of the population, the habitat of many wild plants and animals has been destroyed. This has rendered many plants and animals extinct, many others are on the verge of extinction and many have been declared endangered. Natural processes are also responsible for the extinction of certain species but this bio-natural process is so slow that it is imperceptible to the relatively young human civilisation. During the human presence on the surface of the earth the process of extinction of most plants and animals is linked to the activities of human beings (Negi 1991).

The species that become too narrowly restricted to a particular area due to biotic pressure or the process of selection are the ones that will invariably become extinct sometime in the near future. An unbalanced sex ratio in a particular species is a danger signal of its decline and subsequent extinction. At present, a number of animal species are slowly moving towards extinction. In many cases, the pressure generated by human activities is serving to hasten this process.

The diversity of wild species of plants and animals in Lunglei district has a very large taxonomic range, in proportion to the enormous diversities of ecosystems and geographical conditions, which these species inhabit. This diversity at the species, sub-species and variety levels is a result of evolutionary processes. However, in the last few decades, this diversity has faced increasing erosion. Habitat loss, over hunting and over exploitation, introduction of exotic species in river ecosystems, poisoning and other factors including progressive disempowerment of local communities and destabilisation of Mizo traditional environmental management systems, have caused this loss. Some elements of the loss, which have remained undetected or severely under-studied, include decline of the sub-species and varieties of species. This silent erosion is not necessarily due to any anthropogenic factor, but often due to complex and less understood environmental factors.

Lunglei district is endowed with unique flora and fauna, rich in bio-diversity comprising of rare and threatened animal and plant life. Both plants and animals are under a severe strain which has brought many of them to the verge of extinction. It has exerted an unprecedented pressure on the habitat of plants and animals. Forests have been cleared to pave the way for agriculture, human settlements and multipurpose projects. Many rare species have already been lost forever due to this pressure on land and forests. Many species of trees, shrubs and herbs have become extinct due to the increase pressure of man on forests. In the study area, there are a number of rare and threatened animals and plants species, which if not adequately protected may become extinct in the near future. This alarming trend has attracted the attention of conservationists, voluntary agencies and the government.

#### **(a) Flora**

Many plant explorers have studied flora in north-east India. But study area has not yet been explored except for some sporadic visits by botanists. Hence, even now, much is not known about flora of the study area. Only some descriptions of endangered flora are provided here. The detail list of endangered and threatened species of the study area is presented in Table 3.11. The endangered floras are *Arundina graminifolia*, *Dendrobium densiflorum*, *Berginia ciliata*, *Zanonia indica*, *Auilaria malaccensis*, and *Gynorcardia odorata*.

Due to overexploitation orchids have depleted considerably in Lunglei district. Some of the rare species of orchids include *Calenthe sp.*, *Goodyera procera*, *Habenaria sp.*, *Phaius sp*, *Anoectochilus*, *Bulbophyllum*, *cymbidium*, *Dendrobium*, *Eria*, *Pholidota*, *Liparis*, *Saccolabium* and *Vanda*. Many species of orchids are now under threat due to fast expanding economic activities in the region. Unless some urgent steps are taken to document, conserve and multiply the threatened species, many of them would become extinct before their potential is realised.

## (b) Fauna

Lunglei district though very rich in fauna has not yet been thoroughly surveyed for its faunal resources. The vertebrates which have either been sighted or collected show that the amphibians are represented by 2 species, fishes by 16, and reptiles by a single, birds by 266 and mammals by 43. The detail endangered and threatened species of fauna in the study area has shown in Table 3.11. The region has wide ranges of *Insects*, *Molluscs* and *Crustaceans*. There are a few thousand species of insects alone. But only about 12 species of *Butterflies* and *Moths*, 20 of *Beetles* and 13 of *Molluscs* (*Gastropod* – 9 and *Bivalvia* – 4) have been collected and recorded till now. A few species of *Molluscs* such as *Brotia costula* and *Paludomus conica* (*Gastropod*) and *Solenaia soleniformis* (*Bivalvia*), etc., constitute the different types of *Snails* which are edible. These are commonly sold in the markets in the district.

The birds, which have been studied somewhat in detail, are represented by 7 species of *Owls*, 10 of *Pheasants* and *Partridges*, 12 of *Hawks* and *Eagles*, 9 of *Egrets* and *Hérons*, 7 of *Cuckoos* and 11 of *Bulbuls*, etc., belonging to 43 families. The threatened species occurring in the *Important Birds Areas* (IBAs) are also found in the study area. As identified by the *Bombay Natural History Society and Network of Ornithologists and Ornithological Organisations* the *White-backed vulture* species has been upgraded to critical level because it has suffered an extremely rapid population decline, probably as a result of disease compounded by poisoning, pesticide use and changes in the processing of dead livestock. The *Lesser adjutant* stork qualifies as vulnerable because it has small, declining population as a result of habitat loss and degradation, hunting and disturbances. *Mrs. Hume's pheasant* bird is threatened because of hunting, habitat loss and degradation. Other important threatened species found are *Dark-rumped swift*, *Oriental darter*, *White-cheeked hill partridge*, *Great pied hornbill*, *Brown hornbill* and *Blyth's tragopan*.

The family of *Muscicapidae* (Babblers, Thrush, Fly Catchers, etc.) is predominantly represented by 94 species. Of these the endangered and threatened species are the *Blyth's tragopan*, *Humes bartailed pheasant*, *Peacock pheasant*, *Great pied hornbill*, *Indian pied hornbill*, *Rufous necked hornbill*, *Kalij pheasant*, *Lesser whistling teal*, *Crested serpent eagle*, *Sparrow hawk*, *Imperial pigeon*, *Red breasted parakeet*, *Indian lorikeet*, *Large hawk cuckoo*, *Crow pheasant*, *Forest eagle owl* and *White breasted kingfisher*.

The mammals which have been found and well studied include *Insectivore*, *Primates*, *Carnivore*, *Pholidota*, *Rodentia*, *Artiodactyls* and *Lagomorphs*. Important species recorded are *Small toothed civet*, *Wild bear*, *Tiger*, *Leopard*, *Slow Loris*, *Hoolock gibbon*, *Assamese macaque*, *Capped langur*, *Chinese pangolin*, *Bay bamboo rat*, *Brush tailed porcupine*, *Himalayan crestlers porcupine*, *Grasp-eating mongoose* and *Barking deer*. The common species of mammals found are *Malaya tree shrew*, *Hoolock or White browed gibbon*, *Assamese macaque*, *Shrew*, *Indian short tailed mole*, *Short tailed shrew*, *Short nosed fruit bat*, *Indian pipistrelle*, *Hoary bellied*, *Himalayan squirrel*, *Striped Himalayan squirrel*, *Giant flying squirrel*, *Bay bamboo rat*, *Indian pied mouse*, *Common house rat*, *Himalayan crestless porcupine*, *Palm civet*, *Clawless otter*, *Barking deer* and *Indian wild boar*.

The scarce species are *Slow Loris*, *Capped langur* (very rare), *Leopard*, *Tiger*, *Leopard cat*, *Chinese pangolin*, *Flying fox*, *Serotive bat*, *Common yellow bat*, *Malayan giant squirrel*, *Large Indian civet*, *Small Indian civet* and *Small Indian mongoose*. The district forest report has mentioned that there was not much wildlife left in the district excepting a few herds of *Elephants*, a few *Tigers*, *Leopards* and *Bears*, *Mithun* and *Bison*. *Wild dogs* were fairly common in the past. Both *Himalayan black bear* and *Malayan bear* are still somewhat common. *Game birds* have become scarce.

Forests ecosystems of the study area are under severe pressures, both from biotic and abiotic factors. The original forest cover area is lost mainly due to the practice of shifting cultivation and use of forests for various non-forest uses. Moreover, forest degradation is caused by illicit felling, lopping for fuel wood forest and fodder, removal of forest cover for litter, forest fires etc. Given the rich biodiversity of this region, its conservation has become a major challenge.

**Table 3.11 Rare and Threatened Species in Lunglei District**

FLORA	ANIMAL	BIRD
<i>Arundina graminifolia</i>	Slow Loris	White-backed Vulture
<i>Dendrobium densiflorum</i>	Capped langur	Lesser Adjutant
<i>Berginia ciliata</i>	Leopard	Mrs. Hume's Pheasant
<i>Zanonia indica</i>	Tiger	Dark-rumped Swift
<i>Auilaria malaccensis</i>	Leopard cat	Oriental Darter
<i>Gynocardia odorota</i>	Chinese pangolin	White-cheeked Hill Partridge
	Flying fox	Great Pied Hornbill
	Serotive bat	Brown Hornbill
	Common yellow bat	Blyth's tragopan
	Malayan giant squirrel	Humes bartailed pheasant
		Peacock pheasant
		Great pied hornbill
		Indian pied hornbill
		Rufous necked hornbill
		Kalij pheasant
		Lesser whistling teal
		Crested serpent eagle
		Sparrow hawk
		Imperial pigeon
		Red breasted parakeet
		Indian lorikeet
		Large hawk cuckoo
		Crow pheasant
		Forest eagle owl
		White – Breasted - kingfisher

Source: *Mizoram and Its Wildlife*, Centre for Environment Protection, Aizawl 2000.

**CHAPTER – IV**  
**CAUSES OF DEGRADATION**  
**OF**  
**FORESTS**

Why are we losing forests? Most national forest policies state that forests should be conserved, and yet we see increasing levels of degradation. The causes of degradation of forests are not well understood. Discussion often mixes the direct causes (e.g., slash-and-burn agriculture) with the underlying fundamental or root causes of loss. Sharma (1993), Deacon (1994), Jepma (1995), Pearce and Moran (1994) introduce the issues in economic terms). Direct causes include agricultural expansion, overgrazing, poor logging practice, etc. Underlying causes include market and policy failures, population growth, rural poverty which lead to land conversion, etc.

#### **4.1 CAUSES OF DEGRADATION**

Humans have used the forests in socially acceptable ways for various purposes for millennia. They have cut down timber to construct the infrastructure of civilisations and they have taken wood from forests for fuel. In many parts of the tropics, farmers have been practising shifting cultivation for generations. With the usual long fallow periods, shifting cultivation treats the land in a sustainable way. That is, it recycles nutrients, conserves the forests, the soil and water, and encourages diversification of crops. But the traditional system is being rapidly replaced by shortened fallow periods in which the forests does not regenerate, the land has little or no chance to recover, fertility declines, weeds take over and the soil erodes. The forces behind this change are familiar logging, population growth, the arrival of migrants who do not follow sustainable land-use practices and the need to produce crop after crop in order to remain financially secure (Tarasofsky 1995). Forest fires, fuelled by dry debris from logging under slash-and-burn practice may also be damaging forests, as is extracting too many non-timber forest products and over-hunting. Over-harvesting a single species, may, for instance, reduce the population of a key pollinator or seed-dispersal species. Taking too much firewood and seasonal livestock overgrazing can badly affect dry forests.

According to the FAO, 90 per cent of forests degradation is caused by unsustainable agricultural practices, while logging and plantation forestry play a greater role in forests degradation. Unsustainable agriculture is undoubtedly one of the major direct causes of forests degradation in many countries of the world. A simplistic approach to the problem would imply blaming the "ignorance" of the farmers involved in this process.

Forests worldwide are being threatened by uncontrolled degradation and conversion to other forms of land uses, influenced by increasing human needs, agricultural expansion, and environmentally harmful mismanagement, including lack of forest fire control, anti-poaching measures, unsustainable commercial logging, overgrazing, airborne pollutants, economic incentives, and activities of other sectors of the economy. The impacts of loss and degradation of forests are in the form of soil erosion, loss of biological diversity, damage to wild habitats and degradation of watershed areas, deterioration of the quality of life, and reduction of the options for development.

Degradation of forests is closely linked with human activities and hence can be checked to a large extent provided these linkages are clearly understood. In order to understand the reasons for degradation of forests an attempt has made here to examine the various causes of degradation of forests in the study area. Forest and forest ecosystems of study area are under severe pressures, both from biotic and abiotic factors, due to population explosion, encroachments on forest lands, loss of forest cover for other non-forest uses, shifting cultivation practice and degradation caused by illicit felling, lopping for fuel wood and fodder, removal of forest cover for litter, forest fires etc. its conservation has become a major challenge. The main causes of degradation of forests in Lunglei district are depicted in Figure 4.1. In order to understand the reasons for degradation of forests an attempt has made here to examine the various causes of degradation of forests in the study area.

*Too general*

## Main Causes of Degradation of Forests in Lunglei District

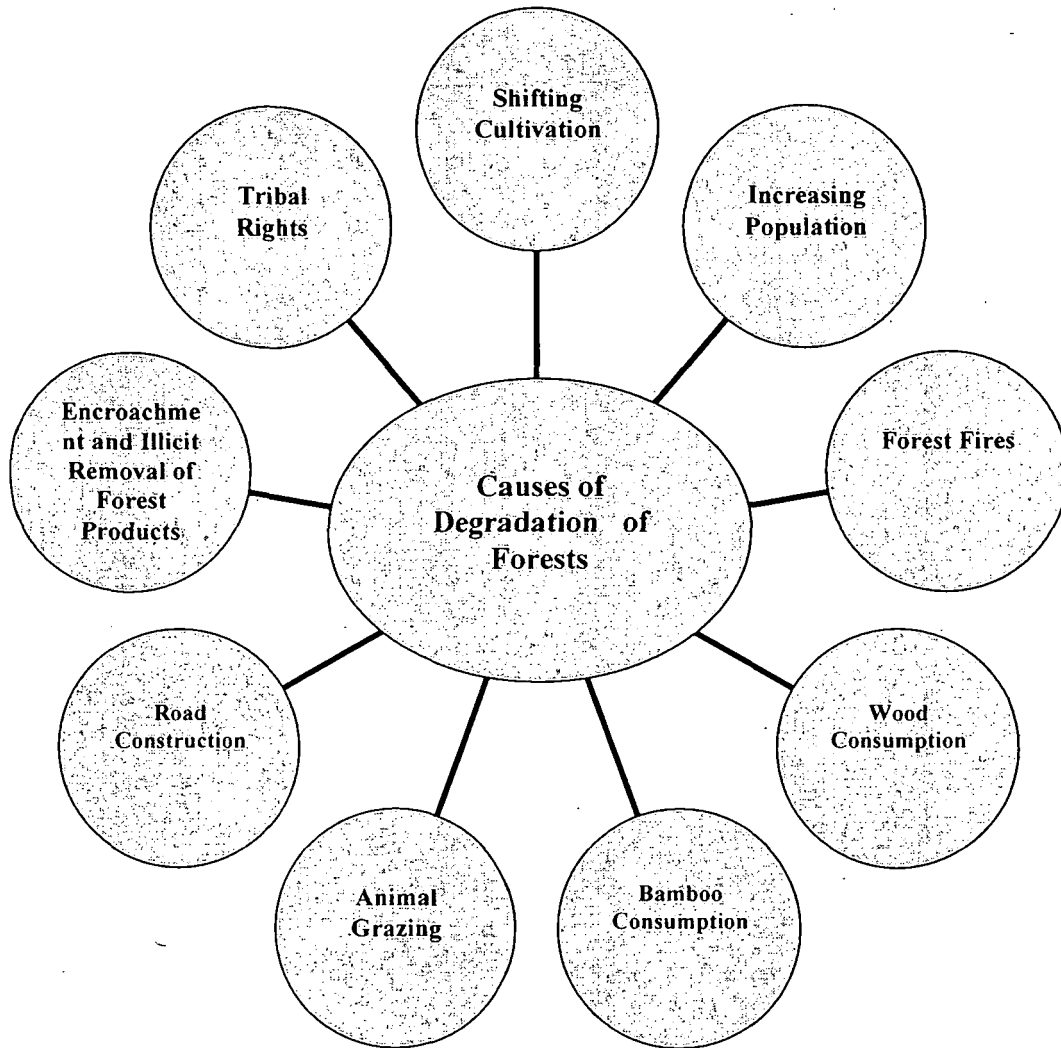


Figure 4.1

### (i) Shifting Cultivation

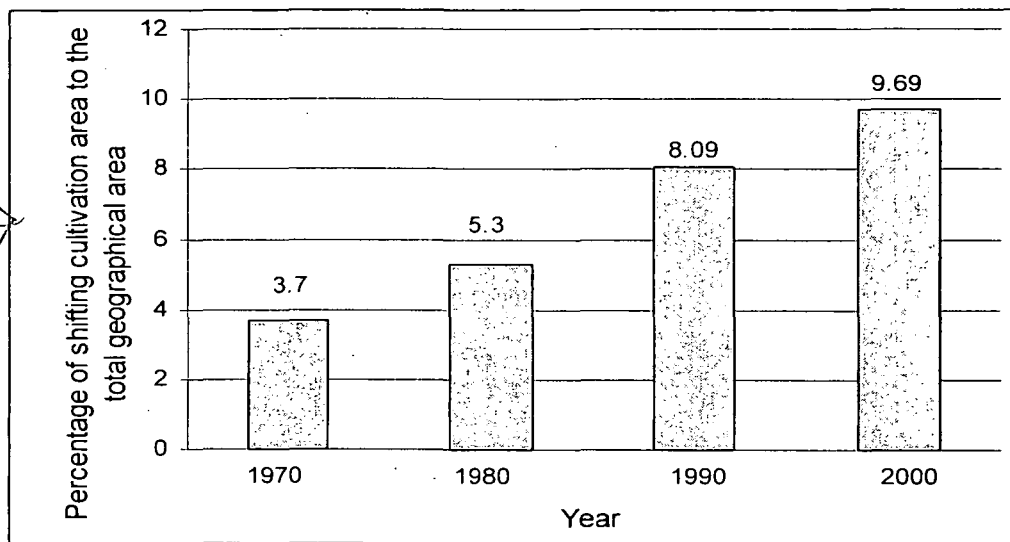
Shifting cultivation is still widely practiced in Lunglei district which is one of the most important causes for degradation of forests affecting the ecology of the area and leading to decreases in natural regeneration of tree species to a considerable extent. *Jhumming* involves the clear felling of the forest trees and allowing them to dry and before the onset of monsoon the entire area is burnt for cultivation. After cultivating the land and then when the yield decreases the area is abandoned and the people select some other forested area and repeat the process. Earlier the cycle of *jhumming* used to be around 20 – 30 years, but with the increase in population the cycle has come down to 3 to 4 years with the result the forest are being cleared off at a very fast rate and in the course of time giving rise to bamboo forests. *Jhumming* can not be prevented by law also, since much of the forest areas are owned by individual communities. Forest areas burnt and cleared for *jhum* in the study area has clearly shown in Plate 4.1 to 4.4. In a shifting cultivation landscape, the bamboo invades and later is replaced by the secondary forests. However, due to the human pressure and ill management practices not only the primary forests but also the secondary forests are being cleared. There is an extremely frequent change of mosaics into non-forest natural vegetation and vice-versa since existing forest areas are decreasing. Under the threat the forest has become of immediate concern. Annually a thousand of hectares of forest areas are brought under *jhum* cultivation. In 1970 about 3.70 per cent of the total geographical area was under *jhumming*, while in 1980 it increases to 5.30 per cent of the total geographical area. In 1990 and 2000 about 8.09 per cent and 9.69 per cent of the total geographical areas were under *jhum* cultivation, respectively (Table 4.1, Figure 4.2). During the study period (i.e. from 1970 to 2000) the shifting cultivation has increased by 5.99 per cent to the total geographical area (Table 4.2). The shifting cultivation area has been changing over the decades in the study area (Figure 4.3). At present the percentage of shifting cultivation area is sharply declined, may be this is due to the introduction of other permanent occupation by the state government as an alternate the traditional shifting cultivation. The age-old practice of shifting cultivation has been a single factor responsible for the forests degradation.

**Table 4.1 Area under Shifting Cultivation in Lunglei District**

Year	Area (in Hectares)	Percentage to Total Geographical Area
1970	16, 746.06	3.70
1980	23, 982.76	5.30
1990	36, 709.76	8.09
2000	44,000	9.69

Source: District Agriculture Officer, Lunglei 1970 - 2000 -

**Percentage of Shifting Cultivation Area in Lunglei District from 1970 to 2000**



**Figure 4.2**

**Table 4.2 Decadal Change of Shifting Cultivation Area from 1970 to 2000**

Year	Area (in Hectares)	Percentage to Total Geographical Area
1970 - 1980	7, 236.70	1.60
1980 - 1990	12, 772	2.80
1990 - 2000	7,290.24	1.60
<b>1970 - 2000</b>	<b>27298.94</b>	<b>5.99</b>

### Decadal Percentage Change of Shifting Cultivation Area from 1970 to 2000

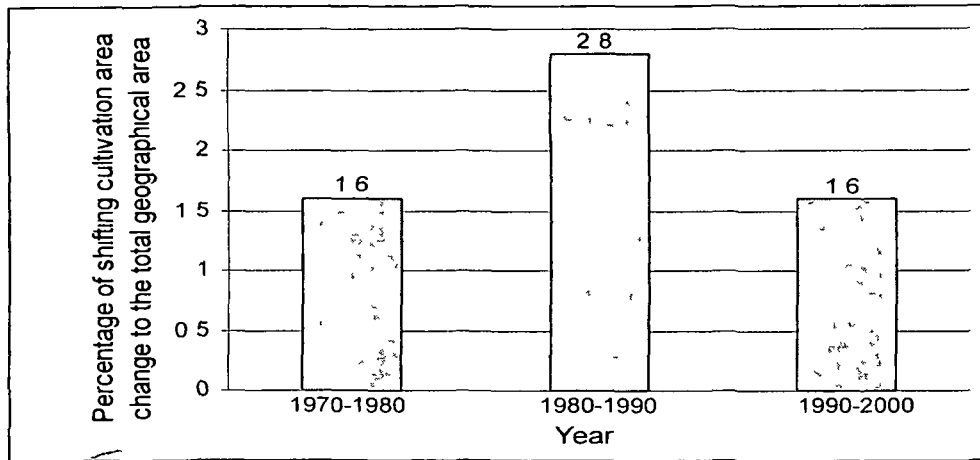


Figure 4.3

#### (ii) Increasing Population

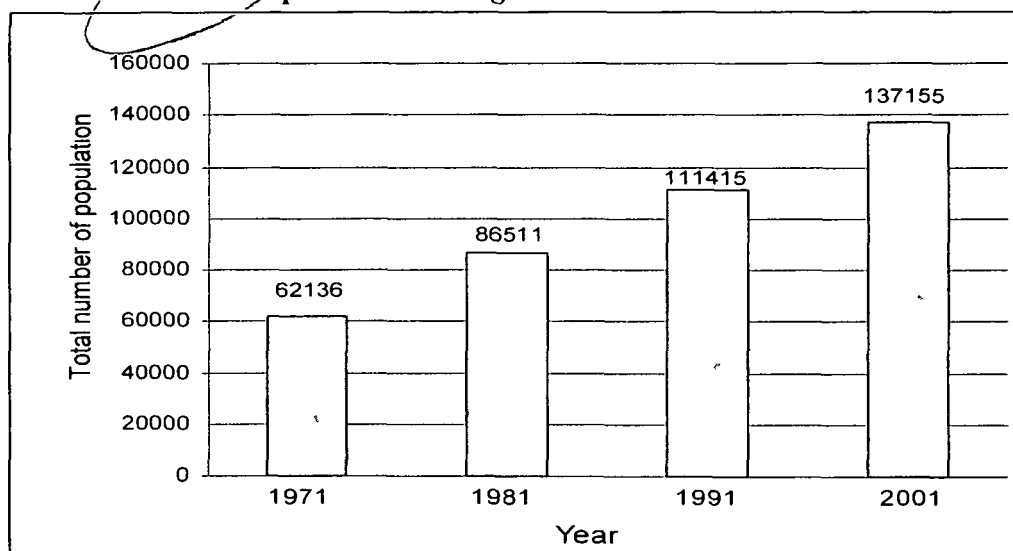
Barnes (1990) suggests that rates of forest loss are linked to factors of human population growth and the area of remaining forest, and that the rate of increase is expected to continue to rise. The degradation of forests through this process of population pressure, shorter fallow periods etc. is only part of the declining forest story. Another side of the coin is that of declining *jhum* cycle. As *jhumia* population grows land availability for *jhumming* decreases with the result that *jumias* return to the original site between 3 to 4 years later, *jhumming* being an ecologically destructive process, in the past when 20 to 30 year cycles were followed allowed soil replenish itself, but under such short cycles, soil and secondary forests are irrevocably damaged. It has also led to the increased demand of settlements. The population of the study area has increased rapidly during the last three decades (Table 4.3, Figure 4.4). It was 62, 136 persons in 1971, 86, 511 persons in 1981, 1, 11, 415 persons in 1991, and 1, 37, 155 persons in 2001. In the last Census, i.e., 2001, the population of Lunglei district constituted 15.39 per cent of the total population of Mizoram. Within thirty years the total number of population increase is 75, 019 persons (Table 4.4, Figure 4.5). Due to population pressure on land, more and more forestland was brought under cultivation and settlements. Plate 4.5 and 4.6 shows degradation of forests due to the expansion of settlement in the study area.

**Table 4.3 Number of Population in Lunglei District**

Year	Number of Population
1971	62, 136
1981	86, 511
1991	1, 11,415
2001	1, 37,155

Source *Census of India 1971 - 2001*

**Number of Population in Lunglei District from 1971-2001**



**Figure 4.4**

**Table 4.4 Decadal Growth of Population from 1971 to 2001**

Year	Number of Population
1971 - 1981	24, 375
1981 - 1991	24, 904
1991 - 2001	25, 740
<b>1971 - 2001</b>	<b>75, 019</b>

*persons or just Population*

### Decadal Growth of Population from 1971 to 2001

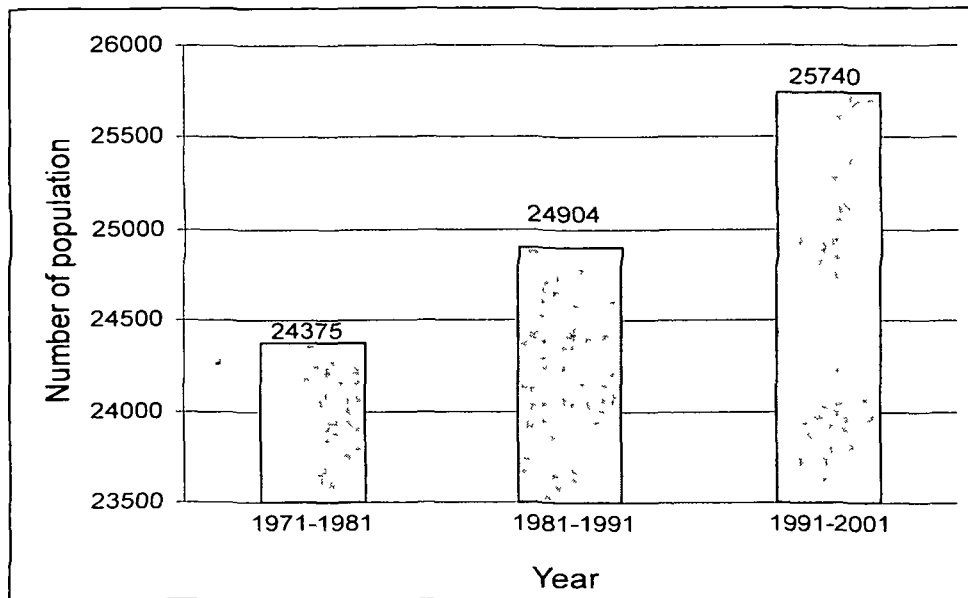


Figure 4.5

Shifting cultivation or *jhum* is the principal method of cultivation in the study area. Agriculture still occupies a very important place in the economy of study area. The entire economy of this area is dominated by agriculture and it is the main occupation. Majority of the working population is engaged in agriculture and related activities. In the study area, agriculture is not merely an occupation but also an established traditional and accepted way of life of the people. In fact, the numbers of cultivators have been increasing over the decades (Table 4.5). In 1971 the number of cultivators was 21,753 persons, while in 1981 the number of cultivators increases to 28,229 persons. Within ten years the number of cultivators has increased by 6,476 persons. In 1991 the number of cultivators has jumped up again to 35,192 persons. Between 1981 and 1991 the number of cultivators has increased by 6,963 persons. Lastly, in 2001 the numbers has increased to 46,203 persons. During the last decade i.e. from 1991 to 2001 the number of cultivators has shot up by 11,011 persons.

**Table 4.5 Number of Cultivators in Lunglei District**

Year	Total Population	Total Main Workers	Numbers of cultivators
1971	62, 136	26, 312	21, 753
1981	86, 511	36, 035	28, 229 (+ 6,479)
1991	1,11,415	52, 302	35, 192 (+ 6,963)
2001	1,37,155	71, 770	46, 203 (+ 11,011)

Source: *District Research Officer, Lunglei 1971 - 2001*

Figures in the bracket indicate increases number of cultivators

There is a positive co-relation between population density and forest cover. Increased in population is directly correlated with per capita decrease in forest area. The per capita forest area is defined as the forest area per person Increase in population has shown significant decline in per capita availability of forest in the study area. Table 4.6 and Figure 4.6 show per capita availability of forest in relation to population pressures. Today the national per capita forest area is only 0.09 hectares. Among the states of India Arunachal Pradesh has the highest per capita forest area which is 6.00 hectares. The per capita forest area of the study area in 1970 was 6.93 hectares, whereas in 1980 it has declined to 4.83 hectares. Due to the increase of population the per capita forest area has gradually declined over the years. In 1990 the per capita forest area has come down to 3.67 hectares, finally in 2000 the per capita forest area has declined again to 2.88 hectares Though increase in population is the main cause of declining trend of per capita forest area, deforestation and decline in forest cover area is also responsible for it.

**Table 4.6 per Capita of Forest Area in Lunglei District**

Year	Per Capita Forest Area (in Hectares)
1970	6.93
1980	4.83
1990	3.67
2000	2.88

\* Per-Capita based on recorded population and forest area.

### Per Capita Forest Area in Lunglei District from 1970 to 2000

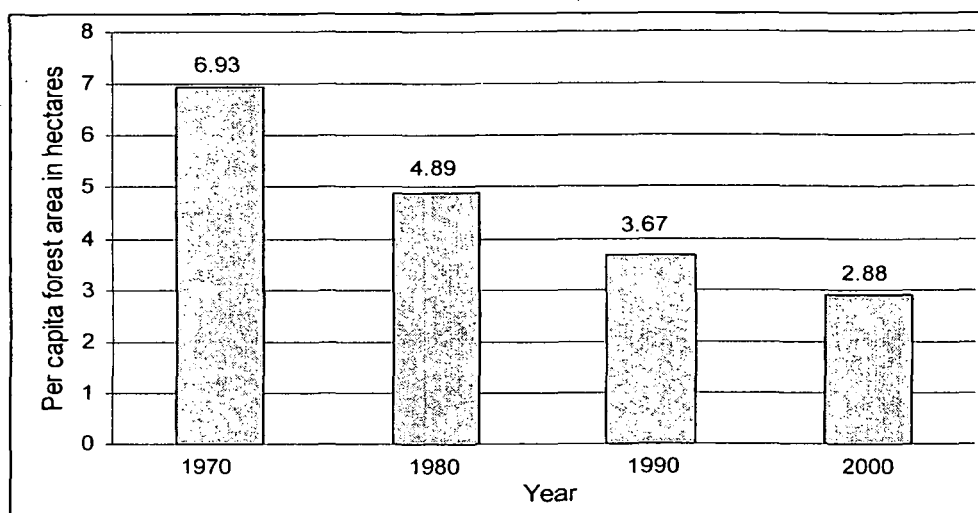


Figure 4.6

#### (iii) Forest Fires

India's northeastern region, commonly known as the "land of seven sisters", is a land of diverse ethnic groups, tribes and cultures. Shifting cultivation, locally known as "jhumming", has been and continues to be a way of life for many of these tribes since time immemorial. Consequently, the tribes appreciate the role of fire and its uses in their traditional shifting cultivation system. However, since the period for slash and burn generally coincides with the dry and windy months of the year, incidences of fires spreading beyond the boundaries of designated plots into the adjoining forests are not common. In extreme cases, such fires may even destroy entire villages or hamlets. Years of experiences by different communities have led to the evolution of community-based fire management practices that are rather specific to each tribe in northeast India.

Natural causes of forest fires (e.g. lightning strikes) are rare. Forest fires are usually related to human activities, such as: (i) *jhum* where highly inflammable bamboo flakes and kindling charcoal are blown to adjoining areas, setting dry grasses and leaf litter on fire, (ii) Not clearing firebreaks around the *jhum* land before starting the burning,

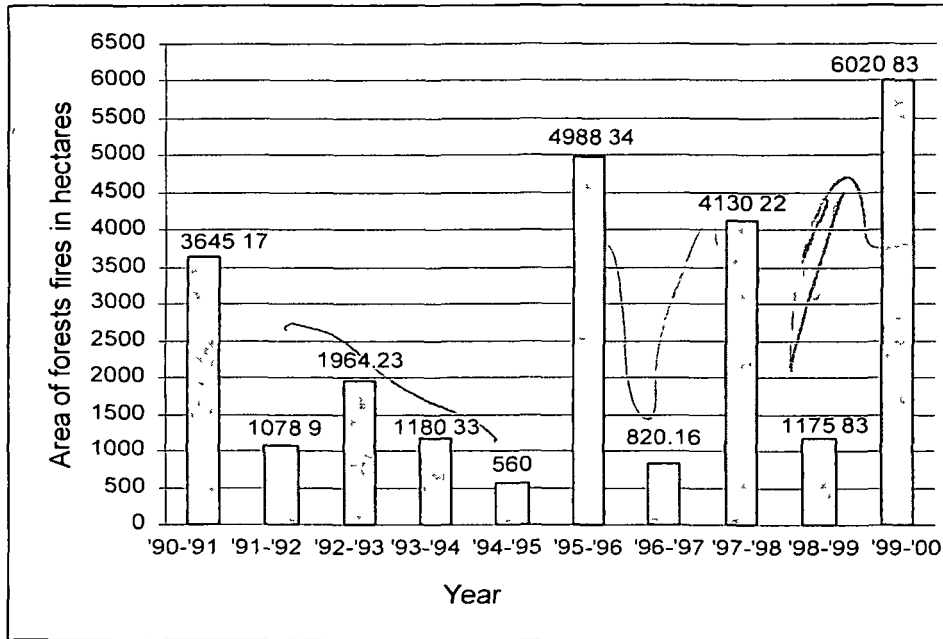
(iii) Annual roadside clearing and burning (usually in February and March, the driest period of the year), (iv) Burning of dry grasslands and forest floors by cattle grazers during the dry season to destroy unwanted vegetation and facilitate growth of new shoots for grazing, (v) Burning of forest floors to improve visibility for hunting wild animals, (vi) Careless prescribed burning and fire line layout and construction, (vii) Charcoal-making in the forests and (viii) Cooking and camping by woodcutters and other forest users. Unfortunately, data are available from 1990 to 2000 only (Table 4.7, Figure 4.7). Owing to this a information can not be highlighted from 1970. From the Table it is evident that forest fires occur every year, however the area affected forest fires from one year to another. During 1999 to 2000 the maximum area of 6,020.83 hectares was engulfed in forest fires, while the smaller area of merely 560 hectares was affected by forest fires in 1994 – 1995.

**Table 4.7 Area Affected by Forest Fires in Lunglei District**

Year	Area (in Hectares)
1990 – 1991	3, 645.17
1991 – 1992	1, 078.90
1992 – 1993	1, 964.23
1993 – 1994	1, 180.33
1994 – 1995	560
1995 – 1996	4, 988.34
1996 - 1997	820.16
1997 – 1998	4, 130.22
1998 – 1999	1, 175.83
1999 - 2000	6, 020.83

Source: *Department of Environment and Forests, Aizawl 1990-2000*

**Area Affected by Forest Fires in Lunglei District from 1990 to 2000**



**Figure 4.7**

**(vi) Road Construction**

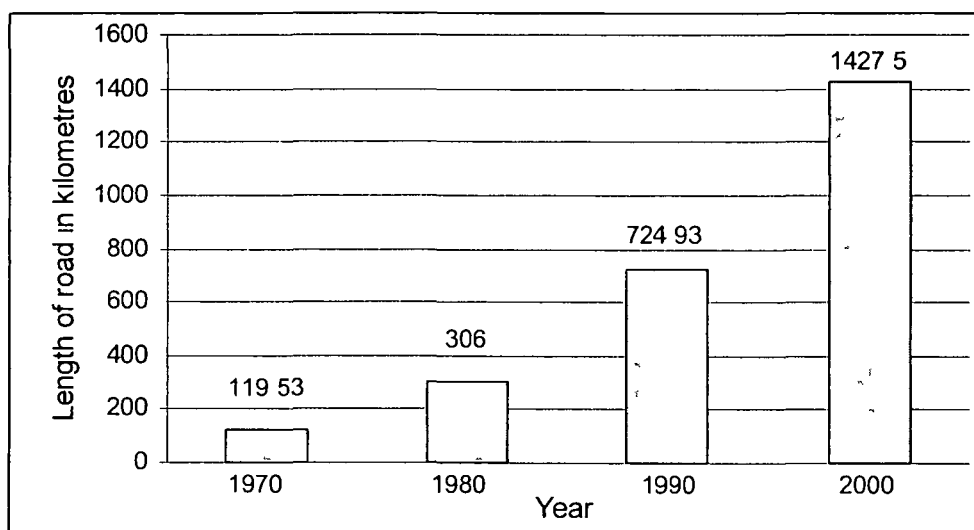
In near absence of railways and water transport in the region, road are the only means of transport. Though roads are considered best channel for socio-economic development, yet speedy construction of roads without properly assessing the ill-effect on the ecosystem have caused visible and invisible harms to the nature. Roads connect peoples and places and are important communication links. However, land has to be acquired for the construction of roads. This is usually done by clearing forest areas. Apart from cutting down a number of trees in the way, roads necessarily involve some cutting and blasting of hill sides at times which result in slope failure (Plate 4.7 and 4.8). Among all, landslide is the most glaring example. In 1970, the length of road was 119.530 kilometres, while in 1980 it has increased to 306 kilometres. Consequently, the length of the road in 1990 has jumped up to 724.93 kilometres and in 2000 it reached to 1, 427.50 kilometres (Table 4.8, Figure 4.8). During the study period the total increase of length of road in the study area is 1, 307.97 kilometres (Table 4.9, Figure 4.9).

**Table 4.8 Length of Road Construction in Lunglei District**

Year	Length of Road (in Kilometres)
1970	119.53
1980	306
1990	724.93
2000	1,427.50

Source: District Research Officer, Lunglei, 1970 - 2000

**Length of Road in Lunglei District from 1970 to 2000**



**Figure 4.8**

**Table 4.9 Decadal Growth of Length of Road from 1970 to 2000**

Year	Length of Road (in Kilometres)
1970 – 1980	186.47
1980 – 1990	418.93
1990 – 2000	702.57
<b>1970 - 2000</b>	<b>1,307.97</b>

### Decadal Growth of Length of Road from 1970 to 2000

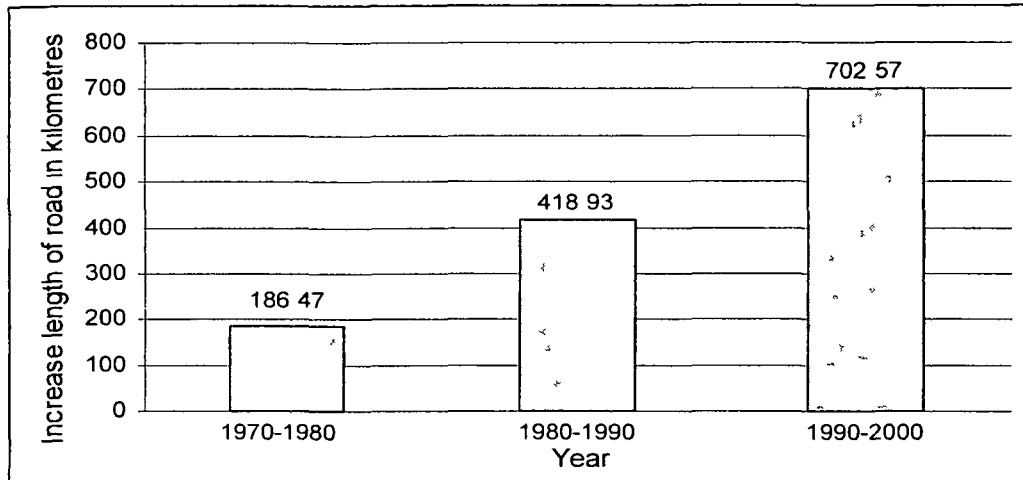


Figure 4.9

#### (v) Wood Consumption

The demand for timber and fuel wood has kept on increasing due to the increase in per capita requirement of wood. Majority of population of Lunglei district is heavily dependant on forests for timber, fuel wood and other forest products. The fuel wood requirement is believed to be met from unaccounted sources, i.e. neither from accounts of government forests nor from trees on private land. It indicates the practice of illegal exploitation of forest resources on large quantity. Therefore, the impact of man on the natural resources just on this account alone is alarming. In absence of the management plans and proper resources survey studies, the exact position of potential availability and supply of different kinds of forest products is not known. However, on the basis of consumption studies conducted during 2000-2001 by the then Forest Survey of India (FSI) it has been worked out that 5,794 m<sup>3</sup> wood for house construction/repair, 1,254 m<sup>3</sup> wood for furniture, 112 m<sup>3</sup> for agricultural implements and 46,739 m<sup>3</sup> for fuel wood is consumed per annum in the district.

As regards fuel wood consumption, Forest Survey of India (2001) study indicated that it is 2.07 m<sup>3</sup> per capita per year in rural areas and 0.9 m<sup>3</sup> per capita per year in urban areas. Another study conducted by North-Eastern Council in 2000 revealed that fire wood

consumption in the rural areas vary from 1.48 to 2.99 kilograms per capita per day and in urban areas it varies from 1.02 to 2.09 kilograms per capita per day in the study area. Increased wood consumption has led to the forests being poorly stocked and having younger age classes, harvestable yield is very less, and there is a wide gap between sustainable supplies and demand indicating heavy pressure on the forests.

#### **(vi) Bamboo Consumption**

Bamboos are extensively used by the local people in house construction, fencing etc. Forest Survey of India stated the aggregate consumption of bamboo stands at 11326 MT/year in Lunglei district. Besides this, substantial bamboo shoots are harvested for food/vegetable by the people and small food processing units during rainy season, data on which is not available. Besides above, according to the State Forest Report the per capita consumption of bamboo is 4.41 numbers, in rural area and 1.18 numbers, in urban area in the study area. Bamboo is the second largest source of forest products. Bamboos are used as timber for construction purposes, village fuel wood, food and fodder, re-inforcement of concrete structures and laminated bamboo-plywood. Bamboo shoot is canned as food in the study area since 1990. Cane production came along with bamboo and cane works in the industrial sector, cane chairs, cane table, cane stool, hat, umbrella sticks, etc. are made of canes. Other ethno material culture of bamboo and cane include fences, outdoor benches, water vessels, conduits, guard-rails, bamboo torches, bamboo store houses, for weaving and tying purposes, etc.

#### **(vii) Animal Grazing**

The system of livestock production in the study area is mostly based on grazing on forest lands and on the grasses of the hill slopes. Although required information regarding the loss of forest cover due to grazing is not available. Considerable quantity of leaves and fodder is collected from forest. Absence of development of adequate fodder and pasture areas and increase in cattle population has led to forests degradation. In 1970, the livestock population was 81,892 which included Cattle, Buffalo, Mithun, Horses, Ponies, Sheep and Goats. The number increased to 1, 14,806 in 1980, and it gone up to

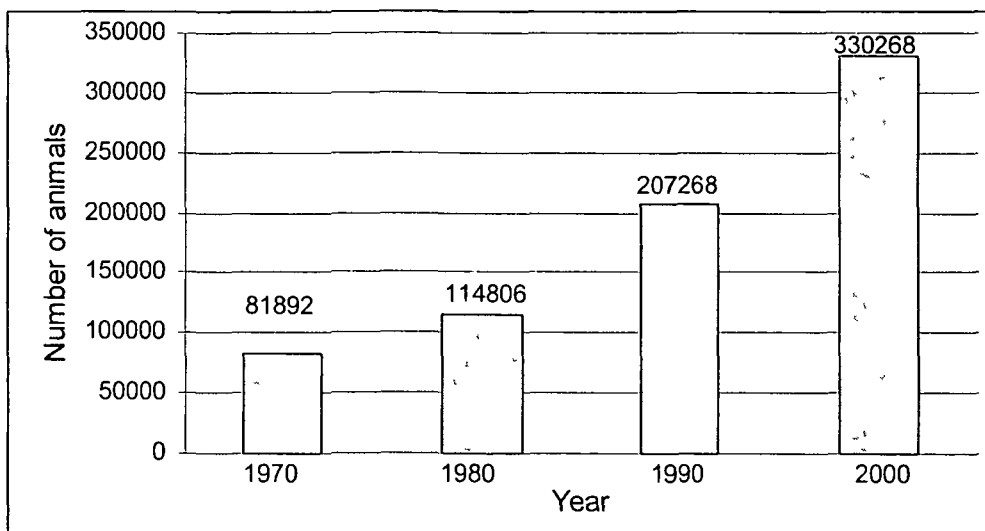
2, 07, 268, in 1990. The number has jumped up again in 2000 to 3, 30,268 (Table 4.10, Figure 4.10). The number of livestock has been increasing every decade (Table 4.11, Figure 4.11). No adequate fodder and pasture lands have been developed for the livestock grazing. Most of these graze in the forests which causes damage to the forest by way of destroying the young generation of plants. Increase of livestock population will make forests more vulnerable to grazing damages.

**Table 4.10 Number of Animals in Lunglei District**

Year	Number of Animals
1970	81,892
1980	1, 14,806
1990	2, 07,268
2000	3, 30,268

Source: District Research Officer, Lunglei, 1970 - 2000

**Number of Livestock in Lunglei District from 1970-1990**

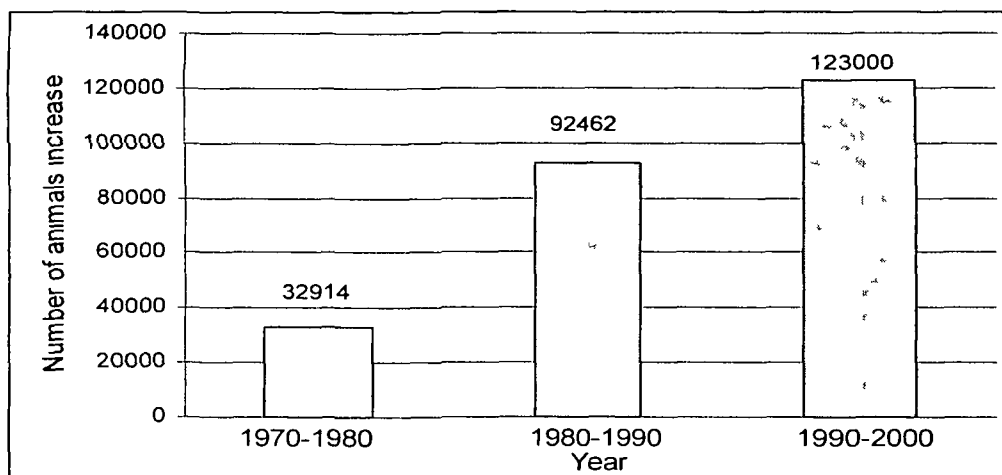


**Figure 4.10**

**Table 4.11 Decadal Growth of Livestock from 1970 to 2000**

Year	Number of Animals
1970 – 1980	32,914
1980 – 1990	92,462
1990 – 2000	1, 23,000
<b>1970 - 2000</b>	<b>2, 48,376</b>

**Decadal Growth of Animals from 1970 to 2000**



**Figure 4.11**

**(viii) Encroachment and illicit removal of forests products**

Problem of encroachment of forest lands and illicit removal of forest products are exerting tremendous pressures on the forest resources of the district resulting in their depletion. Unfortunately, no data is available for this aspect, but nobody can deny such happenings. Sometimes, anti social elements make heavens in forests in this way. It would be necessary to demarcate and consolidate the forests and equip/train the forestry personnel adequately with facilities and equipments to save the forests from above threats which are on the increase.

### **(ix) Tribal rights**

Under the provision of the Tribal rights, applicable in the study area, villagers are entitled to utilise forest products without any limit free of charge for their home consumption. Such unrestricted rights often result in over exploitation of forest resources and also lead to degradation far below the recuperative power of the forests. Hence promotion of tree plantation and protection of forests by people for meeting their requirements will need to be encouraged.

The socio-political situation is playing a very important role in the degradation rate in spatial and temporal domain of the district. The sustainable forest management in the area prescribes by the forest department is 10-20 rotation cycle. However, in absence of any management plan, estimate of growing stock and stratification on site quality, the exploitation of wet tropical evergreen forest in the study area is left to timber mafias. The apex court imposed an interim ban on felling in forests on December 12, 1996. Being the owner of India's has to be restored and the resources are to be used in a sustainable way. The order has come at a very proper time wherein the region was losing thousands of hectares of forest every year, mostly due to government and traders' nexus. Most of the forest in the district is controlled by the traditional community and private, whereas merely about 15 per cent of the total forest area is controlled by the government. The community forest and the private forest practices could not preserve much of the areas. The unique land ownership system could not manage the forest or exercise any control on the over-utilisation of the resources for the authority. The concept of people's participation has failed in the district to restore the forests resources and its optimum utilisation. Non-scientific forest management practices have resulted in the fragmentation of the forest landscape in the district. The permit system, introduced to help the local people, has become instrumental for siphoning huge number of trees out the region. The rampant felling has changed the scenario of the dense evergreen forests of the district to denudation, except merely 17.33 per cent of the total forest cover area. The present image of the district forested landscape is due to the non-scientific and weak management

**Plate 4.1 Forests Burnt for *Jhum***



**Plate 4.2 Recently Burnt Forests for *Jhum***



**Plate 4.3 Bamboo Forests Area Cleared for *Jhumming***



**Plate 4.4 Forests Cleared for *Jhum***



**Plate 4.5 Forest Area Decline Due to Expansion of Lunglei Town**



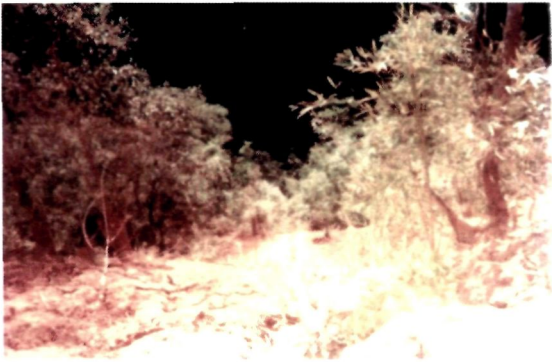
**Plate 4.6 Deforestation for Settlement**



**Plate 4.7 Degradation Due to Road Construction**



**Plate 4.8 Degradation Due to Erosion**



## **4.2 FOREST CONSERVATION**

Forests are a renewable resource and contribute substantially to economic development. They play a major role in enhancing the quality of environment. The future of rural development in the district is linked directly with the survival of forests. Ecological balance demands for increase in forest area but the demands for forests products are increasing in geometrical progression due to rapid growth of population and general improvement in the standard of living. Keeping the invaluable importance of forest in mind right from early times man societies are aware of forest conservation in ways. Today there exist both traditional and modern forest conservation methods. In modern times not only people but the government and even Supreme Court are involved in conservation of environment including forests. In this connection following points are worth mentioning.

### **(i)Supreme Court Order 1996**

#### **General**

1. In view of the meaning of the word 'forest' in the Act, it is obvious that prior approval of the central government is required for any non-forest activity within the area of any forest. In accordance with section 2 of the Act, all on-going activity within any forest in any State throughout the country, without the prior approval of the central government, must cease forthwith. It is, therefore, clear that the running of saw mills of any kind including veneer or ply-wood mills and mining any mineral are forest purposes and are, therefore, not permissible without prior approval of the central government. Accordingly, any such activity is prima facie violation of the provisions of the Forest Conservation act, 1980. Every State government must promptly ensure total cessation of all such forthwith.
2. The felling of trees in all forests is to remain suspended except in accordance with the working plans of the state governments, as approved by the central government. In the absence of any working plan in any particular state, where the

permit system exists, the felling under the permits can be done only by the Forest Department of the State Government or the State Forest Corporation.

3. There shall be no fresh felling in the forests belonging to the government. District and regional Council till the disposal of their existing stock of legal and illegal timber (For North-Eastern State)
4. The remaining timber belonging to government and District Councils shall be forest offered for sale to government Departments for their bonafide official use and the rest shall be sold in public auction of through sealed tenders after fixing floor price by an expert Committee with a representative from the member of environment and forest. Private timber owners whose stocks have been cleared by HPC shall have the option of selling the timber either in the auction organised by the Sate Forest departments/Forest Development Corporation or directly.
5. Existing inventories stock of timber originating from plantation in private and community holdings in the States of Meghalaya, Mizoram, Tripura, Manipur and Nagaland may be disposal of by their owners under the relevant State laws and rules. In States where such laws and rules do not exist, the necessary laws and rules may frame within six month.

#### **Forest Protection**

1. An action plan shall be prepared by the Principal Chief Conservator of Forests/Chief Forest Officer for intensive patrolling and other necessary protective measure to be undertaken in identified vulnerable areas and quarterly shall be submitted to the central government for approval. The approval plan together with the modification, if any, shall be acted upon.
2. To ensure protection of the forest wealth the forest officers in the northeastern states may be empowered with authority to investigate, prosecute and confiscate on the lines of the powers conferred on the forest officers in many other states in the country.

3. The state governments shall be responsible for providing all facilities including security and police force to strictly enforce forest protection measures to stop illicit felling, removal and utilisation of such timber. The Chief Secretary shall review the various matters concerning forest protection and development in his state at least once every six months with senior officers upon the rank of Conservator of Forests. Regional Chief Conservator of Forests shall invite to all such meetings.

#### **Scientific Management of Forest**

1. Working plan for all forest divisions shall be prepared by the state governments and got approved from the government of India and forest working shall be carried out strictly in accordance with the approved prescriptions of the working plans. The working plans should be prepared with in a period of two years. During the interregnum the forests shall be worked according to an annual felling programmed approved by the MoEF which shall be incorporated in the concerned working plan. In case a working plan is not prepared within this time frame, future felling will remain suspended till the regular working plan is prepared and got approved.
2. The forests under the District, Regional and Village councils shall worked in accordance with working schemes which shall specify both the programme for regeneration and harvesting and whose period shall not be less than 5 years.
3. The maximum permissible annual yield in the interim measures suggested above, shall not exceed the annual harvestable yield determined by Ministry of Environment and Forests. The plantation schemes raised on private and community holdings shall be excluded from these requirements but shall be regulated under respective State rules and regulations.
4. The States shall identify ecologically sensitive areas in consultation with leading institutions like the Indian Council of Forestry Research and Education, Wildlife Institute of India, North-Eastern Hill University, North-Eastern Regional institute

of Science and Technology, leading NGOs etc., and ensures that such areas are totally excluded from any kind of exploitation. The minimum extent of such areas shall be 10 per cent of the total forests cover area in the state.

#### **(ii) Joint Forest Management**

The State government introduced the scheme of “Joint forest management” to be implemented jointly by the *Department of Environment and Forests* and the *Village Forest Development Committee* constituted by the government. It was first discussed and debated in a training cum seminar jointly organised by Regional centre NAEB/department of environment and forest in Mizoram on 28<sup>th</sup> February 1994 among government officials, NGO/Voluntary Agency and resource persons in the state with a view to evolve an operational strategy with the local people for improving forest management in the state. The seminar thus recommended among other things, adoption and implementation of JFM in Mizoram, formation of Village Forest Development Committee (VFDC) with the involvement of Village Council authority and NGOs like YMA etc.

The impact of JFM on protection, conservation and regeneration of forests can not be quantified now as the scheme is initiated only a few years back. Like-wise, distribution of usufruct and quantum of benefits accrued to VFDC members can not be highlighted at this stage. However, the recent survey exercise undertaken by this department shows that JFM has showing its impact but it is still in incipient sates. Most of these VFDCs are living in and around the forest deriving their livelihood and essential needs from the forest. JFM has brought in appreciable change in outlook among villagers, forest department and its officials as it provide ample employment opportunities in the form of wages through creation and maintenance of plantation. People are involved in various stages of implementation of the scheme including selection of the beneficiary (Member) choice of species, plantation works maintenance, protection etc.

### **(iii) Green Mizoram Programme**

The Government of Mizoram has deeper feeling on continuous fast depletion of tree cover, which affects the socio-economy and environment in the state. Hence, the government felt necessary to launch a second mass venture under the programme “Green Mizoram”. As decided by State Level Committee, Green Mizoram Day was observe for maintaining trees panted under Green Mizoram programme 1999 by government department, thereby, carrying out casualty felling, weeding and fencing of the plants by selected staff of departments in their respective plantations as the day was not announced as a government holiday. For this day, actual required seedling was issue to various departments for casualty replacement and additional planting where necessary.

### **(iii) Social Forestry**

Social forestry aims at meeting communities of fuel wood, fodder, small timber and protection of agricultural fields. Social forestry programmes require some urgent measures in reorienting the management practices and modifying the social/community forestry afforestation models to ensure greater participation of the rural population. Effective management and exploitation of natural resources will require organising a village resource management society. The main functions of this organisation are organising inputs, marketing, social welfare activity, generation of villages fund and employment opportunities, etc. Effective sharing of the benefits in social forestry programmes with the local population should be made irrespective of status. Therefore, a people and NGOs has plays a major role for the implementation of social forestry programmes.

## **CHAPTER - V**

### **SUMMARY AND CONCLUSION**

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## 5.1 SUMMARY

Forests are one of the most valuable ecosystems of the world, containing over 60 per cent of the world's biodiversity. This biodiversity has multiple ecological social and economic values. Apart from its intrinsic value, varying from the important ecological functions the forests have economic value in terms of numerous products, which could be extracted from the forests. For many indigenous and other forests-dependent peoples, forests are their lifelines. They provide them with edible and medicinal plants, bush meat, fruits, honey, shelter, firewood and many other goods, as well as with cultural and spiritual values. On a global scale, all forests play a crucial role in climate regulation and constitute one of the major carbon sinks on the earth, their survival thus preventing an increase in the greenhouse effect. Even in the study area forests plays an important role in environment, ecology and economy as they constitute a basic life support system and are important in the economy and life of the people. Forests, especially tropical forests, are said to be the lungs of the earth, so also of a country, of region, hence of the study area as well. In fact, forests represent the very soul of the people.

On one hand, forests are a vital component of the natural environment of an area. They are governed by various physical factors, while on the other they create typical environment where a variety of life forms live. The forests influence rest of the physical and environment. Unfortunately, such a vital resource has been under constant threat from man since time immemorial. Not only their area is shrinking but their quality is also declining, affecting both man and environment. The loss of the tropical forest is the greatest loss on irreversible loss, indeed. It is interesting to study degradation of forests. Therefore, in the foregoing chapter forests degradation in Lunglei district has been discussed.

The word forest has many meanings but nowadays it usually refers to an association of plants and animals in which trees are dominant. The Forest Department, Aizawl, has adopted the Dictionary meaning of forest to avoid any confusion. On the

basis of the Dictionary meaning the Forest Department has prepared data on forest cover area of Lunglei district. Whereas, the Remote Sensing Application Centre, Aizawl has followed the remote sensing keys to identify types and area of forests in Lunglei district.

Degradation of forests commonly refers to reduction in the productive capacity of the forests. Food and Agriculture Organisation (FAO) of the United Nation described degradation of forests as the changes within the forest class that negatively affect the stand or site and, in particular, lower the production capacity. Degradation may be permanent, although some forest areas may recover naturally or with human assistance. Therefore, degradation of forests involves the processes, which result in the loss of forest cover, change in canopy density and loss of biodiversity.

Lunglei district was once very rich in flora and fauna covered with thick forests. However, with the passage of time due to degradation the forests have lost their original character. Three types of forests are found in the study area. These include- (i) Tropical wet evergreen forests found in the western areas where precipitation is high, (ii) Tropical semi-evergreen forests cover a vast area in the central part of the district, and (iii) Mountain sub-tropical forests, mostly confined to the higher elevation eastern part. All these types of forests have been affected by degradation, but the mountain tropical forests of higher elevations are not much affected due to inaccessibility.

Every year thousands of hectares of forest area is cleared due to various factors and the rate of deforestation has been increasing over the decades. The forest cover area was quietly high in 1970 with 4,31,218.5 hectares, i.e., 95.06 per cent of the total geographical area. In 2000 the forest area has declined to 3,95,621.06 hectares, accounting for 87.20 per cent of the total geographical area of the district. Hence, during the 30 years of study period (1970 to 2000) the total loss of forest area in Lunglei district is of 35,597.44 hectares, which accounts for 7.85 per cent of the geographical area.

Forests degradation can also be seen through changes in the forest canopy density during the study period. There were 50,163.25 hectares (34.82 per cent) of dense forests in 1970, which came down to 71,634.20 hectares (17.49 per cent) in 2000. Hence, within 1970 to 2000, the dense forests area has reduced by 17.33 per cent of the total forest area. In 1970, the open forests existed on 2,61,483 hectares of land covering 60.63 per cent of the total forest covers area, while in 2000 it has increased to 2,94,621.40 hectares or 71.93 per cent of the total forest cover area. Therefore, within thirty years, the open forests area has increased by 11.30 per cent. Consequently, in 1970 the degraded forests area was 19,572.25 hectares, i.e. 4.53 per cent of the total forest cover area, whereas in 2000 it has increased to 43,286.60 hectares or 10.94 per cent of the total forest cover area. Between 1970 and 2000 the degraded forests area has increased by 6.41 per cent. At present in the degraded forests tall trees are absent, but there is predominance of bushes. Number of medium trees also declines from dense to open and then to degraded forests. Number of small trees is more in open forests than the dense forests and degraded forest as well. The presence of bushes naturally shows an increasing trend from dense forests to degraded forests, and that is an evidence of forests degradation.

Spatial variation in forests degradation has been analysed with help of block level data on forest cover and this data is available for two time periods only. The forest cover area was quite large in all the Blocks in 1970. However, due to degradation the forest cover area has declined in all the Blocks in 2000. But the rate of degradation is uneven, for example Bunghmun Block has lost about 8,326.36 hectares of forests accounting for 7.29 per cent of its total geographical Block area, whereas, Hnahthial Block has lost 7,052.82 hectares or 7.37 per cent of its total geographical Block area. Lungsen and Lunglei Block have lost 11,039.36 hectares or 8.12 per cent and 9,178.86 hectares or 8.50 per cent of its total geographical Block area, respectively. This shows that the loss of forests has been more in Lunglei, for which the main reason is growth of urban centre Lunglei and its population.

Forests degradation is also evident from the destruction of habitat of wild life of the district. As a result of forests degradation many species of plants and animal are threatened or at verge of extinction. In fact Lunglei district is known for its rich and diverse wild species of plants and animals. It has a very large taxonomic range, in proportion to the enormous diversities of ecosystems and geographical conditions, which these species inhabit. However, in the last few decades, this diversity has faced increasing erosion, which mainly because of habitat loss. However other reasons like over hunting, over exploitation, poisoning, disempowerment of the local communities etc. The important endangered and threatened floras include *Arundina graminifolia*, *Dendrobium densiflorum*, *Berginia ciliata*, *Zanonia indica*, *Auilaria malaccensis*, and *Gynorcardia odorota*. The threatened birds are: *Lesser adjutant*, *Mrs. Hume's pheasant*, *Dark-rumped swift*, *Oriental darter*, *White-cheeked hill partridge*, *Great pied hornbill*, *Brown hornbill* and *Blyth's tragopan*. In addition, the threatened animals occurring in the district are: *Slow Loris*, *Capped langur* (very rare), *Leopard*, *Tiger*, *Leopard cat*, *Chinese pangolin*, *Flying fox*, *Serotive bat*, *Common yellow bat*, *Malayan giant squirrel*, *Large Indian civet*, *Small Indian civet* and *Small Indian mongoose*.

Degradation of forests is not an isolated phenomenon rather it is degradation of entire forest ecosystem, which is not only habitat of various life forms. Hence, it leads to loss of biodiversity, and also disruption of biogeochemical cycles, which operate through the medium of soil and plants of an ecosystem. The forest department has enlisted a number of endangered plant and animal species of the study area (mentioned earlier). The point to emphasise is that degradation of forests causes a chain of reaction in the ecosystem and biosphere as a whole and hence the importance of forests must be seen much beyond, not merely as stock of forests products. Many physical, biological and chemical processes are associated with the forests for the maintenance of life and physical systems.

As forests and forest ecosystems of the study area are under severe pressure due to various biotic and a biotic factors and given the rich biodiversity of the region, conservation of forests has become a major challenge to be paid attention immediately.

Large areas of forest are denuded in Lunglei district every year, due to one or more factor. This has resulted into a strong threat to the sustainability of forest resources and it has also affected the ecology and environment of the region. Keeping in view the continued depletion of forest cover in the district resulting from excessive biotic pressure like illicit felling, clearing of forest for *jhumming*, human habitation and other developmental activities, the government of Mizoram launched a massive venture (Green Mizoram) for resuscitation and forestation of all barren lands in Mizoram including private, government and semi-government lands for converting such areas in to green cover thereby creating a better environment. In addition, the state government has introduced the scheme of “Joint Forest Management” (JFM) to be implemented jointly by the Forest Department and the Village Forest Development Committee (VFDC) constituted by the government for conservation and regeneration of forest. The apex court’s interim ban (12.12.1996) on felling of trees from the forests has also come in to effect in the study area to conserve the forests and use them in a sustainable way. Ultimately, the Supreme Court of India finally disposed of the writ petition by passing an order on 15<sup>th</sup> January 1998. The judgment clearly states that the Government will control felling of trees and the local requirements will be met through conservation and maintenance of environment and ecology. But enforcement of law is a complex issue. On the one hand, the Forest Department has been given a task of protecting the forests, but on the other, without adequate policing powers. Due to exploitative role of forest departments, the local people have been alienated and it is impossible to control the deforestation in the district without the active support of the people of the district.

## 5.2 MAIN FINDINGS

Main findings drawn from the present study can be summarised as follows:

1. The total forest cover was 4,31,218.50 hectares in 1970, accounting for 95.06 per cent of the total geographical area, whereas in 2000 the forest cover has decreased to 3,95,621.06 hectares, i.e., 87.20 per cent of the total district area. It clearly indicates decrease in the forest cover during the thirty years.
2. Within a period of thirty years, i.e. from 1970 to 2000, the total loss of forest cover has been of 35,597.44 hectares (i.e., about 1186.58 hectares per year). In other words, the loss in terms of percentage was 7.85 per cent of the total geographical area. The only positive side of this loss is that the total percentage of forest did not fall down below the required percentage as per the Forests in the Mountain Tracts prescribed by the Government of India in 1982 which enjoins that 60 per cent should be maintained under forests in such areas.
3. The rate of forest cover loss has gradually increased over the decades. During 1970 to 1980 the rate of degradation was 1.79 per cent, while from 1980 to 1990 it increased to 2.98 per cent. Finally during 1990 to 2000 it shot up to 3.90 per cent. The rate of decline in forest cover area shows that maximum degradation took place during 1990 to 2000- an increasing trend indeed- and that is the point of concern for the environmentalists.
4. Not only the forest area has shrunk but the forest canopy density has also changed adversely during the studied period. Between 1970 and 2000 area of the dense forests declined by 17.33 per cent of the total forest area, certainly a cause of worry for the environmentalists because it is loss of primeval or climax forests of the area and the tropical zone as well, which are the most valuable natural resources of the world. Contrary to it, the percentage of open forests area has gone up by 11.30 per cent, and that of the degraded forests by 6.41 per cent of the total forest area. The increase in both open forests and degraded forests is at the

cost of dense forests, i.e., primeval forests. This is because decline in the latter directly results in increase in the open forests and degraded forests.

5. There has been spatial variation in the degradation of forests, for which Block wise data has been used. The forests cover was quite large in each Block in 1970, e.g., Bughmun Block had the highest percentage of forest cover, i.e., 97.23 per cent of its total geographical area, comparatively high in the district as a whole. Whereas, Lunglei Block had the lowest percentage of forest cover with 91.99 per cent, comparatively low in the district as a whole. No doubt these figures are very high compared to the prescribed limit.
6. During 1970 to 2000 the forests cover has declined in all the blocks, but the rate is uneven. Bughmun block has been less affected as far as the loss of forest cover is concerned, because within thirty years it has lost forests on 7.29 per cent of its total geographical area, whereas Lunglei Block has been the most affected where the decline in forests area is by 8.50 per cent of the total geographical Block area. These should be seen in the background of highest and lowest forest cover respectively in these two Blocks. That's why any decline forest cover from the Lunglei Block is a dangerous sign because it has the lowest percentage of forests in the district. Forests area has also declined in Lungsen Block and Hnahtial Block by 7.73 per cent and 8.12 per cent, respectively within the study period. Hence, the percentage of forest loss has been high in Lunglei and Lungsen Block in comparison to the district as a whole within the study period.
7. Forest degradation has also affected the rich and varied biodiversity of the area because of destruction of habitat of wild plants and animals. As a result number of species of plants and animals are threatened. For example, the endangered fauna include the *Arundina graminifolia*, *Dendrobium densiflorum*, *Berginia ciliata*, *Zanonia indica*, *Auilaria malaccensis* and *Gynocardia odorota*.
8. The endangered and threatened bird species are White-backed vulture (*Mulukawlh*), Lesser adjutant (*Kanghlai*), Mrs. Hume's pheasant (*Vavu*), Dark-rumped swift (*Pengleng*), Oriental darter (*Varul*), White-cheeked hill partridge

(*Rungbekvar*), Great pied hornbill (*Vapual*), Brown hornbill (*Vangai*), Blyth's tragopan (*Vanga*), Peacock pheasant, Indian pied hornbill, Rufous necked hornbill, Kalij pheasant, Lesser whistling teal, Crested serpent eagle, Sparrow hawk, Imperial pigeon, Red breasted parakeet, Indian lorikeet, Large hawk cuckoo, Crow pheasant, Forest eagle owl and White breasted kingfisher.

9. The other scarce mammal species of the area are Slow Loris, Capped langur (very rare), Leopard, Tiger, Leopard cat, Chinese pangolin, Flying fox, Serotive bat, Common yellow bat, Malayan giant squirrel etc.
10. The main causes of degradation of forests are the shifting cultivation, forest fires, population increase, road construction, demand for timber and fuel wood, bamboo collection, animal grazing and encroachment, illicit removal of forests products and curtailment of tribal rights.
11. Shifting cultivation area has increased over the decades, in 1970 it was only about 3.70 per cent of the total geographical area, whereas in 2000 it jumped to 9.69 per cent of the total geographical area and this increase is directly at the cost of forests. Owing to it not only the area of dense forests has declined but the open forests have turn into degraded forests.
12. In 1971 the total number of population was 62,136 persons, while in 2001 it increased to 1,37,155 persons, i.e., an increase of 75,019 persons during the thirty years. With the increasing of population the numbers of cultivators have been increasing and the per capita forest area has also declined. In 1971 there were 21,753 cultivators, while in 2001 their number increased to 46,203 persons. The per capita forest area in 1970 was 6.93 hectares, whereas in 2000 the per capita forest area has come down to 2.88 hectares. This is because of both, increase of population and decrease in forest cover area.
13. However the loss of 35,597.44 hectares of forest cover area during thirty years may appear very small when compared with the loss of forest cover in the tropical zone, it is undoubtedly a significant decline keeping in mind that the loss is of primeval or climax forest of the tropical zone of the world and hence, it is a

serious loss indeed. In case of the study area clearance of 35,597.44 hectares within thirty years of original forest is definitely a great loss because such forest are a rare commodity today and such loss is irreversible for the time being.

14. The trend of decline of the original tropical forests is itself a dangerous sign not only for the environment of the district, but of the tropical belt and of the world as a whole, because the tropical forests are called lungs of the earth. Under the influence of various developmental activities the dangerous trend may turn worse in future and that is the point of great concern for the environmentalists.
15. There is an urgent need of policy measures to undo the massive losses to the green cover of this region. A large part of the forests in this area fall under the category of open forests at present and the percentage is 71.93 per cent (2000) of the total forest covers area. That itself indicates the seriousness of the problem.
16. The gradual increasing rate of changes in forest cover and canopy density is certainly a cause of worry for the environmentalists, because the rate of changes is expected to continue and rise due to increasing demand of various forests products. If the rate continues to rise further, it believed that after sometimes the entire dense forests may turn to either open or degraded forests. Thus, large areas of dense forests are prone to conversion to open forests or degraded forests, and that is unfortunate for the man and environment both.
17. At present in the degraded forests tall trees are absent, but there is predominance of bushes. The presence of bushes naturally shows an increasing trend from dense forests to degraded forests. Number of medium trees also declines from dense to open and then to degraded forests. Number of small trees is more in open forests than the dense forests and degraded forest as well. Tall trees are mostly confined to the dense forests. The tall trees definitely represent climax vegetation of an ecosystem, while the small trees and bushes are secondary growth, and thus secondary in value to the climax vegetation.
18. Small change in forest cover, canopy density and biodiversity may be in Lunglei district, however any change in forests affects structure and function of forest

ecosystem, leading to decline in its productivity and that is a point of great concern for the environmentalists, planners, administrators, and the people.

19. It is a good sign that the people, NGOs and government have realised the damage caused to the forests and to the environment of area and responded to it with positive steps to restore the damage. Therefore, forest conservation efforts have started and desirable results are eagerly awaited to see once again harmonious relationship between man and environment.

### **5.3 SUGGESTIONS**

In the typical physiographic and socio-economic conditions of the study area, where the indigenous people rely heavily on traditional practice of forest utilisation, the right approach should be to plan for forest development in such a manner that there would not be any further decline in the perpetuating stock even after meeting the essential food, fodder, fuel and timber requirements of the people as well as the growing requirements of commercial exploitation. Thus, strategy of development plan of the forests in Lunglei district should, therefore, take into account the ecological and socio-economic aspects, if the management is to result into sustainable development. Therefore, stress should be laid on the development of all the three categories of forest, viz. protection forestry and production forestry. This will not only restore the ecological balance but also fulfil needs of forest products coming from different quarters.

#### **(i) Protection Forestry**

Protection forestry aiming at protection of ecosystem and environmental stability of the region will encourage activities like promotion of nature/biosphere reserves. The practice of agro-forestry and watershed based farming system is the sustainable system highly pertinent to the region. Besides, sustaining the ecology and environment, these systems will also increase the productivity of land. The main hurdles in the higher adoption of these systems and technologies are lack of individual land ownership rights

and intensive extension efforts, need for higher initial investment, long gestation period, lack of market infrastructure, etc. Therefore, implementation of new land reforms, efficient extension system, liberal institutional credit and development of market infrastructure should be prioritised for more and successful adoption of these schemes.

### **(ii) Production Forestry**

Production forestry aims at meeting the diverse requirements of regional and national economy by bringing about quantitative and qualitative improvement stock. Afforestation can be done either by afforestation on land, which previously did not carry forests, or land which carried forest earlier and artificial generation. Large areas of forests are owned/controlled/managed by the community organisations of the forest dwellers, which have direct access to the resources of these forests. The forest dwellers enjoy historical prerogatives as a member of specific community. It is, therefore, obvious that forestry development in this region can take place through harnessing the community institutions for the purpose. Further, it is also essential to ensure greater co-ordination between the government machinery, people and voluntary organisations in regards to enhancement of productivity of forestlands under protective care and supervision.

Apart from these forestry programmes a change is required in the attitude of the people towards natural resources, especially the forests. The plundering attitude does not have place now, for the forests degradation has crossed critical limit of self-restoration of the lost ecological balance. Despite having faster regeneration capacity of the wet tropical forests, the forest ecosystem has lost its self regulating and recouping potential. Even if it is there man cannot wait or stop use of forests up to the time the natural regeneration of forests will take place. So man is at receiving end, hence he has to do something positive to improve the health of the forests by checking its degradation on one hand, and by growing more forests (an ecosystem). It means simple planting of trees will not be much help because forests degradation is, in fact, degradation of an ecosystem as well- full of wild life.

Besides these, the present stock of man - power in the study area is required to be made more professional. A different managerial strategy is required. More accountability of Forests and Environment Department is required. More awareness is required about the crisis of the genetic erosion of flora and fauna. The demand supply gap of forests products has to be narrowed down through alternative sources of non-conventional energy as a substitute of fuel wood. The shifting cultivation has to be checked through the practising of horticulture, animal husbandry and forestry along with agriculture according to suitability of the agro-climatic conditions. There is a vast scope for horticulture and plantation crops in the district. Keeping in view of the land capability, agriculture crops should largely be grown in the plains, valleys and lower hill slopes. In the higher hills, agro-horticulture, agri-silvicultural, agri-horti-silvicultural and silvi-pastoral farming system can be adopted depending on the land slope conditions.

Increasing community awareness is the basic and lasting measure for protection, conservation and development of forests. When community as a whole is made to realise how forests resources contribute towards environment, ecological balance and sustainable development in the district, then that will make a lasting on a forests environment as well. Because local community help in finding out the resources and also identifying environmental problems, the community can also start a movement on forests protection and other environmental issues in a more practical way with quick action. Community participation towards forests conservation/protection, management and afforestation programme is urgently needed. In this context the following suggestions may be considered.

- (i) Environmental education must be given to the people in various forms through lectures, exhibitions, essay writing, seminar/workshops, discussions, documentaries, film shows on forests, its resources, economy etc.
- (ii) Forest Department in the district must develop joint action plan towards such problems. Besides, there must be close collaboration and expertise with the Union Government and international agency on environment.

- (iii) Adequate financial assistance needs to be accorded towards forest department so as to regulate and take a prompt action.
- (iv) Rapid afforestation measures should be adopted by the government in the region as well as by the public.

In the present age of globalisation when international community subjects natural resources of a region, however accessible or inaccessible it may be, to exploitation, conservation of forests is a big challenge for the indigenous people and the government. Illegal removal of forests and wild life further aggravates the situation of forests degradation and also make the task of forests conservation more difficult. The solution lies at the grass root level- the forests dwellers can only be its best protectors once they realise and understand the importance of forests in the biosphere, especially in the survival of life forms. So any development plan for the forests of the area has to involve the forests dwellers to make it really successful. Adoption of substitutes for the forests products will also help in reducing burden on the natural forests of area, and it will be beneficial for the forests of the tropical zone of the earth as well. Keeping in view that over all percentage of forests cover in the district above the prescribed limit for mountain areas, it can be said that it is high time to improve the condition of forests in terms of area and canopy density, along with the biodiversity. This very factor of having forests above the prescribed limit is in one way harmful because it attracts the illegal exploiters of forests, and when they are active success of any forestry development works cannot be ensured. Therefore, the people have to play not a major role but critical role in conservation of forests and the overall environment of the study area. If people are aware of their rights to use forests, they must also be aware of their duties towards the forests and environment of the area, and then only degradation forests can be stopped. The future is bright, for the people and government both are sensible and active.

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