LAND USE PATTERN AND ENVIRONMENTAL DEGRADATION IN MOKOKCHUNG DISTRICT, NAGALAND: A GEOGRAPHICAL ANALYSIS

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YUTSUNGCHABA

Under the Supervision of
Prof. Sangyu Yaden

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Department of Geography

School of sciences

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Nagaland University, Hqrs.: Lumami, Zunheboto

District – 798627, Nagaland

CERTIFICATE

This is to certify that the thesis submitted by Mr. Yutsungchaba towards the degree of Doctor of Philosophy (Ph.D) in the Department of Geography on title **"Land Use Pattern and Environmental Degradation in Mokokchung District, Nagaland: A Geographical Analysis"** embodies the result of his work. To the best of my knowledge the data and facts recorded in the study are based on his own research work.

I therefore, recommend that this thesis may place before the examiners for evaluation for the award of the Ph.D of this University.

07/04/2021

(Prof. Sangyu Yaden)

Supervisor

PROFESSOR
Department of Geography
Nagaland University, Lumami

DEPARTMENT OF GEOGRAPHY

NAGALAND UNIVERSITY,

Hqrs. : Lumami, Nagaland

Declaration

I, Mr. Yutsungchaba, do hereby declare that this thesis on **"Land Use Pattern and Environmental Degradation in Mokokchung District, Nagaland: A Geographical Analysis"** submitted for the award of the Degree of Doctor of Philosophy in Geography comprises the result of my own research work carried out in the Department of Geography, Nagaland University. The contents of this thesis did not form bases 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 my research degree in any other University.

Date: 07/04/2021

Candidate

HEAD
Department of Geography
Nagaland University
Lumami-798627

(Prof. Lanusashi Longkumer)
Head
Department of Geography
Nagaland University
Hqrs.: Lumami, Nagaland

(Yutsungchaba)

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CHAPTER 1

INTRODUCTION

CHAPTER: 1-INTRODUCTION

1.1 Introduction

Land, a natural and renewable resource, is a free gift of nature. Land may be defined as "a sum total of the natural resources over which the possession of the earth's surface gives control". The concept covers the earth's surface, building sites, farm soil, growing forest, mineral deposits and water resources. Land supplies all the basic needs of the people. It is the basis for the production of food and raw materials; it is also the source of income, employment, economic security and power. Land which is single to all human kinds needs an activities, is, however a distinctly a limited resources. Given that limited in supply the quality and quantity of land resource available to men may either hinder or assist the level of development of the country's economy.

The pattern of land use has been affected by population pressure, law of inheritance, misuse of irrigation facilities, overgrazing, deforestation, haphazard growth of industries, unplanned developmental project, environmental disaster both natural and manmade. One of the inefficient land is that the policy for each specific land use has been evolved in isolation. Thus, the requirements of one form of land use have often reduced efficiency of other uses of land. So, long as different uses of land are assessed in isolation and as the pressure mounts, the claims of each form of land use are bound to become difficult to meet.

The land use pattern is an important theme in all aspects towards environment. Land use pattern is conditioned by the association of two sets of factors: Firstly, physical factors such as geology, relief feature, climate, soil and vegetation which limit the use capabilities of land. Secondly, cultural factors which include both economic and institution. From issues of land as a factor of input for production and scarce resources to property rights, the role of

institution and government in land resource management in agricultural perspective, the world's cultivated lands are limited, their limits in physical sense of expansion have been reached, yet new innovation and techniques have opened out new dimensions of land potentialities, whereas, land use refers to a set of human activities that exploit the varied resources offered by the biological features of land cover. Land use thus deals with the problems involved in conversion of land from one major use of another general use. The pattern of land use of a country at any particular time is determined by the physical,economic and institutional framework taken together. The time, methods and intensity of land use together with large number of environmental factors determined the potentials as well as long term sustainability of land productivity.

The Land use pattern is central to agriculture pursuits in a developing country like India, where agriculture is the basis of all socio-economic development. Short sighted policies are often responsible for the degradation of the agricultural resource base. Since agricultural expansion is the main cause of tropical deforestation (Geist &Lambin, 2001), land use intensification has been proposed as a possible solution to reduce forest loss.

The supply of land resource was never so scarce in relation to demand of mankind, therefore the need for conservation and management was never so urgent and sensitive. This situation is becoming more realistic in the developing country like India, where land resources are becoming scarce in relation to its demand. This scarcity leads to unwise use of land, resulting in land degradation having serious environmental consequences which lowers the productivity of soil. The problem of resource scarcity has further accentuated due to rapid population growth, wide spread poverty, different ownership of land, ill defined rights and weakening of traditional management institutions.

The environmental degradation and geo-ecological imbalance in the district though not serious as in the case of other industrially developed states and nations, cannot be neglected because most of the natural environment has changed due to human activities. Environmental degradation in the district is an outcome of population explosion and increasing consumption, combined with technological development. Expansion of urban areas combined with fast growth rate of urban population causes fresh water shortage, sanitation problem, traffic congestion, noise pollution and air pollution. Small and medium scale industries are randomly located in the vicinity of both private/community forests and government owned forests. However, forest degradation is most alarming in private forests.

Mokokchung though a small district in terms of area has rich and varied heritages of biodiversity owing to its varying physiographic and geo-climatic conditions. However, in recent times, the biodiversity of the state is facing serious threats due to increasing population, expansion of settlement areas, random hunting and trapping, logging, pressure onforest land for agriculture and unplanned project and promises in the name of development.

Traditionally, Nagas do hunting and trapping of wild animals for domestic use, medicinal values and festival purposes. This trend still continues in the district despite the Government enacting Wildlife Protection Act. At present some village Councils and NGOs has initiated conservation of wildlife in their village jurisdiction. Since time immemorial Naga were managing its resources by way of land use. In Naga customary law, all land including forest, is privately owned by individual, clans and village community. The ancient Nagas conserve their natural environment in accordance to their own traditional belief and as a matter of fact, the hunters do not kill pregnant wild animals. The traditional knowledge of conserving natural resources and ecology is fast depreciating in the state and everywhere.

Land use policy should ensure that future development of forestry is based on environment planning principles with an emphasis on coordination with development efforts in population resettlement and agricultural development, water and energy development and wildlife conservation.

The degradation of the resource base and particularly of agricultural land is the fundamental constraint to sustainable development. In this fast development in economy and mounting population pressure, it is crucial to frame a rational land use policy to protect the land, soil water and other natural resources. It is important to develop suitable programmes to maintain and improve their condition. A sustainable global economy would be one in which soil erosion and degradation do not exceed soil formation. From physical perspective, soil erosion and environmental degradation is inappropriate agricultural land use pattern. This calls for proper land use and management measures which implies on developing new policies for land, water nad forest and analysing those which already exist.

1.2 Objectives

The objectives of the research were to assess the pattern of land use and status of environmental degradation and to suggest integrated development and management strategy for sustainable environment friendly development in the district with the following :

1.To assess the Land use pattern in Mokokchung.

2.To assess the physical and socio-economic problems and hindrances towards a sustainable

land use pattern taking cases of some villages in the study area.

3.To study the interrelationship between relative relief and land use pattern in Mokokchung District.

4.To identify the extent of environmental degradation related to existing land use in different field.

5. To study the traditional concept of land/ land use and its management.

6. To evaluate environmental protection policy in protecting environment.

1.3 Hypothesis

The study postulate with the following hypothesis:

a) The existing land use pattern acts as a constraint to environmental sustainability.

b) The land resource base is a critical component of the livelihood strategy in a traditional society.

1.4 Methodology

a) Primary methods:

Apart from the physical factors, field survey has been carried out to assess the different parameters affecting the land in Mokokchung district like forest fire prone areas, wasteland, encroachment, shifting cultivation etc. Collection of data through personal interviews, discussion, as well as field observations were carried out. However, scheduled questionnaires are being prepared to collect household level information like traditional knowledge base of the local people on the land utilization, household consumption of

fuel wood, percentage of people depending on land resource, demand and supply of wood and other forest products.

A spatial analysis of the land resources in the study area is being done both of which were of descriptive and analytical methods based upon the data collected from both primary and secondary sources.

The quantitative data on the study area has been obtained and classified to get information on the following:

1. Types of vegetation

2. Forest of fire prone areas

3. Land affected by shifting cultivation

4. Land use / land cover and soil types

5. Land under plantation, wasteland, encroachment, deforestation etc.

To understand the pattern of land resource utilization, an intensive field study of few selected rural villages, on the basis of random sampling method was undertaken. The followingcriteria were applied to achieve the objectives :

1. Land ownership i.e. Private, community or government.

2. Indigenous knowledge based on land utilization and preservation

3. Occupational structure of the village

4. Income of the household generated from the land resource.

Besides survey of secondary source materials such as, official documents, reports and relevant Governmental publication of Mokokchung, Nagaland and India, articles in journals, Periodical, news magazine, newspaper and books, primary source material were being collected. The data collected from various sources has been systematically processed, classified and computed, some of which shall be in drawing representative maps and charts.

b) Secondary Methods:

1. Satellite Imagery Interpretation on land use pattern of Mokokchung District.
2. Central and State Government Reports, articles and information from journals,newspaper, magazines, books, etc for land utilization, environmental management and relevant information such as the occupational structure of the people, demand and supply of the agricultural and forest products.

3. Land use/ land cover Data from satellite imagery.

c) Sample Survey:

Out of the total 105 inhibited village of the district, 10 (ten) villages were selected at random. Out of these ten villages, 20 per cent of the total households from each village was assessed.

d) Data analysis:

The data collected were thoroughly checked, assessed, tabulated and cross examined using appropriate statistical tools and technique, viz, regression, contingent valuation method, etc.

1.5 Study Area

The area of study was concentrated in Mokokchung District, Nagaland. The district comprises of 8 circles, 6 ranges and 105 inhabited villages. The total population of the district (2011Census) was 1,94,622 persons of which 1,38,897 persons constitute the rural share showing the rural character of the district. It has a geographical area of 1615 Sq.Km with an average density of 120 persons per Sq. Km.

1.6 Statement of Problems

Over the past century, human environment research has engaged both agency and structure in order to understand various problems involving the interaction between nature and society. The interaction between the Naga tribes and their environment is inseparable since time immemorial. Traditionally the people heavily depended upon the forests and their environment which offered a multiplicity of options. Nevertheless, nature was able to cope with whatever damages inflicted on it as there was enough time to restore. As such man did not have any concern to conserve and manage their natural environment. However, due to technological and economic advancementand man with little knowledge about the consequences of the later, blinded by the material development and greed, mankind today faces the worst environmental crisis by his own activities.

The unprecedented growth of population and technological development in the district is giving immense pressure on the natural environment. The land is far more affected due to rapid deforestation which is a direct effect of shifting cultivation and logging. Since larger area of forest is owned by a n individual and village communities, the depletion of land is

increasing. Land is seriously affected by agricultural activities as most of the peopledependent on agriculture is involved in traditional methods of cultivationas there is no substitute and introducing of alternative practices is less as majority of the land cover is hilly. Since the district is steeped sloped, top soil erosion is another environmental problem as all the Jhumming areas are concentrated in the river catchments. Besides, the narrowing down of Jhum cycle has its adverse effects on the overall ecosystem in the district. The rapid growth of population and unplanned urban development is another factor, creating land degradationand environmental problem. It has been observed that during the late 1970's and early 1980's the per capita availability of land and water in Mokokchung district was found to be declining. Further serious problem is arising due to various factors such as declining of man-land ration, increasing intensity of land use, changes of land use according to the changing needs of man resulting in land degradation and soil erosion. The present environmental degradation are likely to increase in future making more complicated in days to come as there is no definite planning of land use and environmental policies in the district. It is therefore, necessary that our planning strategies should aim at ensuring the maintenance of land use pattern for sustainable economic development and conservation of the environment in the district.

1.7 Significance of Study

The findings of the study will be useful for the government in framing suitable and rationale land use and environmental policies for the state, which will help, promote sustainable economic development and environmental restoration and conservation. It will also be relevant in understanding the role of communal ownership in the utilization of land

and choosing of suitable land for a particular purpose such as cropland, pasture land, woodland, recreation land, etc.

1.8 Review of Literature

The term Land Use refers to "a set of human activities that exploits the varied resources offered by the biological features of land cover. All human activities require land resources of horizontal space and vertical support. William B Meyer (1999). Land use determines on the one hand, land cover to a large extent, which is determined by physical, socio-economic and institutional factor. On the other hand, land use pattern reflects human interaction with nature and environment. Even the very act of land use change can have systematic effects on environment and physical condition of a region. To Freeman (1968) "land use isthe surface utilization of all developed and vacant land on a specific point, at a given time and space..."Land use is also related to conversion of land from one major use to another general use, (Nanavati. 1959). Land use planning is basically concerned with the location, intensity and amount of land development required for various uses of space, functioning of the city, ex. Industry, wholesaling, business, housing, recreation, education, religious and cultural activities of the people (Chapin, 1957, XIV).

Land use as Vink (1975) defines as "any kind of permanent or cycle of human interaction to satisfy human needs either natural or both from the complex of natural and artificial resources which together are called land."

Land use for any activities to support life is the main occupation of the people, this is largely due to lack of alternative source of livelihood. However , the unfavourable hilly topography offers poor farming and use of advanced machines.

Land is the most important asset of the Nagas. The Naga-tribal concept of land is basically based on the wholeness of life. It is based on the tribal view of 'God self-world relationship'. For the Nagas, the land is associated with their life. The land is the source of their life and it is part of their lives itself. The land system is based on the community ownership. Jhum cultivation or otherwise called shifting cultivation is an age old practices deeply rooted in the cultural life of the Nagas.

John and Nancy (1998) focus on the economic principles surrounding the efficient use of land as a natural resources, determination of the value of land, and the different types of ownership of land effects land use and value.

Borthakur (1992) gives a comprehensive account of agriculture in the North East Region of India in its totality, which provides valuable insight into the resource endowment of water,soil fertility and diversity of flora and fauna of the region and provides guidelines for management and conservation measures based on long years of scientific research experience in the field, which is of great importance for overall development of the region. In Dutta (Ed 1986) land use patterns in North East India, draws light on land and economic development, problems and prospects of better utilization of land, better cropping pattern and agricultural land use, improved land use system for live stock production in the region

The primitive technique of land utilization in jhumming with short jhum cycle is highly uneconomical and cause extensive resource depletion and wide spread land and environmental degradation (RamaKrishnan, 1990). The area is placed under severe threat of soil erosion and de-forestations mainly due to shifting cultivation (Singh and Singh, 1981). In the hilly tracts of the North East India jhumming is the dominant economic activity. Over 86% of the people living in the hills are dependent on shifting cultivation (Wagh, et al 1984)

have viewed that the land resource for agricultural activities should be assessed on the basis of slope, dissection index, soil and vegetation cover and land use of a land at micro level.

According to official sources 44 lakhs tones of fertile soil is lost every year from areas where jhum cultivation is practiced in Nagaland. It has been estimated that 70 per cent of the total top soil and water resource degradation in Nagaland was due to jhum cultivation (The Hindu, 1998). The faulty land use pattern, population pressure, unscientific development activities, large scale de-forestations and agricultural practices on steep slopes are major cause of soil erosion and land degradation (Toky and RamaKhrishnan, 1981). Forest degradation, environmental management and sustainable development of mountain ecosystem have increasingly become the focus of scientific interest in recent years. Of the 2.55 lakhs Sq.Km area of the North Eastern Region, more than 80 per cent of the region is mountainous, which harbours a network of watershed (Gopala Krishnan, 1991). The wealth of the mountains in terms of natural resource and environment is immense and offer vast scope for development(Goldsmith, 2001). Slash and burn agriculture/shifting cultivation has been a major life sustaining activity form majority of the people (Ramakrishnan, 1992).

Vashum R. (2003) elaborated that the North East Region of India requires genuine and sustainable development including socio-cultural, economic, human resource, education system, trade and commerce, science and technology, power sector, transport system, tourism, environment, agriculture, forestry, etc.

Das(1990) point out 'Land use as extremely complex pattern, falling into different types. This complex land use pattern is the result of centuries of human settlement representing the interaction of physical, historical, social and economic factors'. Such a vital

resource needs to be used in a meticulously planned way in complete harmony with various components of land. 'Unscientific and unplanned or ill planned use of land are fast resulting into its grossmisuse which , if not arrested in time, may lead to systematic and secular low-cost of human being' (N.C. Muindar)

(Hussian, Z. 1996) elaborated that the North Eastern Region of India is prone to a number of environmental degradation and needs immediate conservation measures. Degradation of the environment is no new problem: large-scale irrigation causing salination of agricultural land contributed to the decline of Mesopotamian civilization,Glasbergen and Blowers (1995). As environmental degradation and change continues, decision makers and managers feel significant pressure to rectify the situation. Scientists, in turn find themselves under pressure to set out simple and clear rules for proper ecosystem managements, Kay and Schneider (1994).In such circumstances, it is important to search for an alternative land use technique which may prove to be more sustainable and more advantages for the well-being of the environment.

Land use survey is done to classify land according to the utilization made of it. With the increase in population and development of technology there is much demand of land which is finite in character. Consequently, various economic activities compete for the demand of land. Land use studies has been more commonly carried out in the past in rural areas, but now there is enough stress on urban land use studies. Land surveys may be conducted either by (i) Proximate Sensing Technique (ii) Remote Sensing Technique. (Hussian, M. 1996)

Land use changes according to the changing needs of need of man. It is essential to analyse the relationship between various uses of land and land use planning. Land use is determined by natural conditions and human intervention. Land use planning is the process ofevaluating present patterns of land use, other physical, social and economic conditions for the purpose of selecting and adopting the kinds of land use best calculated to optimise production and development on a sustained basis. Land use planning may be at the national, regional, state, district, sub-division, block or village level. Land use planning may also be based on a natural hydrological unit of a catchment of a river or watershed, sub-watershed and at the farm level. Land use planning entails bringing together a wide array of data including socio-economic surveys, soil and land use surveys, remote sensed imagery and aerial photo interpretations and extension services and integrating them systematically for developing integrated watershed management plans (K.S.Puri, 1992).

Arthor Young (1770) in his monumental work environment and cropping pattern opines that temperature, rainfall and soil are the major determinants of cropping pattern of a region Von Thunen was the first scholar who prepared a spatial model of agriculture use and cropping intensity in 1926. He states that prices of farm products control agricultural production on any plot of land.

Agriculture is the most significant class of land use in terms of land and population involved. The land policy cannot be created without first defining the broad agricultural strategy. India would have to improve the productivity of agricultural land. The present average all-India productivity per hectare is among the lowest in most crops in Asia. It is also crucial to reduce the number of persons engaged in the agriculture sector and to use the man

power released from it in the manufacturing and services sectors with suitable training. It is vital to provide the farmers long term security of land for cultivation, incentive to produce more and suitable marketing for agricultural products. Often conflicts within agricultural land itself arise between the use of land for cash crops and food crops. The growth of population and the resultant needs make the conflict of land use more serious.

In India prime agricultural land is being destroyed by urban expansion and the growth of industries. The absence of rigorous environmental planning in the last four decades has allowed the cities and towns to spread out in a disorderly way. The expansion of urban and industrial areas has occurred at the expense of market gardening, activities on prime agricultural lands occurred at the periphery of cities and towns. Land, it should be admitted that, is of great necessity, for a variety of non-agricultural uses. Large good land is being rapidly encroached upon and eventually lost to non-agricultural uses, i.e. urbanisation, road, brick kilns, airports, railways tracks, dams, etc. The national land policy must aim at saving as far as possible the high productivity lands for agricultural uses. The urban expansion and new satellite towns should be restricted to the marginal lands (K.S Puri, 1992).

Next to agriculture, forests including biosphere Reserves and wild life sanctuaries and pastures utilise the most land. The Union Ministry of Environment and forests (MoEF) has reached the first milestone of its ministerial exercise; 'Defining forest in Indian context'. At two day meeting held on April 30th - May 1st, 2007, the Ashoka Trust for Research in Ecology and the Environment (ATREE), a consultant to the ministry for this project, proposed a definition of a forest that already promises to add new potholes in the already – bumpy road of forest management. This is the definition; "An area under Government control

notified or recorded as 'forest' under any Act, for conservation and management of ecological and biological resources", Down to earth (2007).

Forests play a significant role and provide a wide choice for an independent spirited Naga to wander in forest, fishing, hunting and gathering. This indicates that the first major area of dependence on forest is food. It takes the form of shifting cultivation, fruits and flowers from trees and plants, animals and other livestock. The Nagas depends on other forest produce for medicines fodder, house building and implements, Deori.P (2005). As many 500 million kinds of plant, animal and micro-organism have made this planet home since life began over 3.4 billion years ago. Today, there are only 5 million to 10 million species alive – we do not know exactly how many, because there are many biologically uncharted areas such as the tropical rain forests, where some estimate that over 90 per cent of the living organisms remain unclassified. Thus, since life began, about 490 million species have become extinct. Extinction has been the density of a great number of plant species including several unique and irreplaceable varieties. Some of these have disappeared from the earth in nature's own process of evolutionary alteration. Even in respect of familiar species in many cases, little more is known than their appearance and location, Sinha (1996). But for many others, extinction has been caused by man because of his inadvertence as well as ignorance about their economic potential and ecological functions. Hunting and trapping of wildlife is considered to be one of the main reason for decreasing fauna diversity in the state. The evolutionary and cultural development of humans has been shaped by their dependence on other animals, Eltringham (1984). Hunting by primitive humans may have caused extinctions of many large mammals and birds, Bolen. G.E. and Robinson. L.W. (1998). Each man was a hunter in early human cultures. Mitchell (1982) stated that, "Even more than hunting,

trapping has been the subject of heated controversy for the past two or three decades[22]. Forest in India today are pitifully scanty. This has had a very serious adverse affect on wild life and birds and many species have become extinct in the last 40 years K.S.Puri (1992). Depleted forests are no longer yielding forest products as they did 50 years ago. Forestry and forest based industries can no longer earn and save enough foreign exchange. Besides being one of the causes of depressed economy, low density forests cause greater soil erosion and runoff during the heavy monsoon rains. As a result, the incidence of flood and drought and unexpected environmental disaster has increased in recent years. The destruction of forests has affected adversely the food and shelter for wild life and birds and recreational facilities for the public.

Clive (1989) points out that conventional agriculture has caused economic problems associated with over production of crops; increased costs of energy-based inputs and decreased farm incomes. It has also produced ecological problems such as poor ecological diversity, soil and water pollution and soil erosion. Rengma (2001) have concluded that deforestation and ecological degradation have resulted in negative impacts on the climate as well as the tribal society and economy. All must come together in safe guarding the threatened and endangered natural forests.

Human population has important influence on land use and the availability of space for food production and habitat for other species. Meadows, D (Ed 1972) states that population growth may lead to land degradation and retard agricultural growth if markets are inefficient and distorted and the technical and substitution responses lagged significantly behind population growth. Saxena (1999) stated that, the increasing human population and

the rising level of technology both have become significant factors in the variations in world climate and are responsible for the various changes in atmospheric conditions as well as of air pollution. The problem of environmental degradation is related to the self governing nature of the ecosystem. This basic property ensures its stability and continued activity, helps to defines both the process of ecological degradation and the nature of its inducing agencies. We can define ecological or environmental degradation as a process, which so stresses on ecosystem as to reduce its capability for self-adjustment and which therefore, if continued, can impose on irreversible stress on the system and cause it to collapse, Srivastav, N.(1992). Serious degradation of loss of watershed forests in particular has a wide range of major ecological and economic effects through increased erosion, floods, and silting of hydroelectric facilities, irrigation systems reservoir and harbours. The lives and livelihood of the world's population depend directly on the wise management of watershed forests and eco-systems, Trivedi (1992).

According to Commoner (1971) 'the growth rates of a large number of economic activities and developments in technology have promoted a variety of products and processes whose environmental impact are singularly noxious. Environmental impact is the function fro growth of population, technology of production and per capita production". Clawson (1972) agree that over the time, total population, economic output per capita, techniques of resource conversion and utilization and other factors may change. Nathawal (1988) has stated that the exploitative relationship between technology and environment has been responsible for the socio-political pattern emerging in the modern world.

According to 1997 study conducted by the World Resource Institute, only about 20 per cent of the world's original forests remain as large, relatively unbroken, natural

ecosystem. The most recent document, the Forest Resource Assessment 2000(FRA 2000), reports that total forest cover declined about 90 million hectares (222 million acres) or about 2 per cent to about 3.9 billion hectares (9.6 billion acres) during the 1990s. Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives. Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations and assist in implementing national and sub-national environmental policies. As the level of governance is close to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development, United Nations (1992).

Huntington described that increasing population causes change in the pattern of land use, according to Stamp, soil climate and land set most stringent limitations the economic restrains over the overall pattern of land utilization by people in any specific area. Boserup (1965) and Hanshell (1966) treated population as an independent factor in changing the land resource utilization particularly the agricultural land use, whereas Shaji (1967) enumerated that the increasing pressure of population is mainly responsible for changes in the cropping pattern.

While discussing population and resources development P. Sen Gupta (1970) suggested that urbanization played a vital role in changing crop pattern in rural areas. Gosal G.S. (1970) rightly suggested that continuously improving agriculture yields alone cannot provide lasting solution to the problem of population and as such agriculture need to be diversified.

Kelly (1983) opines, "Shifting cultivation works well where the ratio of land to people is high" so that land can be left fallow long enough for natural regeneration of fertility. But in the present context, the chief problem with shifting cultivation is that increasing population and the need for more food to feed them are pressuring farmer to shorten or even eliminate the follow. As a consequence, yields are lower and soil damage is greater. She further argues that only private ownership made the peasants to care about sustainability of the farming method.

Jolly and Torrey (1993) opine that in many societies "Population growth is most likely to result in degradation when land is held in common without rules government its access". On the contrary, Jodha (1989), Shukla (1999) from their studies conducted in different parts of India, show that increased population along with changes in market relation and land privatization have led to decline in common property resources, increased pressure on land, dwindling communal management which precipitated land degradation. They suggest that, privatization may be acceptable solution only when people are willing to invest private land for wasteland reclamation and regeneration.

The success or failure to achieve an efficient allocation of resources system, which ensures sustainable development, depends upon the existing institutional framework of ownership rights that directs and control the uses of land resources for production and consumption Perman and Yuema, (1996). It has been seen that secure tenurial encourages farmers to practice sustainable land management, whereas the absence of any land rights only promotes short-term exploitation and subsequent land degradation.

Brandon and Ramankutty (1993) states that in India there is strong evidence that

when land is owned by the farmers, land prices reflect conversation efforts thus providing a real incentive for sustainable management.

Thomson et al (1992) based on the Thailand ease where the tendency is to increase the privatization of land and the security of private security of private tenure of land supported the evolution of private property rights by stating that, "the cause of organizing the collective management are extremely high and its effectiveness is problematic." Property rights have a significant bearing on resource use and environment. On Indian economies (1916) saw a two-way relationship between institutional structure and economic backwardness. The author considered 'institutionalism' to be the key for the development of an Indian political economy.

Kama (1990) opines that agricultural backwardness of the North Eastern Region could be partly be attributed to unproductive agrarian relation and lack of other institutional support system. Shaban (1987) finds that the output and input intensity per hectare were both significantly higher on the owned plot than on the share cropped-plots in India. In other words, insecure land ownership is inefficient. It is supported by Stanfield (1985) who opines that efficiency in land use is much tied up factor in the institutional framework around a given set of property rights as it is in the institution of property itself.

Deacon (1990) in his work highlights the importance of security of ownership of land and consequent effect on incentives to invest and conserve and the role of government in controlling the system. Hardin (1968) in his paper on the tragedy of the common advocates that communal management or commonage will invariably lead to resource degradation as it is in each individuals benefit to maximize his or her own returns at the cost of the group.

The FAO (1978) described shifting cultivation as cultivation involving the removal and burning the vegetation to create non-permanent clearings which are fallowed the bush or forest for varying lengths of time, but also includes the temporary removal of vegetation for pasturage or other purposes of livelihood". Chaturvedi and Uppal (1953) states... the correct approach to the problem of shifting cultivation lies in accepting it not as a social evil but recognizing it as a way of life... regarding it as an agricultural practice evolved as a reflex to the physiographic characteristic of the land.

"Effort to substitute this system in India have been going on for almost a century; says P.S Ramakrishnan, professor of ecology at the school of Environmental Science, Jawaharlal Nehru University, New Delhi, one of the very few scientists who have studied shifting cultivation in the Northeast. He says Jhum, is not intrinsically irrational. In 1975 Indian Council of Agriculture Research (ICAR) set up 'alternative farming systems to replace Jhumming' programme in Meghalaya in an effort to substitute this system. There hasn't been any success worth talking about. The result has been negligible as compared to the ability of agriculture scientists posted in the region and the large among of money spent. Even scientists acknowledge that the best Indian Scientists from different backgrounds were posted in the region. Perhaps Jhum needs to be studied more closely before it is condemned and replaced. According to Prakash D. (2005), the rotational period for Jhum cycle in past used to be in range of 15-20 years, but with the passage of time on account of ever increasing pressure on the land, the rotational period of Jhum cycle has reduced considerably. Now, the average Jhum cycle is reported to be 4-8 years only. In some areas even in Nagaland, like Dimapur, it has reduced to as low as 6-5 years as a result, the productivity of the land has

decreased considerably. Not only that, it has adversely affected the supply of fuel wood to our kitchen. Besides this, the diversity is on down slide and availability of various useful plants has also decreased considerably. Man has been tempering with ecosphere for a very long time and as an animal modifies its environment consciously. The great transformation occurred when man learned to convert forests into farms and to breed domesticated varieties of plants and animals. With the passage of time, settled civilizations altered the ecology of the entire continents. Not all the environment changes engineered by man have been for the worse, like enormous increase in food production and desert and hills made habitable. But, in the last few generations, mankind's propensity to change his environment has itself been transformed. The power to use and adopt has become the power to destroy abruptly, Commoner (1970).

Water and water resources for irrigation, power generation, drinking purposes,domestic use, industrial use, navigation, inland fisheries, small surface storage and ground water total a large area of land. A lot of agricultural valley land and forests have been submerged by the major and multi-purpose reservoirs built for utilising water resources. Generally a substantial human and animal population is displaced by these projects and alternate land has to be found for their rehabilitation. This is not an easy task. Many of the displaced persons and villagers in the multi-purpose projects were given no land and compensation was not given as promised and was left with no choice but to secure for themselves. Displacing the population leads to social and cultural problems and similar problems will be faced if such multi-propose project and development are taken up in future.

Prasad (1988) states that shifting is the most widely practiced food production and use of land system in the North Eastern hill Region, steep slopes are selected, forest

vegetation is cut, burnt and large number of crops are sown in mixture. The system in the present context has become not only counterproductive but hazardous to the environment. The reckless cutting of trees, clearance of forests for agriculture or habitations, the extinction of many plants, wild life species and fresh water fish are causing degradation of land and ecological imbalance. Cultivation on steep slopes without regard for soil loss has resulted in severe erosion. The practice of shifting cultivation on a reduced cycle in northeast India and in tribal belts has accelerated soil erosion. Dumping chemical wastes in streams has destroyed fish and reduced the value of water. Without government policies that consider both the interests of the farmers and society as a whole, land degradation will intensify as population increases (K.S.Puri).

There is a great need to create awareness for sustained land use to raise farm output. Sustainable agriculture will comprise a range of strategies for tackling a variety of problems including the serious crisis in the utilisation of natural resources, soil erosion and land degradation, loss of soil productivity, and decreasing farm incomes. Practices that improve soil structure as well as productivity such as nutrient cycling, use of large dressings of organic manure, green manuring, leaf fall and ploughing back into the land the unwanted residue of previous crops, and biological control systems are required as urgently as the increased use of chemical fertilisers. Sustained land use involves changes in pattern of crops so that they are more suited to local soil and climatic conditions like variability of rainfall and

workability of soils. Cultivation hedge grows and greater use of renewable energy sources

also helps sustainable land useK.S.Puri(1992).

The environmental problems in India are essentially a problem of resource use and

management. Recent ecological changes affecting the Indian environment are the result of a combination of natural and anthropogenic factors. The human impact mainly takes the form of overgrazing, over cultivation, overbearing of woodlands and overuse of resources. The anthropogenic factors include technogenic activities i.e. forestry, mining, transport, industry, urbanization and tourism, Singh (1987). In 1950, many of the Earth's ecosystem had been altered by human intervention, but by the end of the century, almost every ecosystem was either degraded or seriously threatened.The implementation of various environmental laws and policies in international and national level is very essential for successful management and mitigation of the environmental degradation. Hare (1970) stated that, environmental management is concerned with the man-environment interface, that complex boundary where bio-physical and socio-cultural systems interact. The initiative for managing environmental sound development will depend greatly on the extent of cooperation that can be achieved between Government (Central, State, Local), its subsidiary groups, voluntary agencies, financial institutions, corporate group in public and private sections, educational and research bodies, professional societies, religious and cultural institute, Plan (1985).Hence to mitigate and manage the environment the state of the environment reporting came into being during the late 1980s, following recognition that monitoring or tracking of progress was needed if sustainable development was to be achieved.

The sustainable utilization of resources would help safe guard the environment to meet the needs of the people through the development of natural systems that includes land, water, fisheries, agriculture, and industrial development, Kayastha (1982). Environmental management is "a process of planning, review, assessment, decision making and the like

which is essential in the real life situation of limited resources and changing priorities", Saxena (1999). The images of rapid environmental destruction in the late twentieth century were numerous, and information technology made possible a degree of accuracy in gathering them and an extent of dissemination that made an unprecedented impression on human consciousness. The last half of the twentieth century saw a remarkable expansion of knowledge about the workings of the biosphere, but at the same time activities that damaged the biosphere had been accelerated faster than ever before.

CHAPTER: 2

GEOGRAPHICAL FRAMEWORK OF MOKOKCHUNG DISTRICT

CHAPTER:2 – GEOGRAPHICAL FRAMEWORK OF MOKOKCHUNG DISTRICT

2.1 Introduction

Nagaland is the sixteenth state of the Indian Union and is the homeland of the Naga tribes of the Northeast of India located between 25°6' N and 27°4'N latitude and 93°20'E and 95°15'E longitude having a geographical area of 16,579 Sq.km. The state comprises mostly of high hills in the far north-eastern corner of India, bounded by Myanmar and the state of Arunachal Pradesh in the east and the state of Assam in the west and North and Manipur in the south. The state has a geographical area of 16,579 km^2 out of which Mokokchung district has an area of 1,615 Sq.km with an average density of 120 persons per Sq.km which is inhabited by the Ao-Naga tribes. In accordance with the legends and traditions says that the Aos sprung up from 'Longtrok' which means 'Six Stones'. They then founded the Chungliyimti village where they settled and stayed for a considerable period of time. It is the starting point of the different aspects of development of Ao-culture. In due course of time, they crossed the Dikhu River by a cane bridge leaving other people behind. The people(Aos) who went ahead leaving others behind came to be known as 'Aoer or Ao' which means 'going or gone'. First they occupied a place named as 'Soyim' (Ungma) under Ongpangkong range which is the southernmost range and also the highest altitude of all the ranges. In due course of time, from there they have migrated to different places and gradually as population grew it eventually spread out to different places establishing different villages. The Aos belong to three dialectal different groups namely Chungli, Mongsen and Changki and most comparatively among the well developed districts in Nagaland.

Before the coming of the Britishers the present site of the Mokokchung was a thick forest. The British administrative Headquarters was established there since February 28th

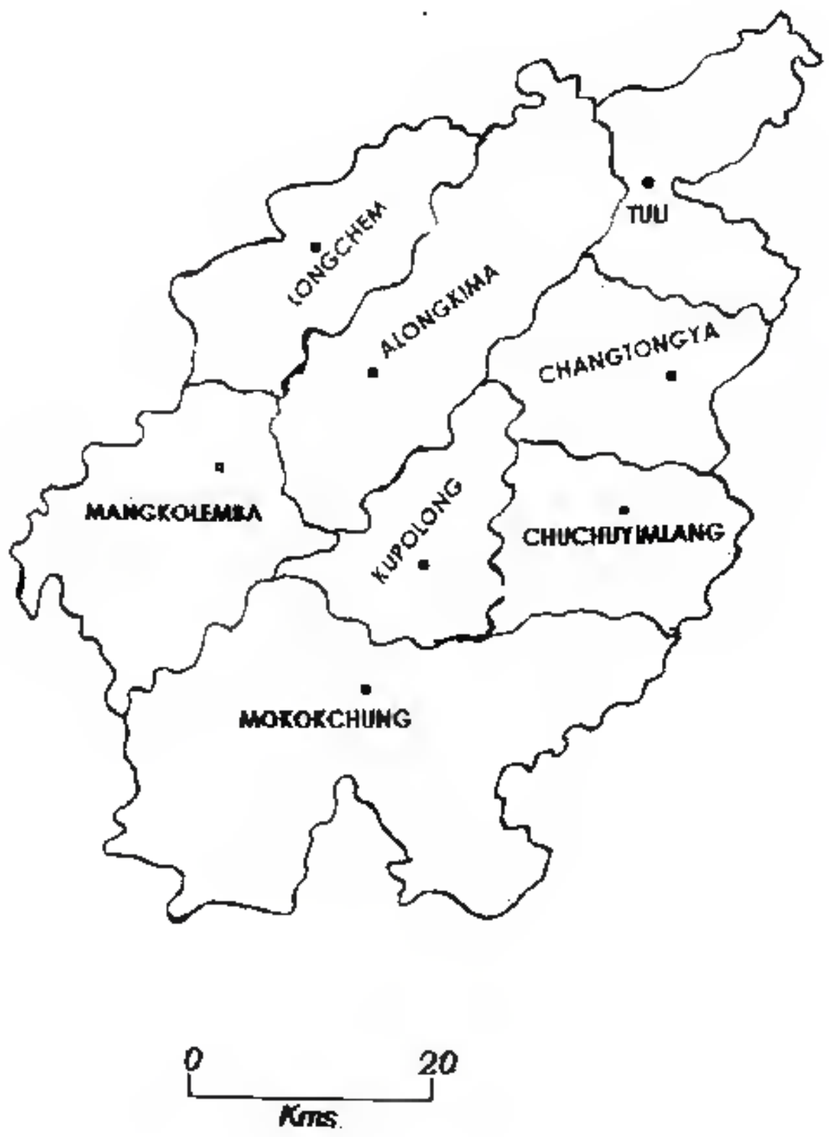
1890 as a Sub-Divisional headquarters till the formation of Naga Hills Tuensang Area (NHTA). On 1st December 1957 when it become a district of NHTA it remained a district even after Nagaland attained its statehood in 1963 with Wokha and Zunheboto as its sub-divisions. Later in 1973, it was demarcated into three districts namely-Mokokchung, Wokha and Zunheboto. The district lies between 93°53' and 94°53' East Longitude and 25°56' and 27°40' North Latitude. It is bounded by Assam in the north, Wokha district in the west,Tuensang and Longleng districts in the East and Zunheboto district to the south (Fig. 2.3). It comprises of 8 (eight) circles i.e. Longchem, Alongkima, Tuli, Changtongya, Chuchuyimlang, Kobulong, Mangkolemba and Ongpangkong and with (six) ranges-Ongpangkong, Langpangkong, Asetkong, Japukong, Tzurangkong and Changkikongranges which is inhabited by 105 villages (2011 census). The total population of the district was 1,94,622 (2011 census) of which there was a change of -16.77% in the population compared to population as per 2001. Having a sex ratio of 925 females for every 1000 males and a literacy rate of 92.68% with rural population comprises of 1,38,897 followed by urban 55,725 (2011 census).

North East Region in India

MOKOKCHUNG DISTRICT

Nagaland in the North East

MOKOKCHUNG DISTRICT IN NAGALAND



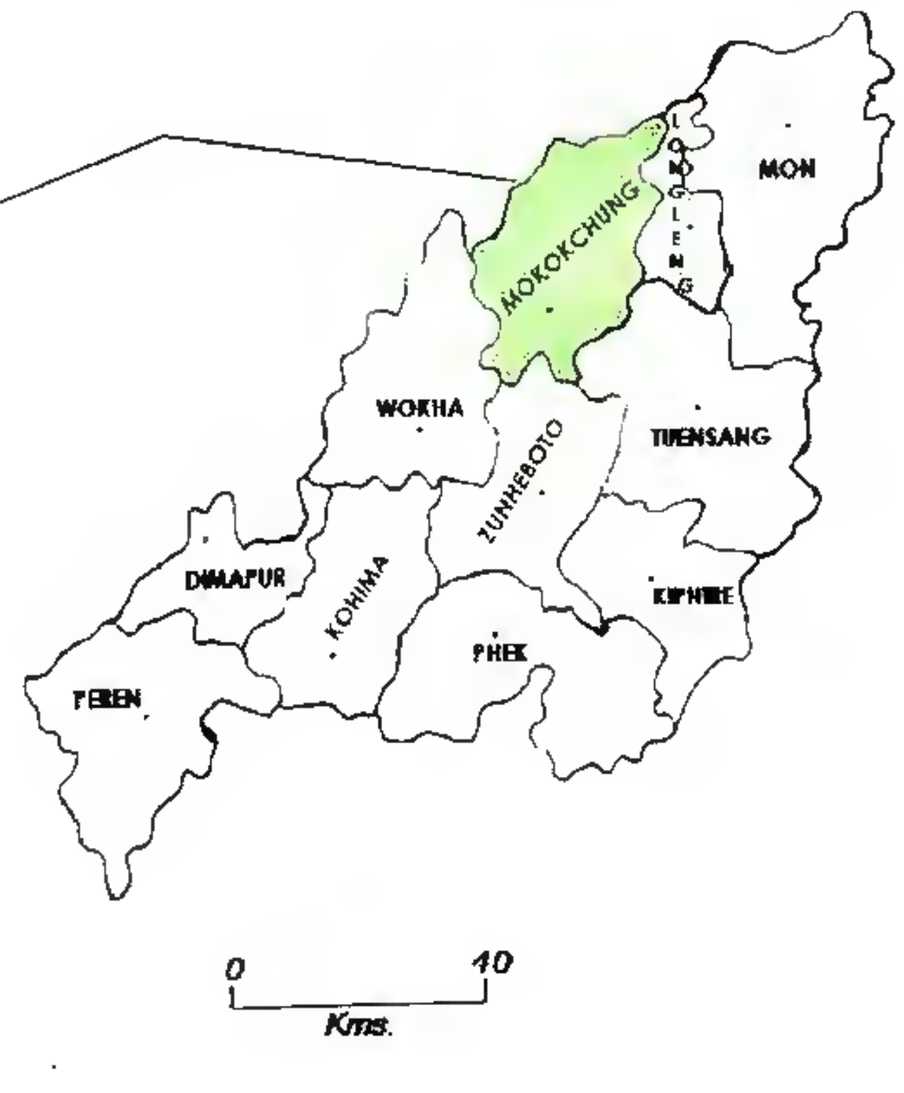


Fig. 2.1 Location Map of the study Area viz. Mokokchung District of Nagaland

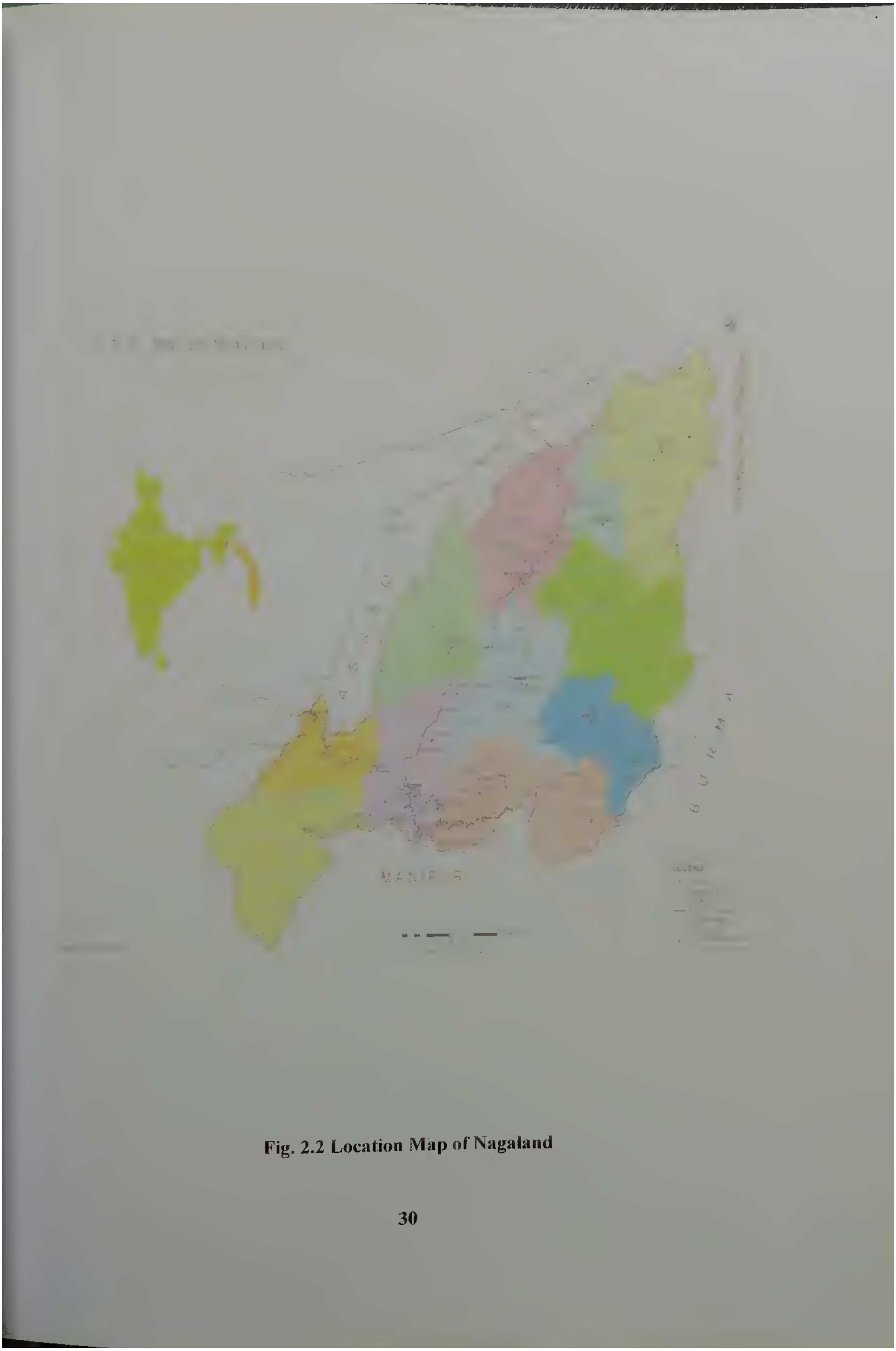


Fig. 2.2 Location Map of Nagaland

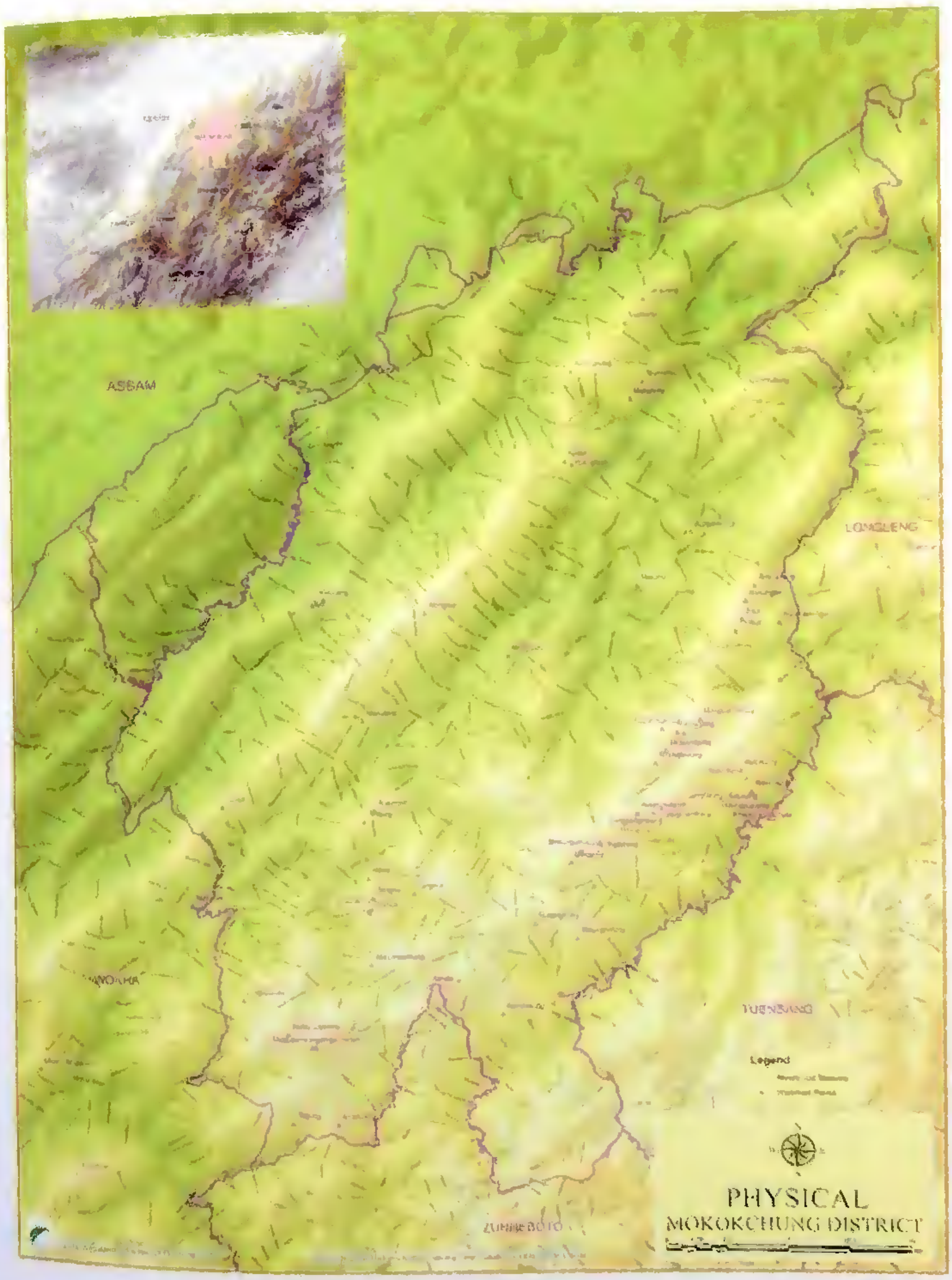
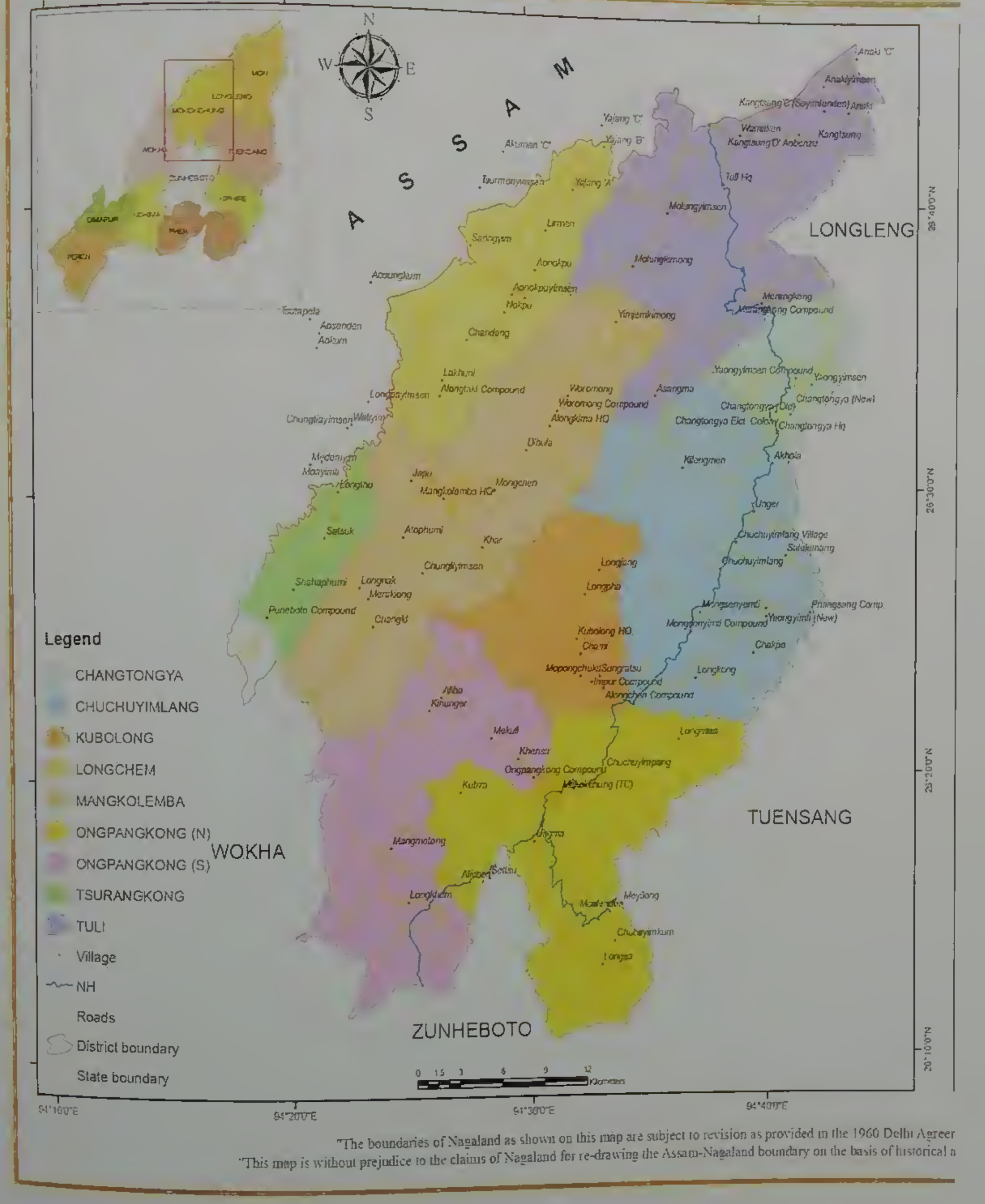


Fig.2.3 Physical Map of Mokokchung



"The boundaries of Nagaland as shown on this map are subject to revision as provided in the 1960 Delhi Agreer
"This map is without prejudice to the claims of Nagaland for re-drawing the Assam-Nagaland boundary on the basis of historical n

Fig. 2.4 Map of Mokokchung District showing eight circles

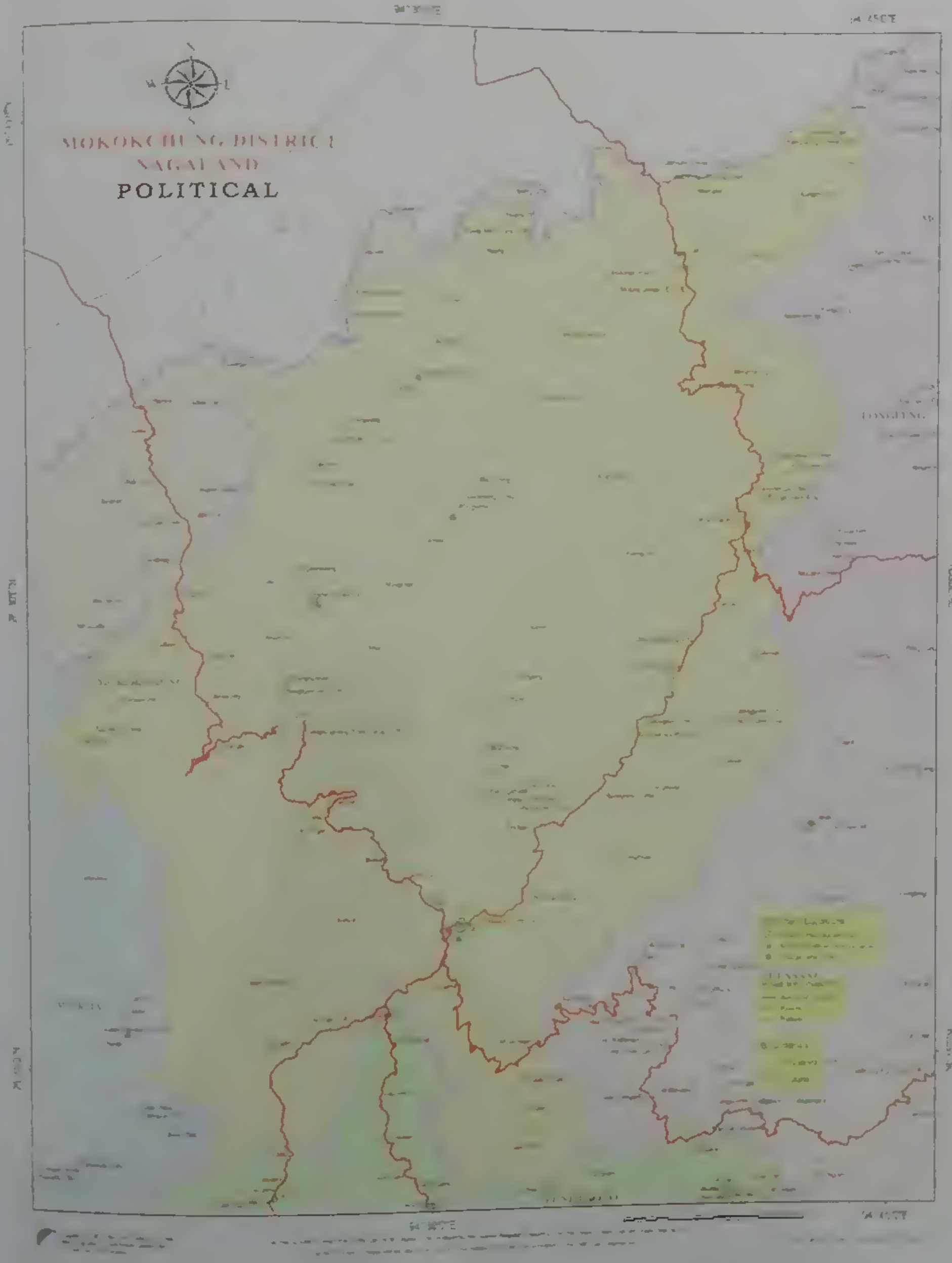


Fig. 2.5. Political Map of Mokokchung District

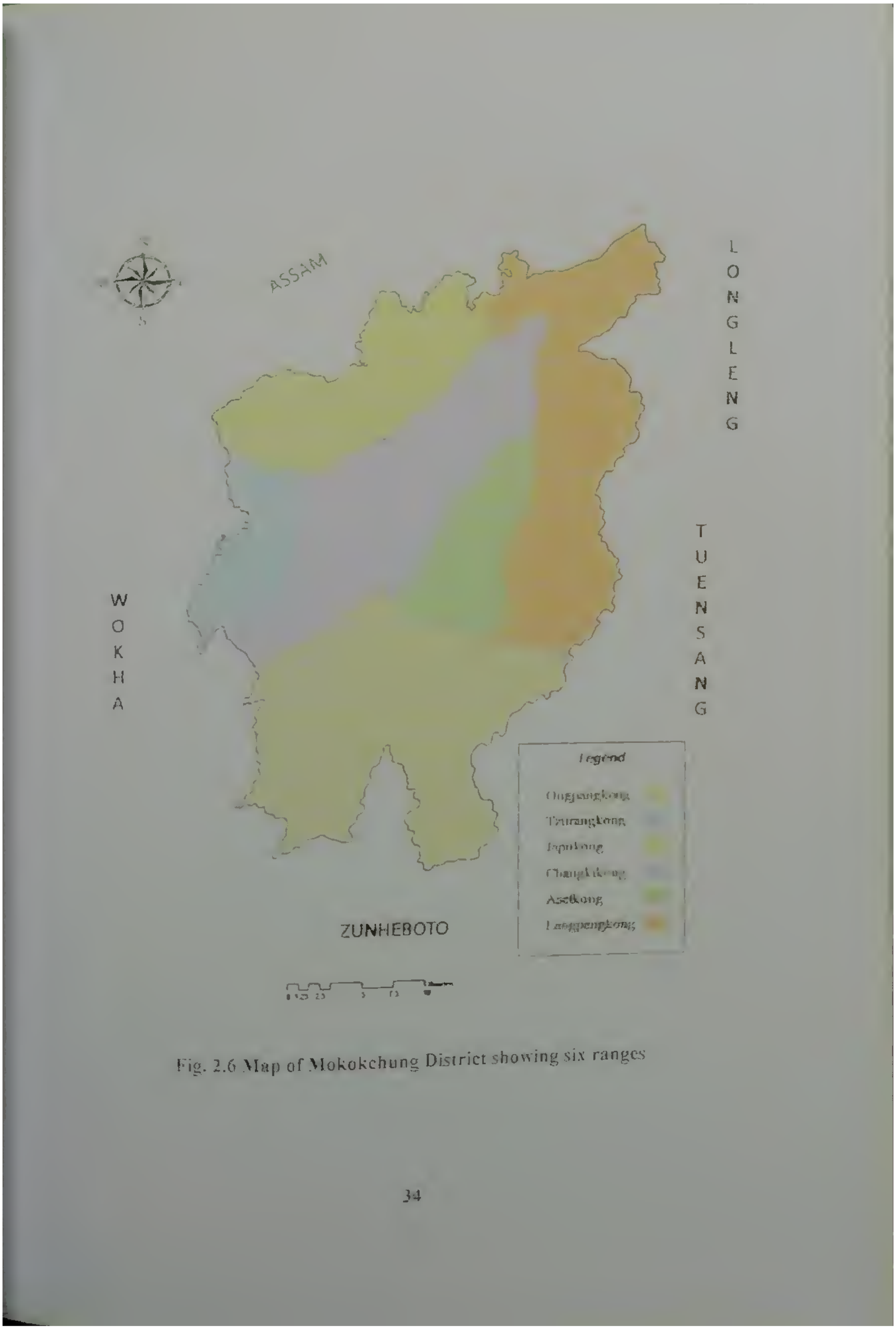


Fig. 2.6 Map of Mokokchung District showing six ranges

2.2 Physiography

The State of Nagaland is mostly hilly terrainexcept a narrow strip of land bodering Assam, interspersed with scattered small valleys on the western and north western flank. However, Mokokchung district is less elevated as compared to other districts. The elevation of the district varies between 800 to 2000 feet above sea level.It is a part of Naga Hills which are dismembered branch of Eastern Himalayas. The region is situated in the hills and has got a number of mountain ranges coupled with sharp crust ridges and narrow valleys with few plain lands. It spread out mostly from north- east and south-west. The ranges are higher on the east than in the west where they merge with the plains of Assam. Between the ranges there are glens and gorges through which streams flow. Out of 1,615 Sq.km nearly half portion of the area is having elevations which were formed cutting through soft and loose geological strata cause by the heavy rains resulting into numerous gorges like valleys. Within the district Milak and Tsurang Rivers with their tributaries flows down the downstream leading to the formation of fertile flood plains i.e. Changki, Tuli and Bhaghty valleys having an average width varies from 1 -2 miles.

The river valleys of Tsurang, Milak and Dikhu on the south eastern sides are steeper compared to the North-western sides. Numbers of perennial streams flow through the district before joining the Brahmaputra River. The district is agriculturally and industrially among the most progressive districts in the State along with Kohima and Dimapur. The major agricultural regions cultivating Jhum cultivation is located in the hilly slope areas being cultivated in different ranges with the maximum cultivators under Ongpangkong range. The terrace cultivation is cultivated in the low-lying areas of Changki-Longnak, Tsurang, Milak

and Dikhu valley regions. Tuli-Milak and Changki-Longnak valleys are also the major small industrial areas. The physiography of the district shows parallel ranges basing on different climate, soil, terrain and characteristics of different vegetation. The six ranges under the district are Ongpangkong, Langpangkong, Asetkong, Changkikong, Japukong and Tzurangkong ranges (Fig 2.6).

1. Ongpangkong Range

It is the highest altitude and also the southernmost range which is bounded by Sema and Lotha on the south and Sangtams on the east. It has an average altitude of 1500 msl having types of vegetations varies from evergreen forest to mixed deciduous forest types. It present, the range consists of 17 villages by having a population of 85,667 (2011). The range has a large tract of virgin forests and forest by adopting ***'Community Reserved Forests'***.

2. Langpangkong Range

It is the eastern most range and the terrain is spread out like a bed. The range dodging with the course of Dikhu River by forming a natural boundary line between Tuensang and Mon districts. It has a totalpopulation of 22, 44 (2011) with 18 villages. National Highway No: 61 stretch through the entire length of the range which covers about 85 kms. Large tracts of community biodiversity and forest reserve are located in this range of which '***Kanglutu Biodiversity Reserve***' has 7060 hectares at Changtongya village.

3. Asetkong Range

This range is located between Menung and Milak Rivers and based as the central range of all the ranges. It runs in an east-west direction with range of Langpangkong in the

east, Ongpangkong in the south and Changkikong range in the north-west which resembles an island. Average altitude msl (mean sea level) is 1100 meters above mean sea level which is marked by distinct warm humid, high rainfall, rugged topography and soil types. It has five recognized villages and small stations by having a population of 15,365 (2011).

4. Changkikong Range

It is located between Milak and Tzurang River in the west, which comprises of 09 villages with 7,316 (2011) approximately. The range has a vegetation of mixed deciduous and evergreen forest which has an accessible Reserved Forest covers at Tsurong valley and Kalomang. It is said to be one of the richest spot of biodiversity under the district with the presence of thick forest covers. Geographically, it consists of various mineral resources mainly the deposits of coals in the area.

5. Japukong Range

This range is the outer most range which stretches from the north to east and south to west lying to the interior (south) of Tzurangkong region. It has 18 villages and altitude varies from 150-950 meters msl having an approximate of 70 kms in length. The range enjoys a warm-humid and sub-tropical type with formations of dense and thick forests. Retongkong and ***SatsuTangen*** are some of the well known reserved forests.

6. Tzurangkong Range

The range borders with Assam and stretches about 15 km from Tzurang River to Tzutapela area. It consists of hillocks randomly which adjoins the plains of Assam mostly along the valleys of Desai and Jhanzi Rivers before debouching into Assam plains. Wangtak,

Tangyong, Dzesu are some of the perennial rivers by having a warm and humid climatic conditions.

2.3 Geology

Geologically, Mokokchungdistrict belongs to the Himalayan Orogeny, where the Himalayan mountain system terminated in sharp acute syntaxial bend along Burmese area.[1]Major portion of the district is covered by Disang series (Eocene) and then Barail series (Oligocene) rocks and Tipam series of still younger rocks occur in the areas bordering the plains of Assam. The lower and middle Eocene age is represented by the group of Disang, upper Eocene and Oligocene age by the Barail group, Miocene by Surma and the Tipam group, Miopliocene age by Namsang beds.

The younger rocks belonging to the Tipam series borders the Assam plains. In the foothills of the district tertiary rocks are dispersed in parallel direction like an individualthrust shell within a system of imprecating strike faults as known the ***'Belt of Schupen*** High rocks are found with disturbed being sliced by cross-faults which results into blocks that have pushed southward due to varying degrees of faulting with fine grained sandstones towards the top of the series.

The Disang group of rocks represents the oldest rocks which is made up of splintery hard shales, from grey to dark iron stained shales has been inter-bedded with fine grained sandstones towards the top of the series. The Disang series consists of metamorphosed rocks

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[1] *Development plan of Mokokchung Sub-Division Mokokchung Urban Area (1971-91) pp.3,4*

and the metamorphism increases southwardfrom Mokokchung to Kohima. Along the base of the hill, west of Changtongya village roughly follows the Milak River This series overrides the Barail sandstones in the northeast-southwest along a thrust fault. Rocks of Barail series consists mostly well bedded sandstones with shale intercalations. It is made up of medium grains ferrogeneous sandstone with partings of shale, mudstones and clay marked by thick coal seams. The Surma group presents alternations of shale and sandstones occasionally with conglomerate. The Tipam sandstones crops out a number of northeastern parallel strips within the ***'Belt of Schupen'*** and also as a prominent hill range which is known as the Japukong range.

The upper unit of Tipam group is represented by sandstones, grits with bands of sandy clays and grained clay formation. It covers an area of 'Desai Reserved Forest' which forms a flat-topped low mounds. In Tsurang and Tsurong valleys this clay occupies the low-lying areas below the scrap falls.

The Namsang beds in this area comprise of loosely packed sandstone with fragments of coal cemented sand. A good exposure if found in the northern part around Tuli and Desai valley. Girujan clay formation overlying the Tipam is composed of typical blue and mottled clays and argillaceous sandstone beds. This Girujan clay also occupies the broad Desai River valley, west of Changki coupled with conglomerates grits etc. The Disang series occurs in the district is estimated to be around 54 million years. Majority of the structured units in the area is composed of a number of sub-parallel thrusts arranged in an imbricate manner dipping in a south-easterly direction. The parallel traverse faults have affected the entire sequence resulting in north-westerly shift of Barail coal measures and the overlying Tipam. Sub-parallel minor reversed faults are also observed parallel to the crest of hills which affects the Tipam sandstones.

The entire district which lies close to the most strategic eastern Himalayan syntaxial bend is having evidences of large scale earth movements. As a result prolonged, the hardest strata are exposed and the occurrence of landslides is frequent particularly the road connecting Mokokchung and Mariani (Fig: 2.11). The Amguri-Mokokchung road is less disturbed by landslides except beyond the Tuli region where the upper strata are composed of loose debris of conglomerate. All these diversity of geologic features and process has brought impact on the environment. And this has further been destabilized by prolonged Jhum cultivation which leads to deforestation and loss of soils.

2.4 Climate and Rainfall

The term 'Climate' is an abstract concept which represents the sum total of all the atmospheric phenomenon at a place, over a particular period of time.[2]

The most important among the numerous meteorological elements are precipitation, temperature, relative humidity and evaporation. Weather and climate are the dynamic features of a physical environment. Indian climate forms a part of climatic patterns of South East Asia. Northeast India has been located at 20°N to 29 30'N latitude and 84°46'E to 97°30'E longitudes. It passes the tropic of cancer across the southern part by providing a tropical type of climate. The climate of Nagaland is controlled by its terrain features varying from tropical to temperate conditions. The hill ranges and mountains with the foothills, plains and sheltered valley marked with climatic variations which determines to a great extent in rainfall distribution. Mokokchung district has a sub-tropical humid type of climate while

[2] ***Sushil Kumar Dash, Climate Change: An Indian Perspective (Ahmedabad: Centre for Environment Education, 2007), 10.***

valleys and the lower range adjoining the Assam plains experience a warm climate. The temperature of the district varies from 28°C - 32°C and winter temperature varies from 10°C to 15°C.Temperature in the district varies according to the variation of altitude to different ranges. July is the hottest month but due to ample amount of showers heat is neutralized while hottest days start from the month of July, August and September While the winter starts from November-December to the early part of February are the coldest months. The dry season starts from December till April month. With the start of southeast monsoon from March to April month and September to October month of Northeast monsoon goes occasional storms. Mokokchung district rainfall is cause by southwest monsoon and generally sets in during the middle month of June till the half of September with heavy rainfall. The average rainfall is 250 centimeters and the district normally enjoys heavy rainfall from May to October.

2.5 Rivers and Drainage System of Mokokchung

The important rivers which are found in the district are Desai or Tsurang, Dikhu, Milak, Tsumok, and Menung. They run parallel to the ridges which act as water dividers either northward or southward except Doyang which cuts across the middle chain. Direction of tributaries is from south to north in accordance with its varying nature of topographic conditions. The main rivers are perennial in nature but volume of water reduces during dry season and often rivers become almost dry.

Main rivers which make significant drainage system are as follows:

1. **Milak**

It is the main longest river which flows across the Ao region and known as Jhansi in Assam. Its source is found in Mokokchung town itself at an altitude of 1300 meters. It flows

northward until it leaves the hills and turns westward near Amguri plains. The river is a bounded line between east of Alongkima, west of Kobulong and west of Changtongya and Tuli circle and in plains it flows through Sibsagar district (Assam). A notable tributary of Milak is Tsurong that runs in the of Longchem and Alongkima circle in the west.

2. Dikhu

This River rises from northern flanks near Serna known as Longa or Nanga Which flows westward and enters Ao region of Longsa village known as Tsula. Then, it flows northward forming a traditional boundary line between the Ao and Sangtam on one hand, and Phom and Konyak on the other. Its total length before emerges into Brahmaputra River is 200 km On the west this river acts as a boundary line for Chuchuyimlang, Ongpangkong, Changtongyaand Tuli circles. The main tributary which falls inChuchuyimlangcircle is Nanungwhich rises from northwest of Longkong village and after flowing across the east of Mongsenyimti, Chuchuyimlang, Salulemang villages and flows into Dikhu.

3. Tsurang or Desai

This River rises from the west of Chungliyimsen village and it is an important tributary of Doyang River. It flows southward with a crescendo bend through the hills of Mokokchung district and northern part of Lotha area. It also passes through the western part of Mangkolemba and south of Longchem circle and continues to run further northward until it leaves the hills for the plains in thewest of Changdang village.

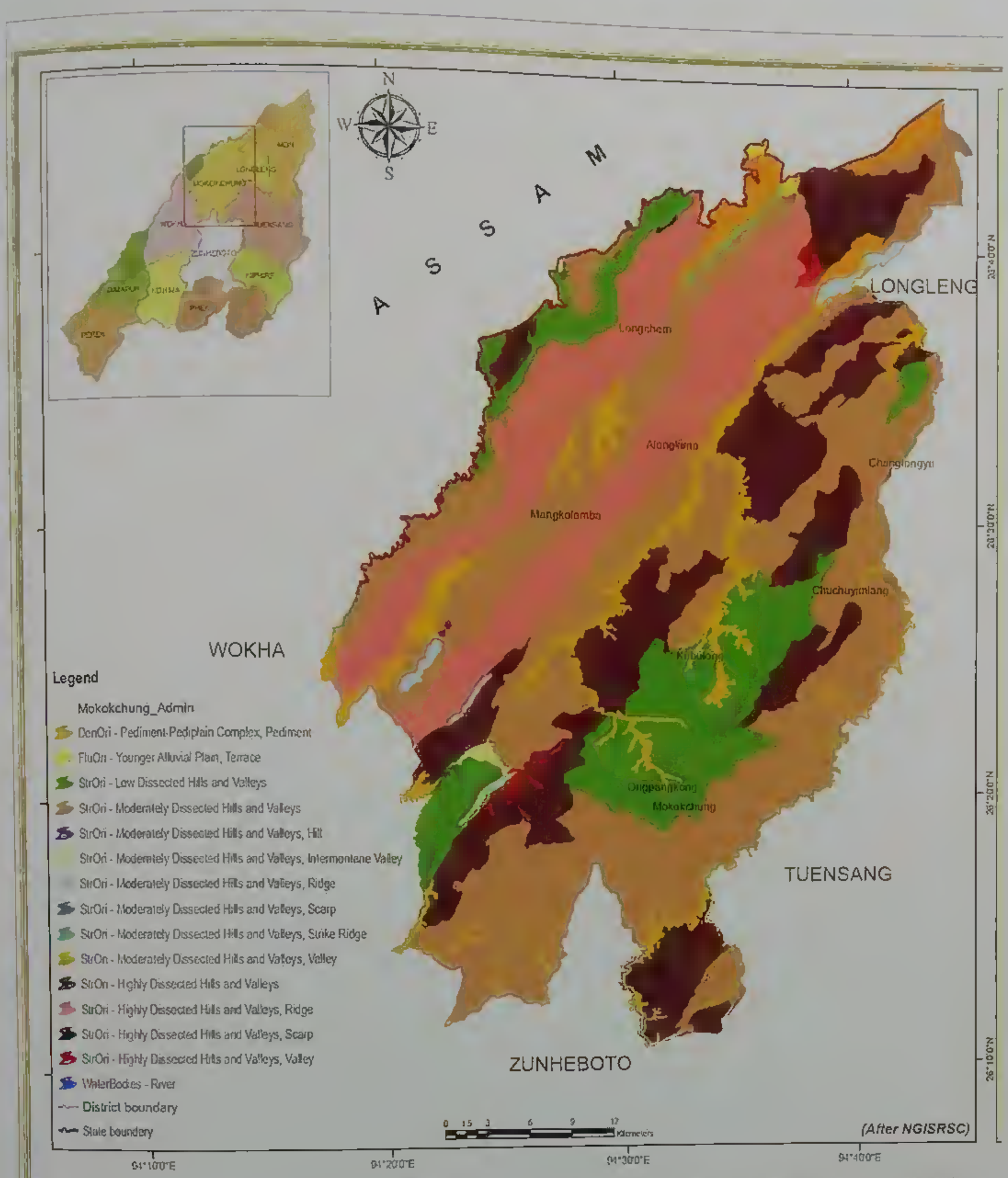
4. Menung

This River has its source at Minkong forest that is located between extreme north of

Ongpangkong and south of Kobulong circles. It flows in between Sungratsu and Longjang villages on one side and Mongsenyimti and Chuchuyimlang villages on the other.

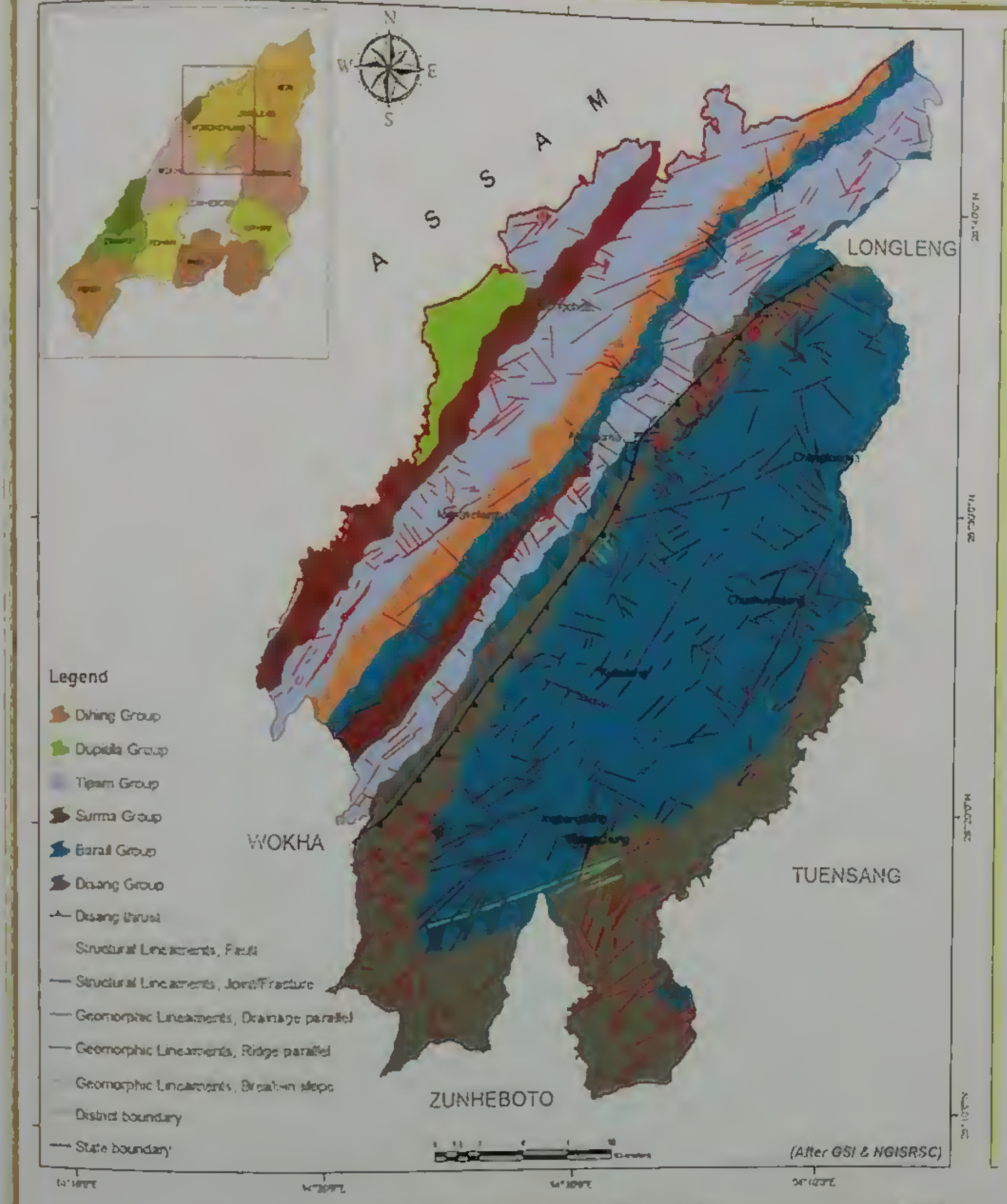
5. Tsumok

It rises from Changtongya and flows through Asangma and Merangkong villages and finally joins Milak River.The rivers of the district run through the ridges as well as it crosses the softer landscapes taking a round course and sometimes making abrupt bends. Therefore, it does not support a stable cultivation, however terrace and fruit plantation are cultivated on the banks of Tsula and Tsurang.



"The boundaries of Nagaland as shown on this map are subject to revision as provided in the 1960 Delhi Agreen
"This map is without prejudice to the claims of Nagaland for re-drawing the Assam-Nagaland boundary on the basis of historical a

Fig. 2.7 Geomorphology Map of Mokokchung District



The boundaries of Nagaland as shown on this map are subject to revision as provided in the 1960 Delhi Agreem
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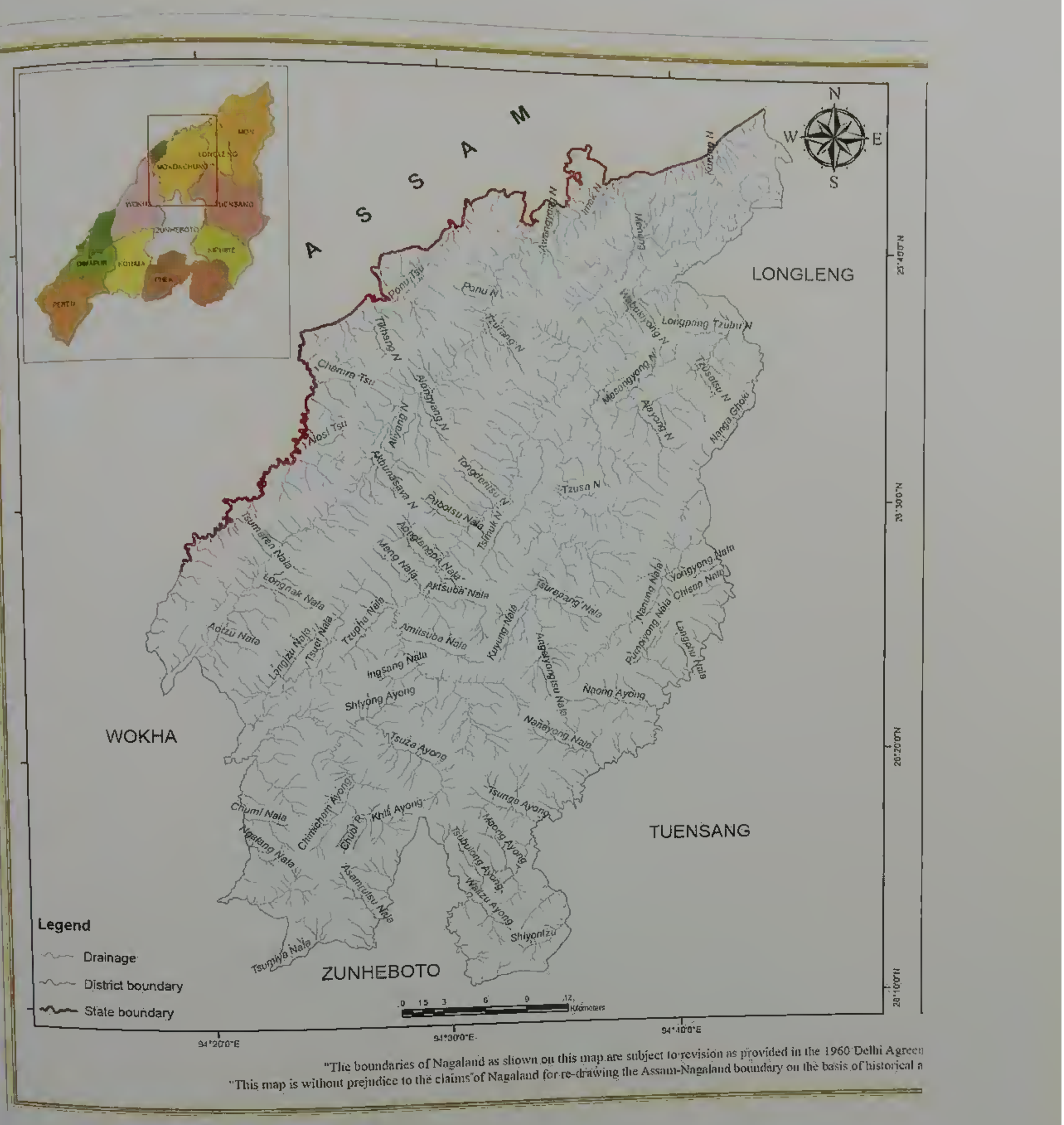
Fig. 2.8 Geology Map of Mokokchung District



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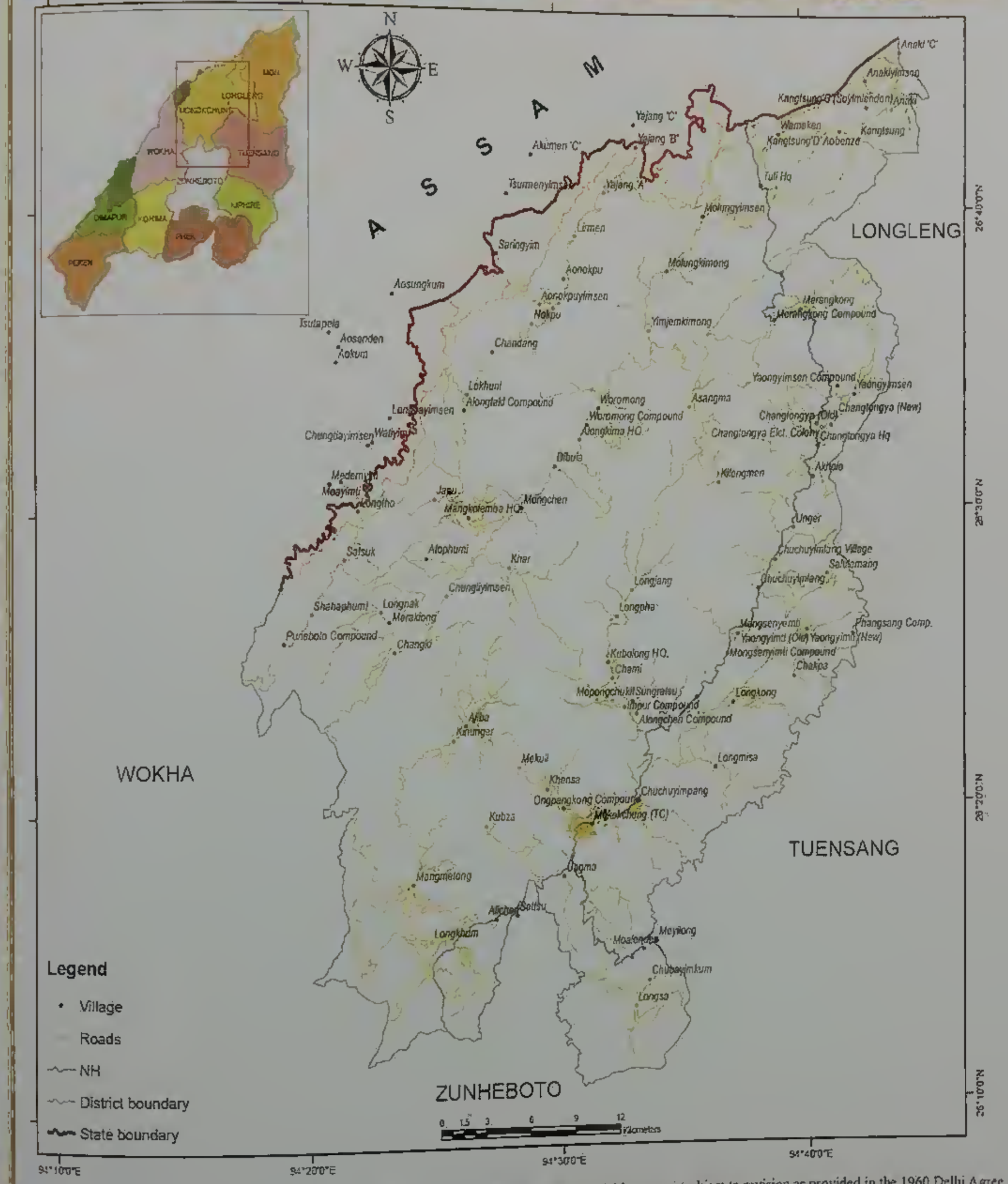
"This map is without prejudice to the claims of Nagaland for re-drawing the Assam-Nagaland boundary on the basis of historical a

Fig. 2.9 Drainage Map of Mokokchung District

Fig. 2.10 Soil Map of Mokokchung District



"The boundaries of Nagaland as shown on this map are subject to revision as provided in the 1960 Delhi Agree
"This map is without prejudice to the claims of Nagaland for re-drawing the Assam-Nagaland boundary on the basis of historical

Fig. 2.11 Road Map of Mokokchung District

2.6 Soil

Soils are the most valuable life supporting natural resource for the society since they produce food, fiber and fodder which are basic to our very existence.[3] For a sustained utilization of soil resource, it is imperative to know the nature, characteristics and extent of different soils, their qualities, produce capacity and suitability for all alternative land use. Soil formation increase about 8mm per century and 8mm per century (or might be higher) in formation under agriculture due to ploughing - it aerates the soil and increases the rate of leaching.

The ecosystem significantly influences the process of soil formation. In Nagaland, large altitudinal variations have given rise to diversity in climate and vegetation. The soil has been developed on shales and sandstones. Soils of Nagaland are derived from tertiary rocks belonging to Barail and Disang series. They are generally acidic, rich in organic carbon but poor in available of phosphate and potash content except in the valleys and in the foothills with comparatively level land and gentle gradients.

The State has identified 72 soils families and was mapped into 36 soil units. The area wise distribution of different soils (order, suborder, great group and subgroups) The Soils of Nagaland belong to four orders, seven suborders, 10 great groups and 14 subgroups. (Fig: 2.10). It is also observed that Inceptisols is the dominant soils followed by Ultisols, Entisols and Alfisols

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[3]*Soils of Nagaland (Their kinds, distribution, characterization and interpretations) for optimizing Landuse-Dept of Soil & Water Conservation, Government of Nagaland, Kohima. pp.8*

The soils of Mokokchung district belongs to Barail series mostly acidic in nature. The PH content varies from 5.6 to 5 8 on an average. Acidity is found higher around Changki area followed by Ongpangkong and Changtongya –Tuli area. Soils found in foothills are rich in deposits and is fertile which is good for cultivation. Organic carbon content is high in higher altitudes while foothills which are continuously cultivated lands have low content of organic carbon. The soils are poor in phosphate (P_2 O_5) excluding some patches adjoining Mokokchung town, Tuli-Merangkong and Waromung village areas. Three major type of soils are found in the district-

1. Alluvial soil (Recent alluvium soils -Entisols), Old alluvium (oxizol and ultisols) and Mountain valley soil (Entisols).
2. Forest soil and
3. Non-lateriate soils.

Alluvial soils are confined along the foothills in the valleys of Tuli, Changki, Bhaghty, Tzurang and plains located on the right bank of Milak River. These soils are transported largely made up of silt, sand and clay. Content of the soil is usually deficient in nitrogen and humus content requires regular addition of fertilizers and manures.

Forest soils are generally found at a height which varies from 900 meters to 1800 meters and are found mostly around deciduous forests. Such kind of soils is rich in humus and deep but slightly acidic in reactions which are fertile for growing variety of crops. Non-lateriate Red soils are formed due to alteration of moist and dry seasons. This type of soil is found in the hilly slopes and hilly tops except in higher altitudes. It contains organic matter due to presence of high humus and degree of high porosity The color red soil is due to presence of iron- oxide and aluminum which contains acidic and have less quantity of

phosphate and potash. Such soils are hard when dry and sticky and when it gets wet, it is regarded as residual soil. The fertility of the soil in the district is due to content of minerals and humus as well as with the prevail of climatic condition. Overall the soil in the region is loose and boggy because it is formed by falling of leaves, branches and the decayed annual undergrowth and shrubs

The inherent problem of soil erosion is further aggravated due to extensive practice of slash and bum or shifting cultivation and deforestation. This ultimately leads to rapid run-off on steep slopes and less vegetation cover and the deposition of materials in the valleys and in the low-lying areas. To avoid soil erosion, use of physical and biological barriers is being carried out for soil conservation.

2.7 Natural Vegetation

The characters of vegetation of a place depend upon its temperature, rainfall, interference by man and soil.[4] Nagaland along has a wide variety of vegetation which falls under Indo-Burma Biodiversity Hotspots. Out of the District geographical area of 1615 Sq.km, forest covers an area of 28976.79 hectares (in 2011).

Most of the virgin forests are found in Tsurang forest that lies in Changkikong and Japukong range and near Milak of Tuli areas respectively. It has three Government Protected Forest i.e. Chubi (134.8 hectares), Minkong (275.32 hectares) and Longsa (18.00 hectares) which comes upto 428.00 hectares.

The district of Mokokchung with its hilly topography and few patches of plains has an

[4]*Gopal Singh (1979): Geography of India, pp.53*

average altitude of 1500 meters well suited to support dense natural vegetation. With the due course of time practice of shifting cultivation by the people for centuries has however destroyed much of the abundant exotic forest canopy which leads to soil erosion. The region consists of both deciduous and evergreen forests being deciduous most part of the trees found in lower latitude. Mixed forest of both evergreen and deciduous trees is present.

The type of forest which is found in the district consists of:

1. Evergreen (Upto an altitude of 1000 meters)
2. Mixed deciduous and evergreen forest (From 1000- 2000 meters)

Forest intake vegetation covers provide lots of essential items for the people. People in this region under study have been living in adjustment with the environment through the perfect and orderly co-existences with the forest and vegetation zone seems to be missing Plantation of various crops and fast growing species and small patches are also being cultivated.

1. Arbore- culture - trees like Chakranta, Eucaleptus etc.
2. Citrus and non-citrus fruits like pears, oranges, guava and pineapple etc.
3. Economic plantation like Sal, Teak, Agar, Rubber, etc. are cultivated

The region is richly endowed with wide diversity of flora and fauna their survival is it risk due to human interference. The small and scattered patches of vegetation/forest resulted due to clear felling and then abandoned after shifting cultivation are changing the basic nature of the forests in terms of biodiversity and other goods and services as well as disrupting the continuity of the landscapes and hampering the ecological balance. Extreme care should be implemented to maintain a perfect harmony towards the awareness and protection of the environment to safeguard the rich natural biodiversity.

CHAPTER: 3

SOCIO-ECONOMIC AND CULTURALCHARACTERISTICS ON LAND USE

CHAPTER: 3 - SOCIO-ECONOMIC AND CULTURAL CHARACTERISTICS ON LAND USE

3.1 Introduction

Nagas' relationship with land has been crucial, complex and varied from time immemorial.For centuries they have been dependent on land for the survival and livelihood. They have also developed unique relationships with the ecological environment mainly through their indigenous and traditional method of cultivation. A holistic understanding of the ecological setting and village ecosystem of the traditional societies becomes essentially important (U.A.Shimary, (2007). Since, land is largely used by the traditional community and members, how land use pattern progress becomes indispensable. It includes all the different types of land utilization in a given area or territory having two main land use pattern formsi.e. land tenure and the other is the method of cultivation of land with customary laws. The customary laws also differ from one village to another or tribes. Land is the use actual made of any parcel of land. The factors such as rainfall, temperature and soil all together contribute to the basis of agriculture and determine the limit of both the cultivability and productivity of the land. Land use mainly relates to the optimum use of the limited land between the alternative major types of land use. The primary use of land are paddy fields, cash crops, forest, pasture, transport, gardening, residential areas, mining, industrial, commercial and uncultivable waste barren and fallow land etc. The customary land as well as ownership of land use has undergone lots of changes in course of time. Today, the land use pattern and the land tenure faced immeasurable threats to the environment. These are due to the increase in population, rapid expansion of urban land, destruction of forest cover on the onset of Jhum cultivation, loss of biodiversity status etc., all these consequences agglomerates and disturbed the environment.

3.2 Socio-Economic Characteristics of the District

Mokokchung district is mainly inhabited by rural communities as a result the main land use pattern in the district is under agriculture of which area under shifting cultivation predominately occupies the hilly region while the terrace (TRC) cultivation occupies the land in low-lying areas .Jhum or shifting cultivation type of cultivation mainly depends upon the monsoon as the rain provides for the seasonal crops. But with the headquarter-Mokokchung being located in the Ongpangkong range it has expanded a lot due to rural people migrating to town for education, employment, health service and commerce This has brought tremendous change from rural to urban sectors in the socio-economic status.

The town has also emerged as one of the most important trading places for the people living in other district as the main National Highway passes through the town which connects the other districts of Tuensang, Wokha, Zunheboto and Longleng.

3.3 Economy

The main economy of the district is solely based upon on agriculture for their livelihood. An important corollary of shifting cultivation has been community or clan ownership of the basic resources of land and forest which is significant for maintaining equity of economic, social status and security of livelihood of the members of the community. However, with due course of modernization and urbanization, occupational structure is fast changing mainly in the non-agricultural sectors While the mining of coal is also a lucrative business activity being carried out in the district. Though the government does not undertake any mining activity, the rural people themselves get explored and exported to the nearby states It is quietly disorganized and the rural people sell off without knowing the real market prices which brought in with great loss. The coal mining activities is largely carried out in

Changki, Mongchen, Molungkimong, Lakhuni, Anaki, Merangkong etc., However, the mining activities are unscientific, unplanned and uneconomical which affects the topographic features and also brought drastic negative alteration in the environment. Technology and scientific method in all the activities have a vital role to play. Today, efficient use of science and technology with integrated ecological concern and institutional factors in land use pattern is needed for economical development.

3.4 Population Characteristics

To achieve the quality of life, factors such as population dynamics, socio-political system, process of development, availability of resources and the existing land becomes essential. As Bugge (1975) describes, a quality of life is an indicator of the physical, psychological, social and cultural well-being of the individual members of some human community. To meet a desirable level land is one of the most important feature for a region where its population is depending on agriculture. But, all the land is not available for agricultural purpose. Therefore, from time immemorial the people of the district has maintained their cultural integrity by having a socio-economic barrier with the people from the plain areas. However, with the advent of modernity the once closed Naga village society has now being open to the outside world. Likewise, the Ao society has also taken up a cosmopolitan nature where people from different communities and villages freely and openly interact by living in relationship with harmony. With the momentum of raising migration especially from rural poor from other communities in search of better prospects has greatly affected the quality of life, economy, socio-culture and environment of the people in the town.

Table: 3.1 Nagaland District wise Population of 2011 census

Sl.no	District	Population
1	Mon	250671
2	Mokokchung	194622
3	Zunheboto	141014
4	Wokha	166239
5	Phek	163294
6	Tuensang	196801
7	**Longleng**	**50593**
8	Kiphire	74033
9	Kohima	270063
10	Peren	94954
11	**Dimapur**	**379769**
	Total	**1980602**

Source: Directorate of Economic & Statistics, Government of Nagaland, Kohima, Statistical Book 2018

Mokokchung district is known to be one of the most developed districts and considered as one of the major metropolitan towns in the State. It has recorded the highest literacy rate in the State. The State having an area of 16,579 Sq.km with eleven districts has diverse population patterns based on the size and location of every district. The State has greatly affected by the population explosion. The State total population according to 2011 census is 19, 80,602 (Table 3.1) with a population density of 119 per Sq.km and a decadal rate (%) of-0.47. It has witnessed unprecedented rise of population since 1971 with record of highest in the country from 39.9% to 64.4% in 2001due to urban growth. As shown in the Fig:31, Dimapur district stands as the highest population of 379769 followed by Longleng district with a total population of 50593 as the lowest. While Mokokchung district 5th with 194622

population. The district has witnessed a drastic population shift in the past few decades with the rate of infant mortality and birth rate attributed to the growth of population. The district overall demographic change and numerous problems such as large numbers of influx of illegal immigrants both in urban and rural areas creates haphazard situation for the development of the district as well as in land use affecting the environment.

Table: 3.2 Population Growth rate of Mokokchung District

Year	Total Population	Density (Per.Sq.km)	Decadal Growth rate (%)
1981	1,04,193	65	+25.84
1991	1,58,374	98	+52.00
2001	2,27,239	141	+43.48
2011	1,94,622	120	-16.77

Source: Directorate of Economic & Statistics, Government of Nagaland, Kohima, Handbook of 2009 & 2012

The district is also dominated by large majorities of tribal population and other communities from the neighboring States. The growth rate of population in the district is steadily growing from 1981-2001 owing to movement of people from other district for education and labour works and migration from other States mostly illegal for commercial trade and as daily wage earners which is considered as the transaction period. Apart from the census 2011 the population growth has decline to -16.77 % (Table: 3.2). This shows the low growth in birth rate also the influx of migrants both legally and illegal has been reduced to a large extent due to the amendment of 'Survival 2007' under the active initiative of AKM in the district.

3.5 Circle-Wise Population

Any region that consists of a particular tribe or clan is characterized by society, economy and political setup of a region. The district comprised of section of people comes from different districts as well as from neighboring states. The dominance populace is the Scheduled Tribe (ST) that comes up to 90% of the population in the district.

Table: 3.3 Circle-Wise Population of Mokokchung District

District/Circle	No. of village in circle 2011 census	Rural/ Urban	Year			
			1981	1991	2001	2011
Mokokchung town	18	U	18060	24803	29332	34432
Ongpangkong circle	21	R	25970	38283	50868	45824
Kobulong circle	10	R	9848	14167	21112	12330
Longchem circle	16	R	5194	9151	12849	8581
Alongkima circle	10	R	8764	9618	21185	11952
Mangkolemba circle	13	R	8665	12128	20966	12950
Chuchuyimlang circle	11	R	8828	18273	23023	17790
Tuli circle	21	R	1058	19238	26603	21513
Changtongya	09	R	8278	12975	22878	7530

Source: Deputy Commissioner Office, Mokokchung, Nagaland

According to (Table: 3.3) of the circle-wise population the district is comprised of eight circles including Mokokchung town. Over the years (from 1981-2011) Ongpangkong circle has witnessed the highest concentration of population with lowest concentration in Longchem circle but in 2011 it was taken up by Changtongya town with 7530.

3.6 Sex Composition

The term sex ratio is commonly used with reference to the proportion of women and men in total population of a country, state and district. The proportion is termed in total females per 1000 males of the area is concerned. Though it is desired that the numerical strength of male of the area and female members should be more or less equal in many instances it is not so.

Table: 3.4 Sex Composition of Mokokchung District according to 2011 Census

YEAR	MALE	FEMALE	TOTAL POPULATION	SEX%(FEMALES PER 1000MALES)
1981	54,648	49,545	1,04,193	907
1991	82,823	75,551	1,58,374	912
2001	118,428	108,802	2,27,239	919
2011	101,092	93530	1,94, 622	925

Source: Directorate of Economic & Statistics, Government of Nagaland, Kohima, Statistical Handbook 2018-2019

The overall sex ratio in the district in 1981 was 907 females for every 1000 males (Table: 3.5) while in 2011 it was gone upto 925. The sex ratio tends to vary inversely with the rate growth of population which shows that the growth rate, the greater the mobility of people and greater the mobility it lowers the ratio.

3.7 Literacy

After the attainment of Statehood in 1963, schools and colleges were given priority that even students from other districts used to come to study in Mokokchung district-Impur

Christian School, Mayangnokcha High school and Fazl Ali College became the first educational institutions in the state. During 1870's American Missionaries were the one who first established the educational institutions. This shows that literacy rate has been increased tremendously.

Table: 3.5 Literacy rate of Nagaland and Mokokchung District

	2001			2011		
	Persons	Male	Female	Persons	Male	Female
Nagaland	67.11	71.77	61.92	80.11	83.29	76.69
Mokokchung	84.27	86.14	82.20	92.68	93.55	91.74

Source: Directorate of Economic & Statistics, Government of Nagaland, Kohima, Statistical Handbook 20011-2012

The district indicates as one of the most literate district in the State and been declared a fully literate district in the year 2007. During the year 2001, the total literacy rate was 84.27% with male 86.14% and female 82.20%. Literacy rate in the district is still tremendously increasing with 92.68% (2011). This means that 92.68 out of 100 person of age more than 6 years are literate (Table3.5). It was ranked first in terms of literacy rate out of eleven districts of Nagaland and 591 out of total g 640 districts in India.

3.8 Rural-Urban Settlements

Mokokchung district is predominately a rural region and rural settlement is a common feature. To study the settlement patterns of the district, it is divided Into three categories- predominately direction of the growth, land types and transport network. The district is hilly and most of the settlement areas are located on the hill top with various village falls into different circles. The main town is located in Ongpangkong range which is the main district Headquarter. Rural population constitute of 137,517 (2011) while urban population is 55,654.

Table: 3.6 Rural- Urban Population of Mokokchung District

Mokokchung	2001		2011	
	Rural	Urban	Rural	Urban
	196,026	31,204	137,517	55,654

Source: *Source: Directorate of Economic & Statistics, Government of Nagaland, Kohima, Statistical Handbook 2005-2012*

It is revealed that the concentration of rural -urban settlement population is more in rural areas (Table: 3.6). The ratio of rural - urban has changed and concentrated more population in urban areas from 1961 to 1971. This is primarily due to commercialization and urbanization which has lead to migrationfrom the rural to urban sectors. The district is pre-dominantly a rural region with a maximum settlement population below 1500 persons. The town of Mokokchung is the only urban area though there are five-sub town considered as rural settlement. Tuli, Changtongya and Mangkolemba with a population of more than 5000 persons that falls under class seven villages in India.

The patterns of settlement on the rugged terrain caused lots of constraints for the development of an area. Most of the rural settlements are of compact type with rectangular and linear shapes. Rural population is higher in all the districts in the state. The main reason of continuous increase in urban population is through industrial growth, jobs opportunities and better educational facilities also by inflows of the new migrants and directly by the natural increase of the migrants.

3.9 Cultural System of Land Use in Mokokchung District

3.9.1 Introduction

Land must be conceived in a more comprehensive manner. It is not only the prize asset but the most essential elements for human survival, and development. A proper utilization and management is the key balance for the sustainable environmental development.

Land use as extremely complex pattern, falling into different types. This complex land use pattern is the result of centuries of human settlement representing the interaction of physical, historical, social and economic factor. Such a vital resource needs to be used in a meticulously planned way in complete harmony with various components of land..[1]However, land as a free gift of nature is limited in supply and therefore beyond human control. The supply of land in its resources are extremely limited and fixed, while demand for land to provide basic needs and developmental activities of human is rapidly increasing which results in a fast decline to the land-man ratio. Human induced alteration on land often results in habitat destruction and loss of species. The problems related to land resources have further accentuated due to weakening of traditional management institutions, different ownerships of land and ill-defined rights. The declining trend of land-man ratio must be viewed with seriousconcern if the district is to achieve a strong economy through higher production in agriculture.

Thus, land-man relation is expressed in two different categories.

1. Land in the individual person who used it.
2. Man and his relationship with the land can be expressed in terms of man as a social being and the land as in-exhaustible resource.

Nagaland, its each tribe and village has a well definite territory bounded on all sides and well demarcated by land or rivulets and ridges to separate it from the territory of its neighbors. While the boundaries are marked by stones, hills, streams as well as by the other land marks which are all distinct and permanent. So, within a given village territory and land, there are different patterns of land use and land ownerships. The land use system includes all

[1]*Peasant Agriculture in Assam; Agricultural Land Use, Das (Ed.1986).*

forms of different land utilization in the given village territory. In Nagaland, land tenure system embodies certain customary laws and under such laws and procedures the land household has the right in the use of basic resource of land and water in the community land and forest. Generally majority of the land belongs to the community. In Nagaland, the pattern of ownership and management differs from tribe to tribe with the exception of Konyak and Sumi tribe where Chieftainship with autocratic rule is practices. Given below is some of the land ownership system commonly practice in Nagaland.

a) Common Village land

Common village land consists residential sites, Morung, graveyard, village community platform, roads, church, monuments, reserved forest and woodland. Any bonafide citizens/ household is free to use such land for any agricultural purposes and also for the domestic consumption but, permission from the village authority is a must for obtaining construction materials or other major purposes, otherwise it will be considered a social offence.

b) Clan land

All clans have a specific plot of land over which they have absolute right and ownership within the villages, such as sites for construction of houses, cultivation, forest, etc. The oldest member of the clan is the custodian under the clan land who exercises a titular right over it. However, the senior members of the land are given the priority to use the land for cultivation. The clan members are also entitledto collect firewood from the clans land.

c) Lineage Land

Another common feature among the Nagas in regard to land ownership is maintaining

different branches of a family lineage and kin group within the same clan. In case of family owned land, the eldest/head of the family takes the final decision over the land. Lineage land can be residential, Jhumland, garden or even forest. This land can be used in manner the concerned lineage sees fit except transferring it to others outside the village jurisdiction.

d) Individual land

Land use which are either inherited or acquired is said as the individual land. For Nagas individual land can be further classified as:

i) Angh and Village Chief: The Angh (Noble Chief of the Konyak Tribe) and the Village Chief or Gaonbura among the Sema tribe has an autocratic system of governance and hence enjoy a wide range of control over the land within the village jurisdiction. Among the Konyaks, Angh's Jhum field is cultivated by the commoners and nominal tax is collected from the farmers which is also considered as tribute to his Anghship.

ii) Ordinary citizens/ Individual owned land: Terrace field, farmlands, tree plantation, residential sites, sites for granary, etc., constitute the individual lands. Individual land can be either of a family owned or individual owned. Individual land can be either inherited or acquired. In Naga society, individual land is transferred from father to son, and when there is no male heir, the land will ultimately revert back to the nearest kin group of the same.

e) Government owned lands

Majority of the land is solely owned either by the community, clan or by individuals, only a small portion of land is owned by the government. This has being used for setting up of educational institutions, medical, offices etc.

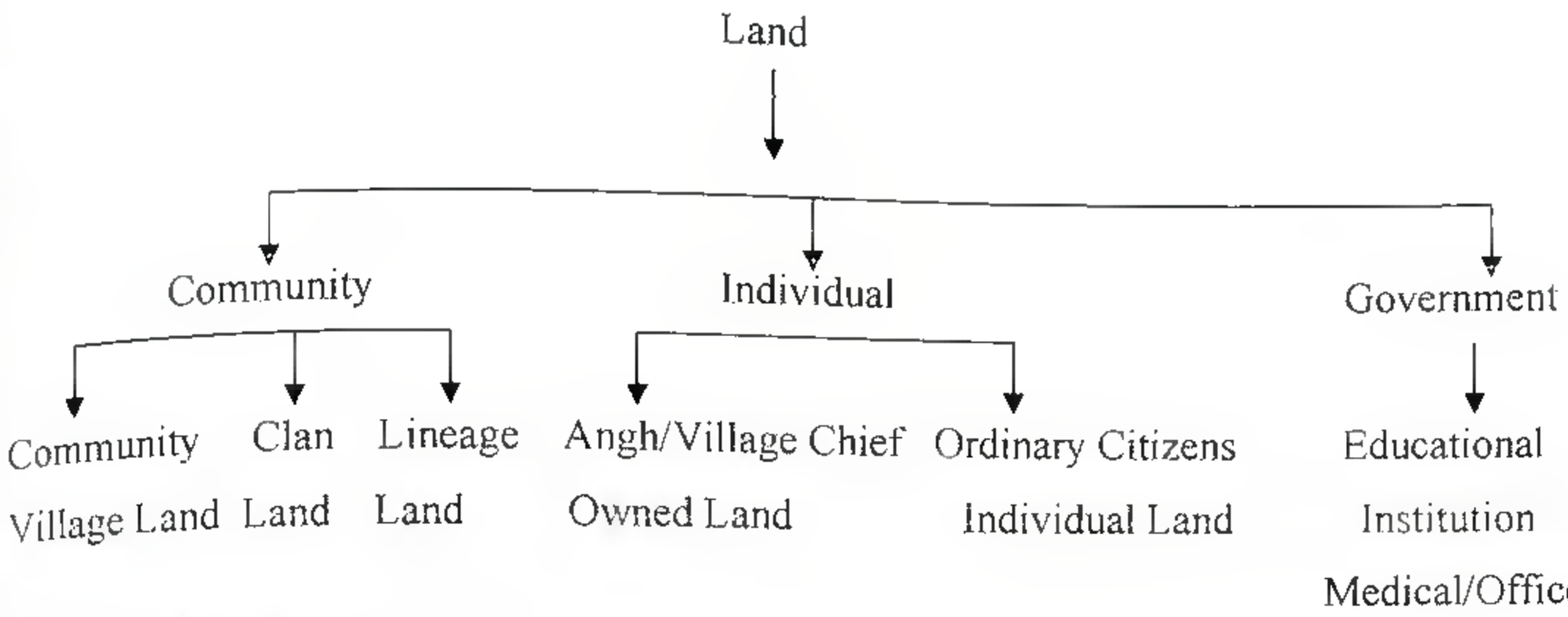


Fig: 3.1 Land Ownership System

Today, community land as well as ownership of the land has undergone drastic changes in course of time especially under the village community land and forest. This is due to the changes attributed to socio-economic transition and pressure on population. The other intervention that has brought changes in the land use is the inappropriate developmental schemes mainly from the State intervention. Moreover, promotions of income generation schemes is inevitable that affects land use patterns and led to competition for land resource (More commercial plantation and tertiary shifting cultivation activities operate in community land).

3.9.2. Agricultural Land use and Crop Production

Agriculture has been the major human intervention for natural resource management aimed at achieving food and livelihood security of human-kind (BinayakRajhandari, 2006). Shifting cultivation is way of life of the people in the hilly areas, especially the people of Northeast India. This system of agriculture has played an important role in the development of human civilization. The system is regarded as the first step in transition from food

gathering and hunting to food production. It is also one of the oldest methods of resource exploitation. Shifting cultivation commonly known as Jhumming is one of the ancient system of farming believed to have originated in theNeolithic period around 7000B. C (D.N Bortakur, 2002).

Generally, tribal economic systems are focused on their traditional land use system, particularly agriculture and forestry. The various land use system type which arise from the livelihood activities of these traditional societies are integral component of landscape mosaic. However, Naga community is one of the largest ethnic groups having several sub-ethnic communities where economic system of the people is largely dependent on the natural environment.

Agriculture is the mainstay of the economy and it is the main source for almost all the households while day labour (both agriculture and non-agricultural wage work like lumbering, stone and quarries) are the secondary most important source of primary income while the secondary source of household income include poultry rearing, vegetables and fruit cultivation.

Out of the geographical area of 1615 Sq.km, land use in Mokokchung district falls under different agricultural categories actively cultivated bythe people and non-agricultural uses of land. Since, the district is endowed with varied climatic conditions and unique ecosystem to raise different types of crops. The agricultural land use isclassifiedas follows:

(a) Jhum Paddy

(b) Terrace Rice Cultivation or Wet Rice cultivation (TRC/WRC) Paddy

(c) Plantation and Spices.

a) Jhum Paddy

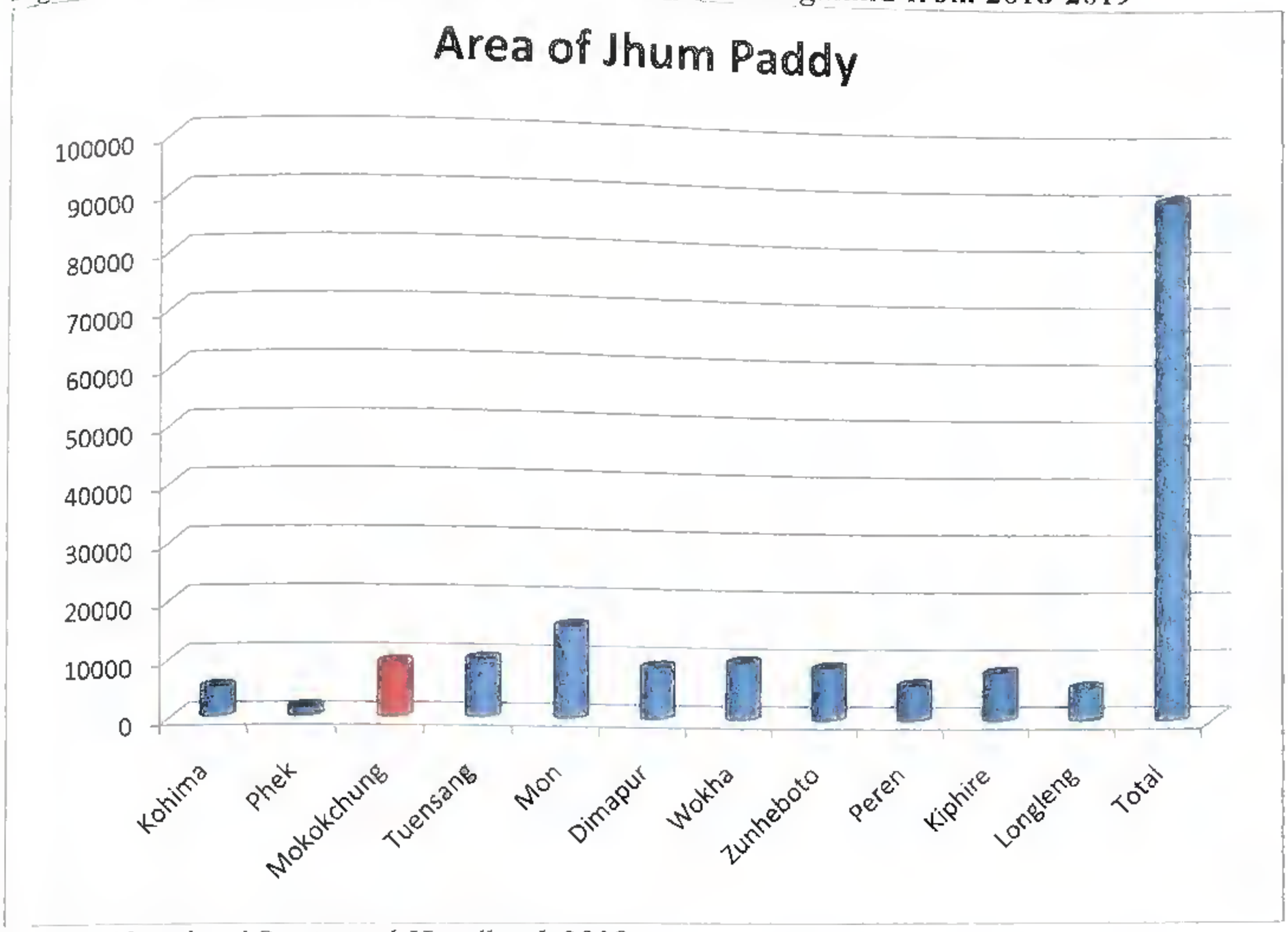
Land use under Mokokchung district is mostly cultivated under Jhum paddy of which Ongpangkong range is the highest cultivator of all the six ranges. The district maintains an average Jhum cycle of 10-15 years but gradually it has been reduced. Beside paddy, other crops such as cereals, pulses, oilseeds, commercial crops are also cultivated. Out of the State 95550 hectares of total Jhum paddy, the district has an area of 9320 hectares.

Table: 3.7 Nagaland District wise under Jhum Paddy (2018-2019)

District	Area of Jhum Paddy
Kohima	5150
Phek	1640
Mokokchung	9320
Tuensang	10050
Mon	15930
Dimapur	9070
Wokha	10080
Zunheboto	9230
Peren	6320
Kiphire	8450
Longleng	5800
Total	91040

Source: Nagaland Statistical Handbook 2019

Fig: 3.2 Graph showing area under Jhum paddy in Nagaland from 2018-2019



Source: Nagaland Statistical Handbook 2019

Table: 3.8Mokokchung District Area and Production of Jhum paddy (in %)

(Area in hectares & Production in Metric Tonnes)

Crops	Area & Production	2014-15	2015-16	2016-17	2017-18	2018-19
Jhum Paddy	A	9630	9480	9350	9330	9320
	P	18660	18640	18670	18570	18550

Source: Directorate of Agriculture 2014-2019

The highest overall both in terms of area and production is during the year 2016- 2017 as shown in (Table: 3.8). From the successive year the area under Jhum and its production decline as many Jhum cultivators have started cultivating cash crops like cereals, pulses, oilseeds and commercial crops.

Besides. the Agriculture and Horticultural department has selected Longkhum village as the vegetable village in the year 2009. The Sungratsu village under Asetkong range has also converted an entire traditional community Jhum site into a model farming unit to sedentary farming activities. In this village Jhum cycle was only nine years which has been increased due to the change in land use pattern.

b) Terrace Rice Cultivation or Wet Rice cultivation (TRC/WRC)

It is cultivated in the low lying areas where water is channeled into flat plots dependent on the contour and slope of the land. The field is prepared in many plot of flat land and on the side of each flat piece of land is raised above the land in order to retain water. It is cultivated in the valleys of Changkikong, Tzurangkong and Langpangkong ranges. Some of the permanent cultivators are Changki, Chungtiayimsen, Khar, Yajang and Merangkong villages. As per the recorded year 2014-15, the area under TRC/WRC was 5890 hectares.

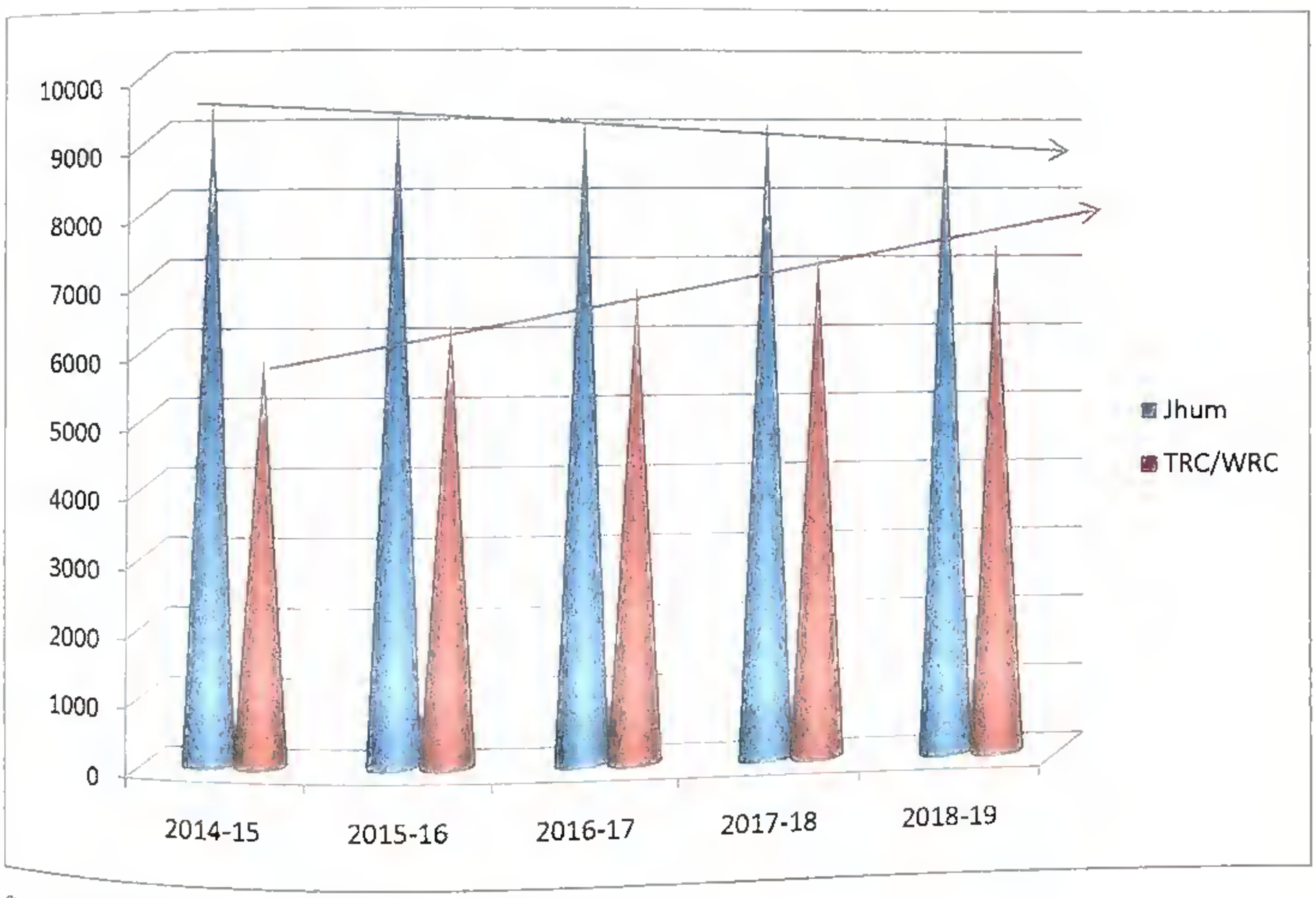
Table: 3:9Mokokchung District Area and Production of Terrace Rice Cultivation OR Wet Rice cultivation (TRC/WRC) 2014-2019 (Area in hectare & Production in Metric Tonnes)

Crops	Area & Production	2014-15	2015-16	2016-17	2017-18	2018-19
TRC/ WRC	A	5890	6410	6880	7340	7540
	P	15840	17520	19250	20870	21700

Source: Directorate of Agriculture 2014-2019

According to the (Table:3.9), the area under TRC/WRC in Mokokchung district was increased with increased in its production of 21700 metric tons. This is due to theencouraging horticulture, commercial farming and adjustment of the cropping patterns to those which offer greater comparative advantage in conformity with the land, water and climate. As shown in (Fig. 3.3), in the recent years priorities has been given to horticulture crops in regard to their potential for improving standards of the people, developing the rural economy, and agro-processing industry and generating additional avenues for employment as a result there is moderate decline in Jhum cultivation.

Fig: 3.3 Graph Showing Area and Production of Jhum and TRC/WRC in Mokokchung District from 2014-2019



Source: Directorate of Agriculture 2014-2019

Table: 3:10 Mokokchung District under Jhum Cultivation in 2010

Sl.No	Village	Household	Jhum Cultivator	(%)
1	LONGKHUM	488	380	77.86
2	LONGSA	680	600	88.23
3	KHENSA	380	240	63.15
4	MOPUNGCHUKET	649	440	67.79
5	SUNGRATSU	720	600	83.33
6	MERANGKONG	520	400	76.92
7	KHAR	802	560	69.82
8	CHANGKI	580	500	86.20
9	ANAKIYIMSEN	120	20	16.66
10	WATIYIM	110	18	16.36

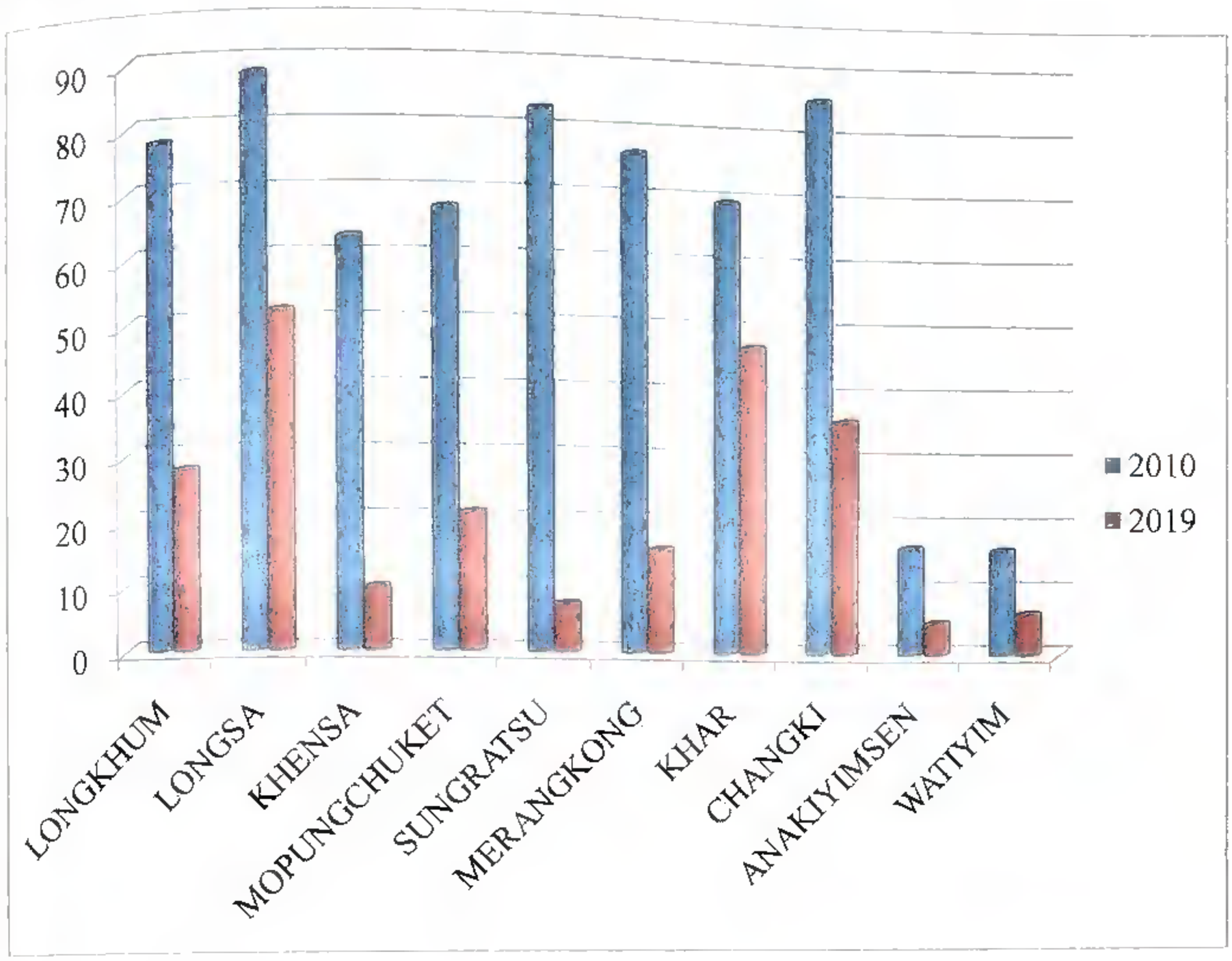
Source: Field Study 2015

Table: 3:11 Mokokchung District under Jhum Cultivation in 2019

Sl.No	Village	Household	Jhum Cultivator	(%)
1	LONGKHUM	546	152	27.83
2	LONGSA	802	417	51.99
3	KHENSA	426	42	9.8
4	MOPUNGCHUKET	743	158	21.26
5	SUNGRATSU	799	60	7.5
6	MERANGKONG	550	88	16.00
7	KHAR	848	402	47.40
8	CHANGKI	690	250	36.23
9	ANAKIYIMSEN	181	9	4.97
10	WATIYIM	169	12	6.41

Source: Field Study 2019

Fig: 3.4 Graph Showing Jhum Cultivation Comparison during the year 2010 and 2019



Source: Field Study 2019

3.9.3 Horticulture

Horticulture crops include fruits, vegetables, and ornamental and flowers. They are intensively cultivated crops for food and ornament. Today, there is a rapid change in the land use pattern in Mokokchung district from traditional agricultural farming to commercial and plantation farming.

Plantation crops like tea, coffee, cashew nuts, rubber etc., with orange, banana, pineapple, passion fruit and vegetables are the main horticulture crops cultivated in Mokokchung district. The tropical evergreen forest has been replaced into plantation along

the foothills in Changki, Longpayimsen, Chungtiayimsen, Tuli, Anakiyimsen and Longjang villages. In Merangkong village nearly 60 per cent of the Jhum land has been converted with rubber and tea plantations and more than 10 per cent constitute livestock farming and it is flourishing to a large extent.

Table: 3.12Mokokchung District Area and Production of Major Crops: (Area in hectare & Production in Metric Tonnes)

Crops	Area & Production	2014-15	2015-16	2016-17	2017-18	2018 -19
Banana	A	1096	505	6880	7340	7540
	P	15504	43	19250	20870	21700
Orange	A	1064	1064	1064	820	NA
	P	9169	7856	7859	5650	NA
Tea	A	NA	NA	NA	15.00	15.00
	P	NA	NA	NA	25.00	25.00
Tomato	A	253	415	447	420	350
	P	2871	3500	3647	3850	3600

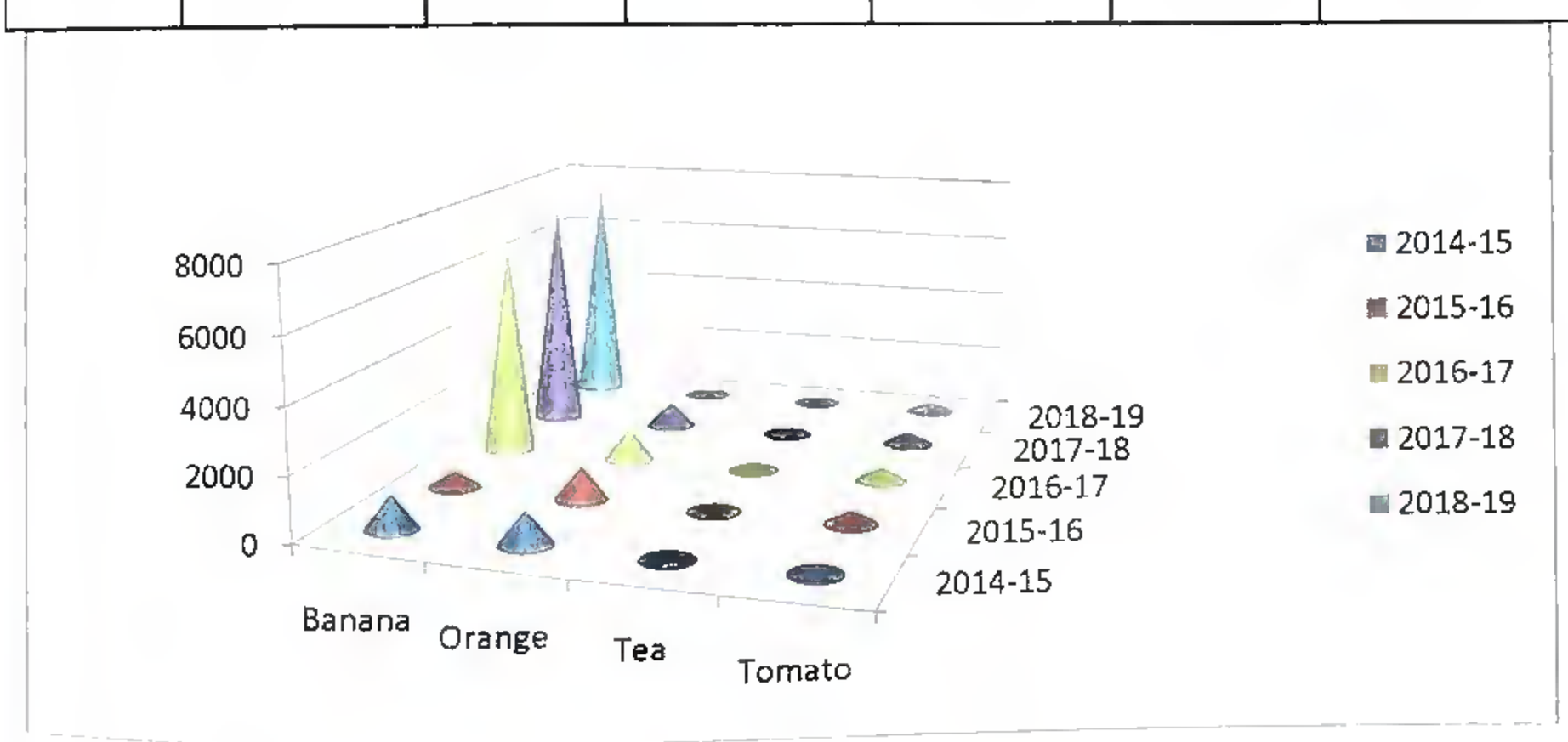


Fig: 3.5 Graph Showing Production of Major Crops from 2014-2019

3.9.4Animal Husbandry, Livestock and Poultry

Animal husbandry, livestock and poultry plays a significant role in providing animal protein for the large population as food. At the same time it provides employment particularly to small/marginal farmers, agricultural labourers, and other rural poor.

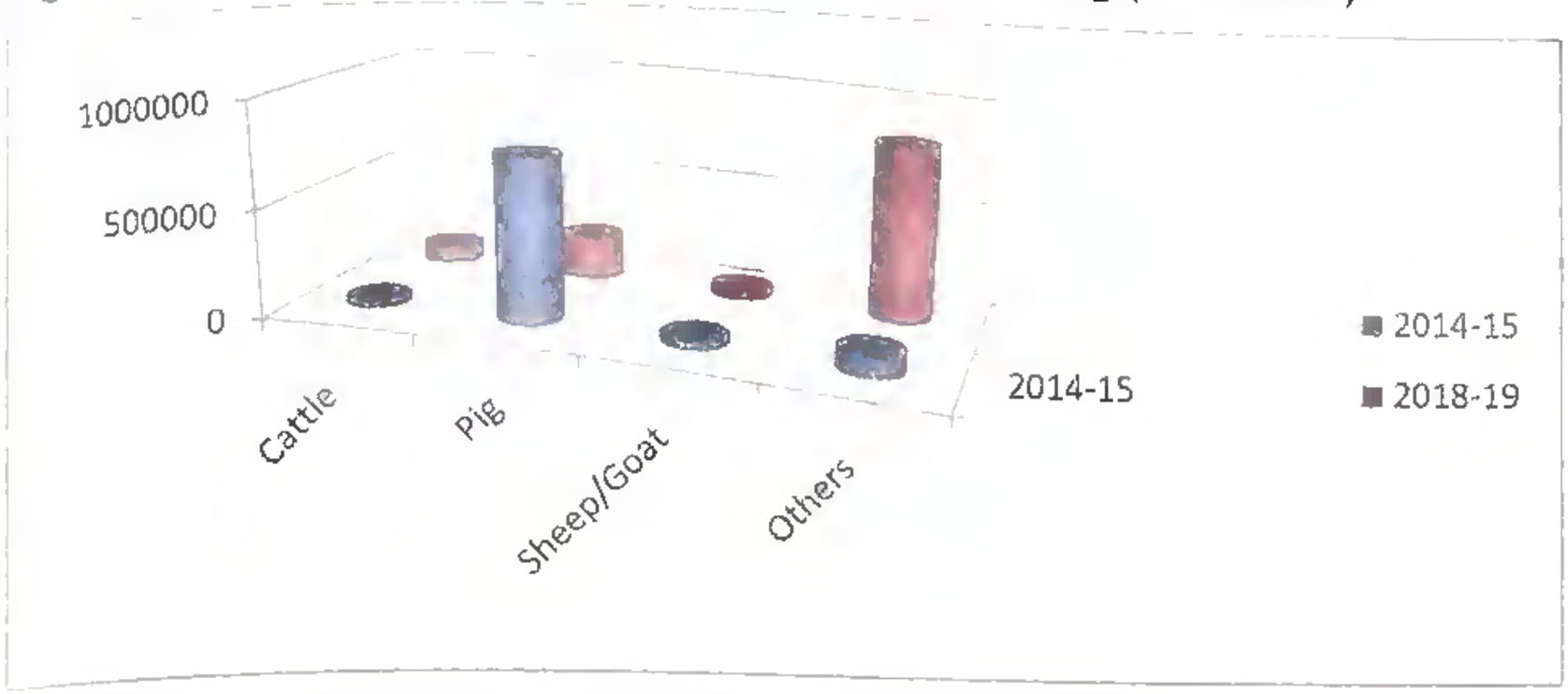
As majority of the population is dependent on meat as food, animal husbandry, livestock and poultry production have a great scope in this district. There is an immediate need to adopt methods for accelerating development of livestock and poultry along with crop production. It can be achieved only through the application of modern science and technology and brining about genetic improvement in the different species of animals. For this purpose again integrated attention should be paid to health care, nutrition, genetic improvement and to processing and marketing.Today, the scenario on consumption of meat as food in the district is different. The slaughter for other animals for consumption is sizeable in number with decrease in pork as shown in the fig. This is because, the people of Mokokchung district is awaken of the threat to the health of a person.

Table 3.13Number of animal slaughtered in Mokokchung (2014-2019)

Sl.No	Animals	2014-15	2018-2019
1	Cattle	33055	82262
2	Pig	755876	210808
3	Sheep/Goat	40350	44976
4	Others	97580	826660

Source: Directorate of Animal Husbandry & Veterinary services.

Fig: 3.6 Number of animal slaughtered in Mokokchung (2014-2019)



Source: Directorate of Animal Husbandry & Veterinary services.

3.9.5. Fisheries

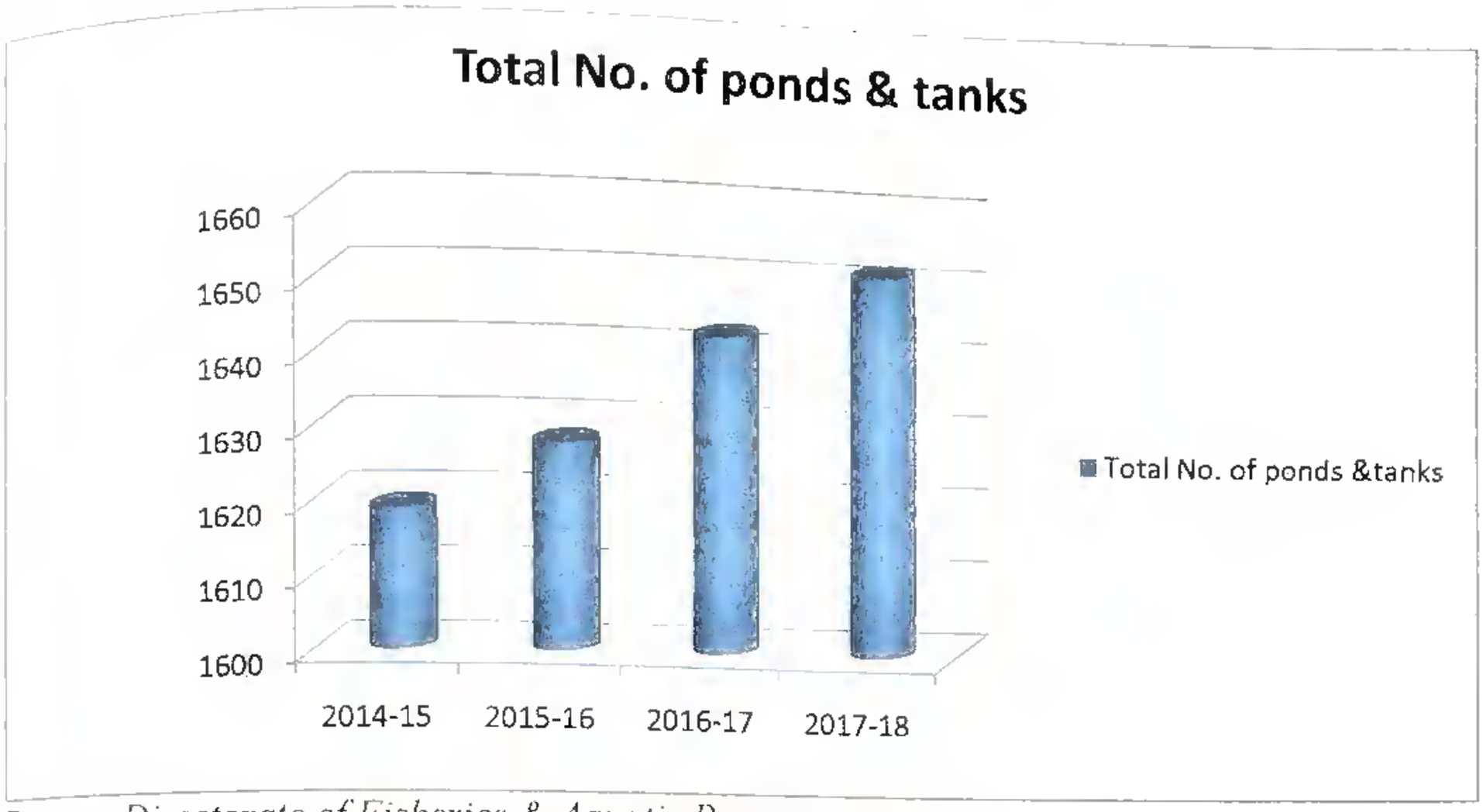
Though our state has no coastline like many other states for fishing, Nagaland too have fish farming. As fishery resources are vitally important in augmenting food supply and nutritional level, providing employment and generating capitals, a well developed fishery industry is needed. Today, government has been implementing various programmes to encourage fish farming and the sport of fishing, often called as angling is promoted to attract domestic and foreign tourist. Farmers in some villages are combining animals and fish culture which assures good production of fish but a sizeable number of fish ponds are left abandoned due to lack of knowledge.

Table 3.14Total No. of ponds & tanks in Mokokchung District

Year	Total No. of Ponds & Tanks
2014-15	1619
2015-16	1628
2016-17	1643
2017-18	1652

Source: Directorate of Fisheries & Aquatic Resources

Fig: 3.7 Graph Showing No. of Ponds and Tanks (2014-2019)



Source: Directorate of Fisheries & Aquatic Resources

3.9.6 Roads

Roads play a crucial role for a country's economy both for movement of passengers and goods. With expanding road network the importance of road transport has been growing continuously. The development of agriculture, industry and service sectors, tourism, etc depend on the quality of roads which should be fuel-economic; ensure smooth flow of traffic; police assistance; good roadside amenities; proper drainage, good landscaping with rows of trees; information signs, regular road maintenance and no hindrance from stray cattle and other animals which are serious accident hazards.

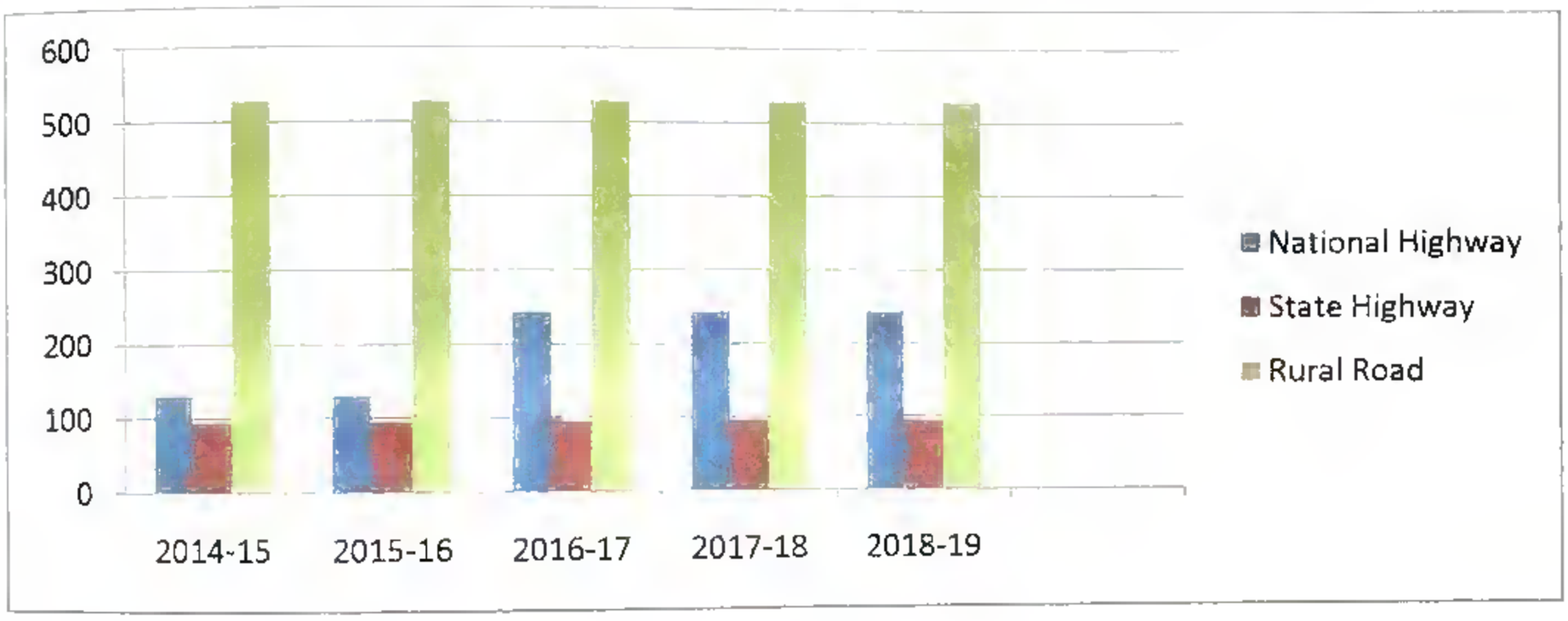
Although the district consists of National Highway, State highway and Rural Road, not a single road in the district can boast of having all the desired specifications as most roads have inadequate drainage, poor surface conditionsand less maintenance.

Table. 3.15 Total Road Length (in Km) in Mokokchung District

Years	National Highway	State Highway	Rural Road
2014-15	131	94.3	528.56
2015-16	131	94.3	528.56
2016-17	243.5	94.3	529.06
2017-18	243.5	94.3	529.06
2018-19	243.5	94.3	529.06

Source: PWD (R&B)

Fig: 3.8 Graph Showing different Types of Roads in Mokokchung District



Source: PWD (R&B)

3.9.7 Stone Quarry, Bricks Kilns and Mining

Brick making is a dry season activity that start as soon as the monsoon rain stops. Unfortunately, brick kilns are mostly situated on fertile agricultural land and is turning fertile agricultural land into unproductive lands.

Rock quarries are a necessity for economic growth of many rural populations and for developmental purposes. In some villages where people's economy is very low and with no

alternative, their immediate environment become the sources of livelihood. However, stone quarries on the road side causes landslide/rock slide threatening human settlement. This activity deplete the forest and make the land unproductive.Ever since the Nagaland Coal Policy 2006 came into force, the Department of Geology and Mining, Nagaland, Inida has issued sufficient Coal Prospecting Licenses (CPL) and Coal Mining Leases (CML), including short term Small Pocket Deposit Licenses (SPDL), thereby bringing many mines under licensing policy of the state.

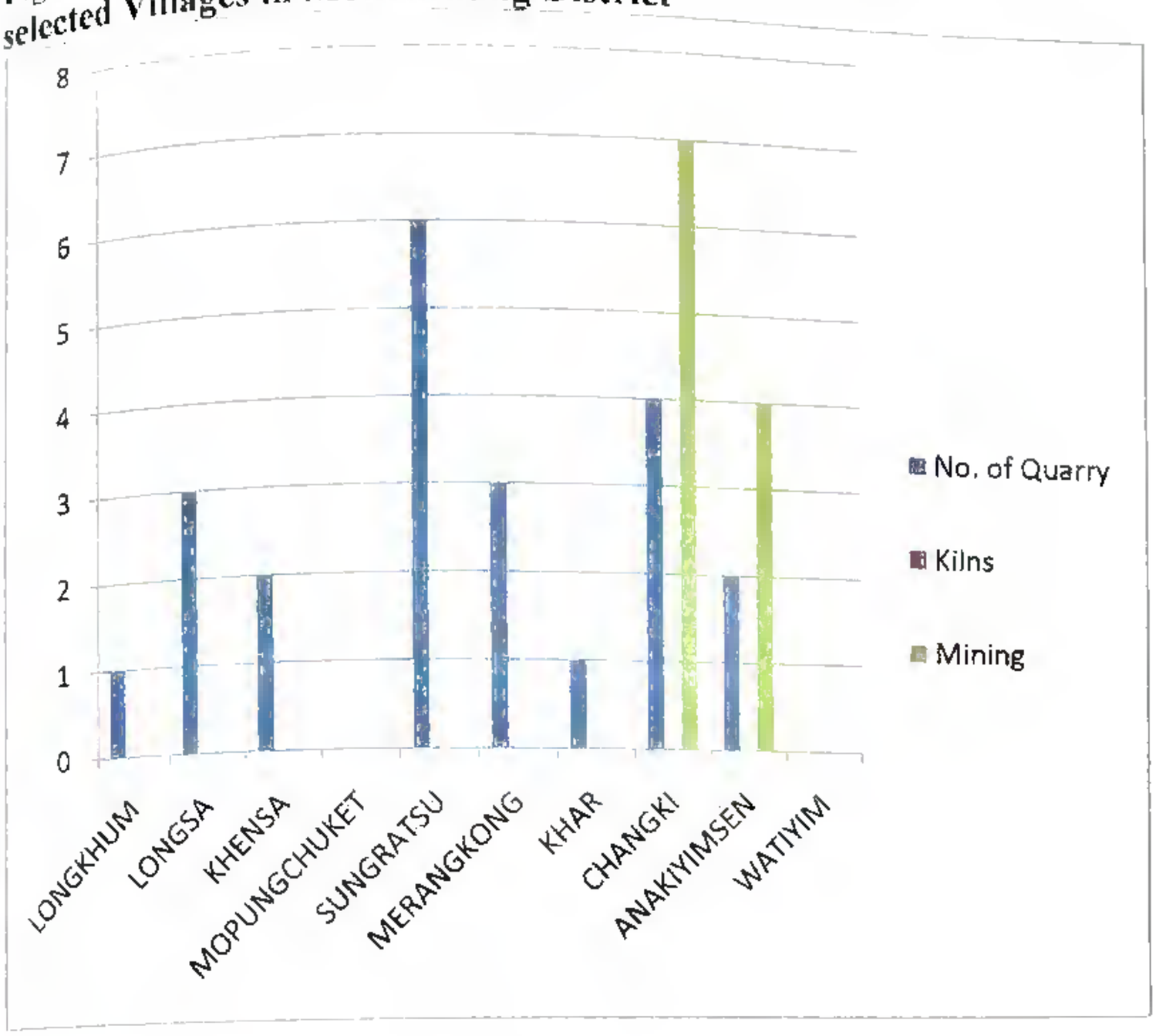
It has issued 27 CML and 11 SPDL so far, out of which 13 CML are currently functional. The rest of the licenses are either expired or non-functional.However, un-planned extraction of coal is still being carried out by private parties or landowners at many places especially in Mokokchung, Wokha, Dimapur, Mon, Longleng and Peren districts of Nagaland.

Table: 3.16Stone Quarry, Bricks Kilns & Mining in Mokokchung District

Sl.No	Village	No. of Quarry	Kilns	Mining
1	LONGKHUM	3	Nil	Nil
2	LONGSA	4	Nil	Nil
3	KHENSA	2	Nil	Nil
4	MOPUNGCHUKET	Nil	Nil	Nil
5	SUNGRATSU	6	Nil	Nil
6	MERANGKONG	3	Nil	Nil
7	KHAR	1	Nil	Nil
8	CHANGKI	4	Nil	7
9	ANAKIYIMSEN	2	Nil	4
10	WATIYIM	Nil	Nil	Nil

Field Study Survey: 2016 - 2019

Fig: 3.9 Graph ShowingStone Quarry, Bricks Kilns & Mining in selected Villages in Mokokchung District



Field Study Survey: 2016 - 2019

3.9.8Forest

Forest resources are the most important assets of the Nagas since time immemorial. The Aos have held their land, water and forest resources closely to the culture and traditions. Most of the forest and its products are being depleted during the onset of Jhum field burning. Owing to this, many reserved forests and endangered species of both flora and fauna nestling abode are destroyed.The chief methods of the exploitation of forests in Nagaland is Jhumming, extraction of firewood and raw materials, manufacture of charcoal, burning of forests and logging which all hinders the natural environmental condition in the State. In most of the villages in the district, every year trees are cut down randomly for firewood and for Jhum cultivation which is a great concerned for the villager.

Thestudy reveals that the Jhum cultivators in the district are constantly modifying and innovating upon their traditional practice to improve but it still have a negative impact on the environment and their ecology. The district onceknown to be arich biodiversity today has been exploited due to population pressure on agricultural land.

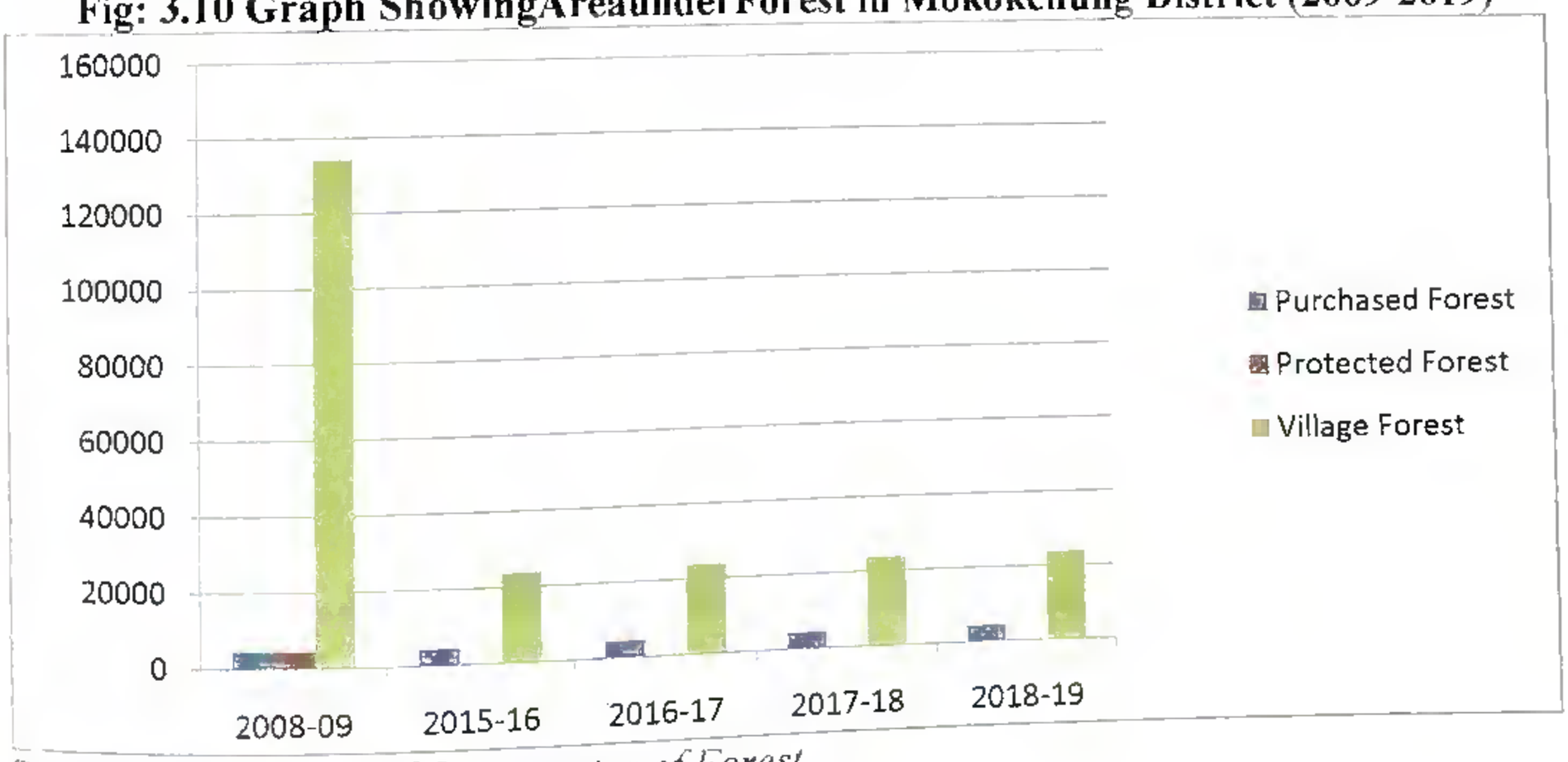
The total forest cover of Mokokchung district in 2015-16 was 28976.79 hectares but a small area has been decreased down during 2016-2018 with 28969.15 due to encroachment and with new purchased during the year 2018-2019 it has been increased to 89022.7 as reported by the department as shown in the Table 3.17.

Table: 3.17Mokokchung District Area under Forest (in hectares)

Forest Status	Year				
	2008-09	**2015-16**	**2016-17**	**2017-18**	**2018-2019**
Purchased forest	4548.79	4548.79	4548.79	4548.79	4602.34
Protected forest	428.00	428.00	420.36	420.36	420.36
Village forest	134523.21	24000.00	24000.00	24000.00	24000.00
Total	139500.00	28976.79	28969.15	28969.15	29022.7

Source: Directorate of Economics & Statistics Department (2019),
Principal Chief Conservator of Forest (2015-2019)

Fig: 3.10 Graph ShowingAreaunderForest in Mokokchung District (2009-2019)



Source:Principal Chief Conservator of Forest

3.9.9Land Alienation (Defence)

Land is also held by defence services, para military and security forces. Guidelines on Cantonement Planning, 1972 indicate the norms and authorized scale of area is usually prescribed by Ministry of Defence. For instance, land for one classification range is normally 335acres and land for each additional range is 139acres and land for special firing ranges for field gun is 45 to 70 sq.km which occupies a large plot of land only for firing purpose. Also, to prevent roadside ambush by the Naga insurgents, a considerable area of roadside jungle has been made to clear regularly without any compensation.

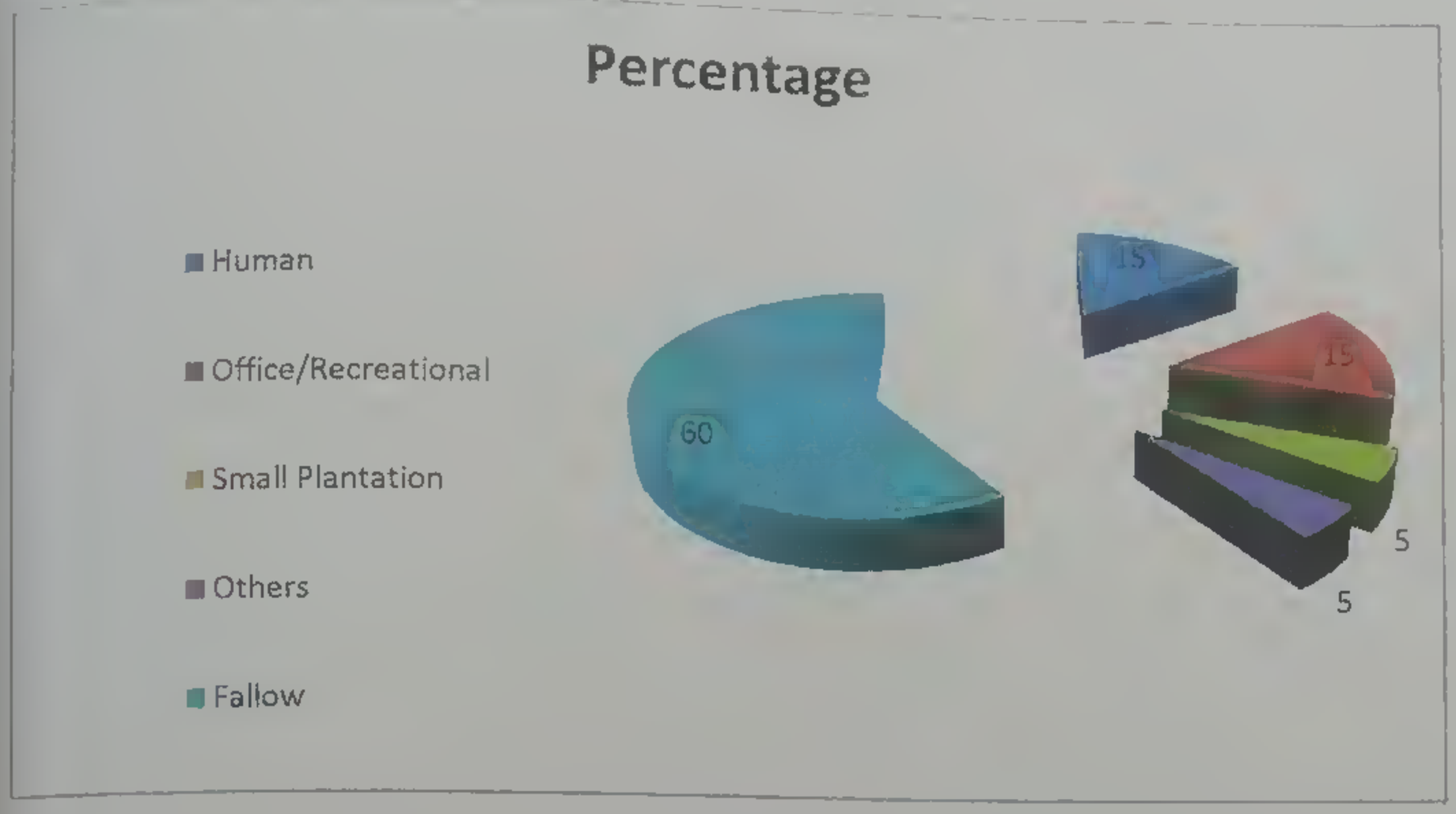
From time to time, critics have claimed that the area used for defence purposes is excessive and it is said some of the land lies fallow in most cantonment areas for years.In the case of 2nd NAP Alichenwhich occupies around 70 ha. as mentioned by the landowners, a large area of land remains fallow for more than three decade as shown in the Fig.3.11. As population increases, there is demand to examine the actual needs of the security forces and ascertain whether any land can be made available for productive purposes. Besides, current land use and future land needs of defence sector undertakings and military farms should be reviewed.

Table: 3.18 Land Use at 2nd NAP, Alichen, Mokokchung District.

Activity	%
Human Settlement	15%
Office/Recreational/Schools/Religious places	15%
Small plantation-	5%
Others	5%
Fallow	60%
Total	100

Source: Field Study 2019

Fig: 3.11 Graph ShowingDifferent Activity in 2nd NAP Alichen (in %) underMokokchung District during the Year 2019



Source: Field Study 2019

3.9.10 Tourism/Recreational Areas

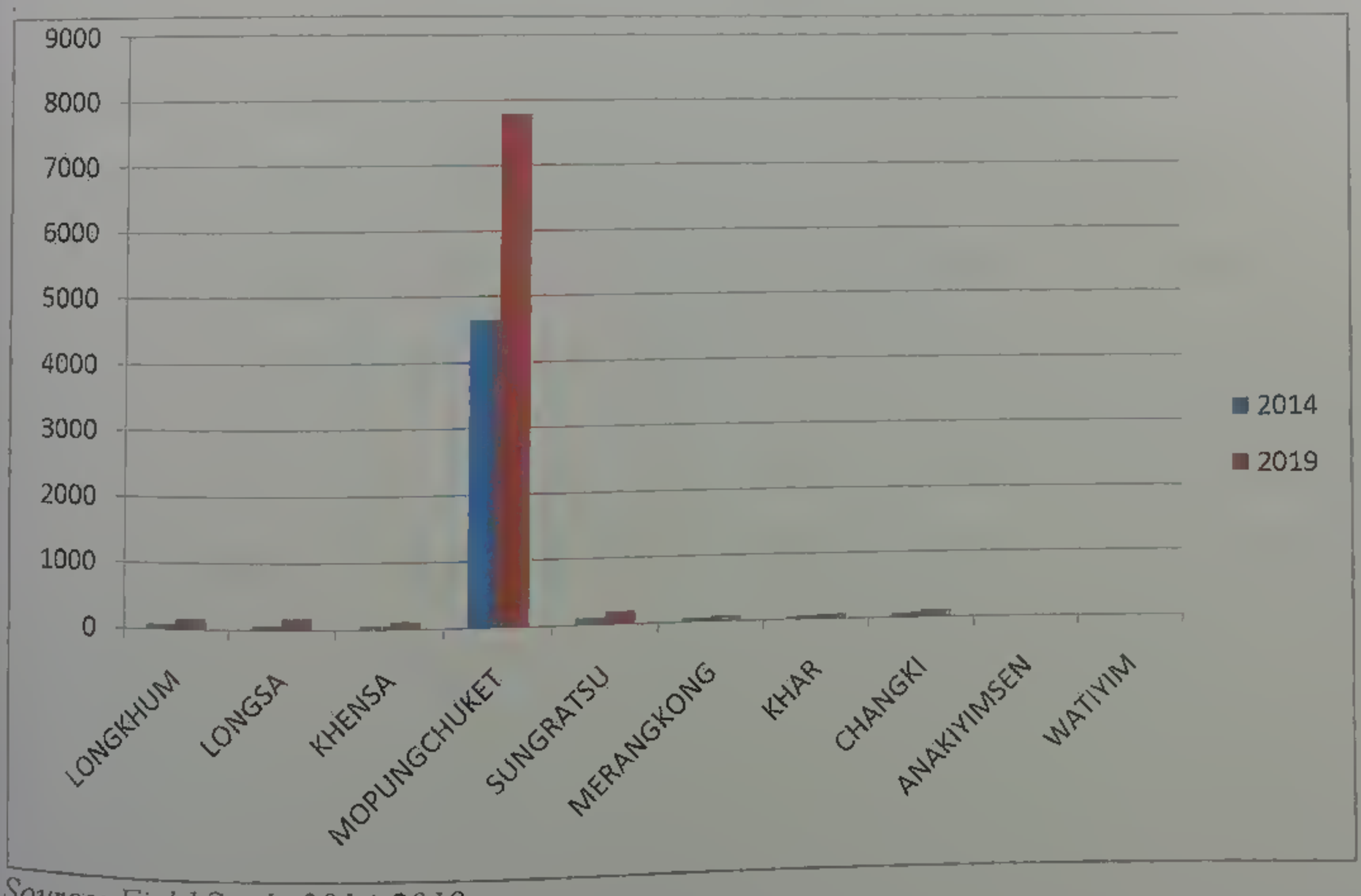
Tourism is the single largest foreign exchange earner for the country. It is an effective generator of employment. Tourist infrastructure should be improved in quality and quantity. Tourist attractions in Mokokchung district include scenery, the hill stations with outstanding landscapes, historical places, recreational area, monuments, wildlife, parks, etc.With increase visitors and influence of modernization, most of the villages are in the opinion of infrastructure improvement:–Monuments, modification of natural landscape, enlarging of play ground, installation tower for electricity & other agencies and if judicious planning and proper management is introduced, whole of Mokokchungdistrictwill become a tourist spot because of the prevailing topography of the region. But, a major weakness of Mokokchung tourism has been the concentration of all activities in certain village like Mopungchuket as shown in the Table:3.19.

Table. 3.19 Total No. of Tourist during the year 2014 & 2019

Sl.No	Village	Domestic & Foreign 2014	Domestic & Foreign 2019
1	LONGKHUM	90 (Assume)	169(Assume)
2	LONGSA	84(Assume)	187(Assume)
3	KHENSA	64(Assume)	122(Assume)
4	MOPUNGCHUKET	4657 *	7792 *
5	SUNGRATSU	108(Assume)	205(Assume)
6	MERANGKONG	68(Assume)	89(Assume)
7	KHAR	58(Assume)	80 (Assume)
8	CHANGKI	78(Assume)	120 (Assume)
9	ANAKIYIMSEN	06 (Assume)	18(Assume)
10	WATIYIM	12(Assume)	22(Assume)

*Source: Field Study (2019)** MCTS

Fig: 3.12 Graph ShowingAreaunderTourism& Recreation in Mokokchung District (2015-2019)



Source: Field Study 2014-2019

3.9.11 Sample villages of Land Use Pattern and Environmental Changes

Longkhum village

It is situated about 17 Km southwest of Mokokchung district under Ongpangkong range located between 26°11'46"N and 26°18'22" N Latitude and 94°20'4"E and 94°28'33"ELongitude . It has an altitude of 1601 meters above the mean sea level which is one of the highest altitude in the entire district of Mokokchung from where one can view the Himalayas from the top of its hillocks. It is surrounded by Mangmetong and Ungma village on the North, Ungma, Settsu and Zunheboto district (Shisimi, Zaphumi and Lumami) on the East, Wokha district old Are, New Are, Sungro, Okotso and Pangtion the West and Zunheboto district (Izheto and Sastami) on the South. It has an average rainfall of 2500mm with average temperature of minimum 10°C and Maximum 28°C.

The total geographical area of the village is 8790 hectares of which 3709 hectares is under total cultivated areas. The characteristics of Longkhum forest ranges is from tropical semi-evergreen forest, sub-tropical broad leaved with hill forest and Montana wet temperate forest with moderate to heavy rainfall from April fall to Mid- October month. These factors enable to thrive and abound with vary rich biodiversity in the land. It is endowed with rich biotic resources of plants and animals having a total forest cover of 150 hectares over the decades.

It has a total population of 3811 (2011 census). The main occupation of the people is agriculture which is practiced in the form of Jhum cultivation based on simple technology. Out of 546 households nearly 152 households are engaged in Jhumming by grab an area of nearly 200 hectares and they cultivate both new Jhum filed (locally called as Ludi) and old

Jhum field (locally called as Pentong). At present the practice of Jhum is rapidly decreasing giving priority to commercial and plantation farming. The villagers give emphasis to organic farming and cash crops like tomato, potato, broccoli and cauliflower are cultivated. Since, the crops grown are organic there is a huge demand in the local market and in the nearby district. The village has been selected as the 'Vegetable Village' in the year 2009 by the Agriculture and Horticulture department, Government of Nagaland. The villagers are environmentally conscious as they have banned hunting in the community forests. However, there is a sizeable decline of forest cover due to the large scale of felling of trees for firewood.

Field Survey Observation of Longkhum Village during 2018-19

1. The practice of large felling of trees for firewood both for domestic and commercial purpose in individual and clan land has brought massive destruction in forest cover.
2. The volume of water of Tonglong River which is the largest river within the village has been reduced to a great extent.
3. The practice of shifting cultivation is rapidly decreasing with increase commercial and plantation farming.
4. Uses of salt to control weeds loosen the soil structure leading to soil erosion.
5. Frost and dew formation which was seen accumulating up to few millimeters and thickness that lasted for days has been reduced.
6. Within a span of nineteen years from 2000- 2019 flow of rainfall is in irregular pattern.

Longsa village

The village is situated in the eastern part of Mokokchung district under Ongpangkong range located between 26°10'40"N and 26°17'31"N Latitude and 94°29'40"E and 94°36'33"E Longitude. It has an area of 7303hectares with 3206 population (2011). The State Highway from Tuensang district to Mokokchung passes this village cutting the lower range. The village is bounded by Sapotimi (Zunheboto district) on the north, Chubayimkum on the south, Lumami (Zunheboto) on the east and Chungliyimti (Tuensang) on the west. The hilly and the undulating topography with microclimate vary from place to place with an altitude of ranging from 600 to 1900 meters above the mean sea level.

The texture of the soil is clay loam with PH 5.90 with 2.40 organic carbons contents. The main economy of the village derives from the forest and lands and these are the major economic resources of the whole community. The majority of the villagers depend on agriculture which is overwhelming categorized under three land use systems-shifting cultivation, horticulture and plantation. Out of 802 households nearly 417 households are engaged in jhum cultivation. Nearly 90 hectares of land is under shifting cultivation with an average Jhum cycle of 11 years. Cash crops like beans, pumpkin, maize etc., are grown mixed with the paddy crop. Among the cash crops, chilly isthe most important crop which was been abundantly found in the local markets. It has a capacity of disposing to all the districts and even to neighboring states and foreign countries packed as chilly pickles. Recently, the production is low compared to last few years back. The village has a forest cover of 450 hectares but with the growing population and expansion of Jhum land forest cover has been tremendously narrowed down. Forest fires are common in the village on the onset of burning Jhum fields during dry months which causes environmental

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degradation. Comparing to last few years the farmers experience low yield in paddy due to late monsoon and are focusing more on horticultural crops and plantation crops.More weeds are also common in the paddy fields.Under the assistance of Agriculture and Funding Agency like NABARD, a Farmers Club of Longsa was established in September, 2010 which act as channel in proper land use pattern. Today, large areas of land are alsoconverted into tea plantation which is cultivated near the Moalenden site 11 kms away from the village. The village is also known as the major producer of essential oil of lemongrass in Mokokchung district cultivated under less than 20 hectares of the village land.

Field Survey Observation of Longsa Village during (2018-19)

1. Burning of Jhum fields and felling of huge forest and clearing of jungles accelerate soil erosion and accentuate variability of rainfall affects in crop production.
2. Growth of population and short fallow period.
3. More weeds are common in the paddy fields.
4. Extinction of varieties of exotic floras and endangered faunas.
5. Drying of natural perennial streams and ponds in the village areas.

Khensa village

The village is situated in the northwest of Mokokchung district under Ongpangkong range with a distance of 5 km from Mokokchung town. It is located between 26°19'27"N and 26°23'31"N Latitude and 94°26'28"E and 94°31'07"E Longitude. The physiography of the village is narrow ridges less than 200 meters wide and have thin mantle of soil with slope

ranging from 10-15 per cent. It also comprises of slope which is a continuous unit after the very steep slopes, and due to breaking of the steep slopes some accumulation of colluvial materials starts in this unit. The soil consists of loamy (Skeptical Typicudorthents) and fine loamy soils (TypeicPalendults). It enjoys a climatic condition of 2°C average to maximum 32°C by having an average rainfall amount of 2500mm.

On each side the village is bounded by Milak and Tzuza River with the formation of different streams, rivulets and gorges. Out of the total geographical area of 3504 hectares around 2800 hectares is under forest cover with Community Reserved Forest of 320 hectares. It has an altitude of 1300 meters above the mean sea level which plays an important role in controlling the temperature and temperature decides the occurrence of natural vegetation in the village. It has a sub-tropical low hill climate with lashes of heavy rainfall at the time of south west monsoon.

According to 2011 census, the total population was 1447 with 426 households. Out of the village total geographical area of 3504 hectares nearly 1000 hectares of land is under cultivation and nearly 10 per cent of the village is involved in Jhum cultivation By having a sub-tropical low climate different varieties of crops are cultivated by the villages. Cultivation of cotton was also prominent during the past decades but today it has found to be decayed due to the adoption of other cultivation and variation in climatic conditions. Orange, pineapple and banana are the main crops which are mainly cultivated in this village. One of the main environmental degradation experience by the villagers is the forest fires. Owing to this natural reserved forests and endangered species of floras and faunas nestling habituated were completely destroyed. Though small in amount, use of chemicals to kill weeds especially on highways and roads by the permanent laborers has negative impact on environment. It is

also perceived that different method of cultivation accounts to a larger percentage in environmental degradation.

Field Survey Observation of Khensa Village during 2018-19

1. Perennial streams have dried up and natural forest canopy are rare due to forest fires.
2. Cultivation of Jhum paddy fields in the hilly terrain cause irreparable damage to the top soil with low yields.
3. Domination of tall grass like broom and shrubs is common in the entire areas.
4. Invasion of more weeds is common in the paddy fields.
5. Use of chemicals to kill weeds on highways and roads has negative impact on environment

Mopungchuket village:

The village is located in the southeast of Mokokchung district under Asetkong range with an area of 3536 Ha. It has an altitude of 260 to 1180 meters above the sea level with a distance of 16 km from Mokokchung town. It lies between 26°21'51" N and 26°27'06"N Latitude and 94°28'33"E and 94°33'14"E Longitude. It has a population of 3072 with 743 households (2011 census). The village is bounded by Khar village in the north, Sungratsu village in the east, Khensa village in west and Mokokchung village towards the south. Some of the major rivers are Milak, Menung, Tsusu.

It is one of the main Tourist attractions under the Tourist Spot in the State. The village has a protected forest "Minkong" which covers an area of 275.32 hectares undertaken by the Tourism department and Tsuzu Watershed Project under the Forest department. The main economy of the village is agriculture of which Jhum cultivation is a pre-dominant. Out of

total geographical area of 3536 hectares, the total cultivable area is nearly 1250 hectares. Out of 743 households nearly 158 households are engagein Jhum cultivation which is cultivated near the Milak Riverwhile the rest is under plantation crops, horticultural farming and few pockets of bee keeping culture. The village maintains a Jhum cycle of (8-10 years). Setting of shifting cultivation starts from the month of December onwards till February followed by burning down of debris in the month of March for the onset of paddy field, during this period large area of wild fires occurs unknowingly.Areas under the shifting cultivation which is cultivated in Milak areas are proned to sever landslides causing massive environmental degradation due to practice on slopes. For the last 6-8 years the village experiences much warmer and less rainfall distribution which affects the agricultural crops due to low dew drop formation.

The plantation is common in the village with nearly 30 households are engaged in this cultivation. Most of the Tea products sell off to other nearby towns and districts. An orchard farm project is also established under the initiative of horticulture department.

Field Survey Observationof Mopungchuket Village during 2018-19

1.Decline of forest cover is another problem.

2. Due to environmental changes bee keeping is also affected.

3. Jhum cultivated areas are prone to landslides.

4. Experiences much warmer and less rainfall distribution which affects the agricultural crops due to low dew drop formation.

Sungratsu village

Sungratsu village was formed from Mopungchuket. The village is located 16 Kms from the Mokokchung Town. The National Highway runs through the village area which is located

10kms from the village. The village is bounded by Mopungchuket in the west and Impur in the south. The village is a hilly terrain with undulating topographical features, at an altitude of 1411msl, latitude 26°21'42"N and 26°27'09"N and longitude of 94°32'11"E and 94°35'51"E.The village has sub-tropical type of agro climatic condition. The village with about 819 households has a population of 3487. The main source of income is agriculture based. Out of 819 households 191 housholds practice Jhum cultivation and the rest are engaged in horticulture, plantation, stone quarry animal and livestock farming.For the last ten 10 years Jhum cycle has been reduce for 15 years to 8 years. The top soil of Jhum cultivated areas are very thin which are eroded easily by wind and rain and causesreduction in its production of crops.

The main horticulture crop being cultivated in the village is orange, passion fruit, litchi, colocasia and ginger. Other horticulture crops are also grown but are in insignificant on comparison with the above mention crops. Tea and Betel vine are the most widely cultivated plantation crops in the village. Tree plantation like Gamari, Hollock, Khokon are found in large scale. The trees are mostly 10-15 years matured with Khokon dominating the plantations in quantity.

The major rivers passing through the village are Tangtangyong, Kuyong and Sungpangyong.Thevillage has tropical and sub- tropical type of climatic conditions. Annually, it receives an annual rainfall of about 900-1600 mm with a temperature of 10°C to 30°C. The common types of soil orders are Inceptisols with fine clay and loamy texture and Ultisols with clay texture.

The current economy status of the village is average. Like any other villages, agriculture is the main source of income and employment. There are also some individuals

who are also engaged in government service or in contracts, business, wage earners etc. Agriculture produced from the village is consumed within village, with moderate marketable surplus.Piggery, poultry and Cattle rearing are the common livestock reared in the village. Few households also rear fish but is minimal. Stone quarry also serves as a source of income for some household but contributes to environmental consequences in the form of landslide.

Field Survey Observation of Sungratsu Village during 2018-19

1. With the reduction in Jhum cycle, fertility of the soil content has been reduced to a great extent.
2. Loss of habitat due to Jhumming.
3. Landslide is frequent due to stone quarry.
4. The top soil is very thin and are mostly eroded easily by physical agents.
5. The villagers converted the entire traditional community Jhum site into a model farming village where sedentarized farming activities is encouraged.

Merangkong

The Merangkong village falls under Langpangkong range, presently covered under Changtongya block. The village is located 58 km away from the district headquarter Mokokchung. The village is a hilly terrain with undulating topographical features, located between latitude 26°34'05"N and 26°40'45"N and longitude of 94°35'53"E and 94°43'0"E.It has a total population of 3254 with 550 nos of households.

The village falls under sub-tropical and tropical type of climatic conditions. It receives an annual rainfall of about 900-1600 mm with a temperature of 10°C to 30°C. Soils of this village are deep, excessively drained, coarse and fine loamy. It has steep and moderately side slope of hills having loamy surface with slide to moderate erosion

hazard. Most of the household in the village is engaged in agriculture as a result the main occupation for their source of income is agriculture. Various agricultural activities taken up by the villagers include Jhum, horticulture and some plantation crops. The people practice Jhumming both in the hills and valley regions of the village. The village is gifted with rich vegetation inwhich different species of trees, shrubs, orchids, ferns etc are found. Bamboo species like longmi, ashi, and Ani etc are also found in the village.Almost every household is engaged in livestock activities these include poultry and piggery. Cottage industries such as weaving, basket making, handicraft and carpentry are taken up by the people for economic activities.

Majority of the villagers are engaged in agri-based activities. Piggery and poultry are widely practiced by majority of the household. Basket making and carpentry are also practice for own use.Orange, pineapple and banana are the marketable surplus crops being produced from this village. Other crops are also cultivated but solely for self consumption purpose only.

A major source of income of the village isfrom agricultural crops, fruits, vegetables, livestock, handicraft items, salaries of employees, business, earning from wages, others.

The village has a rich vegetation with semi-ever green to evergreen forest cover. A wide variety of vegetation is available in the region some discovered some yet to be. Jhumming is practiced which dominates over wet rice cultivation. Tree species like Hollock, Naganeem, Gamari and Khokon are found to grow naturally in this forest belt. Local species like Mesang, Sinsa and Miset are found to grow widely in this area.Horticultural crop which is mainly cultivated in this village are orange, passion fruit and banana. Economic tree plantation like Gamari, Hollock, and Khokhon are widely cultivated.

Field Survey Observation of Merangkong Village during 2018-19

1. Drying of natural perennial streams and ponds in the village areas.
2. Landslide is frequent due to stone quarry.
3. Rainfall is in irregular pattern.
4. Felling of huge forest and clearing of jungles accelerate soil erosion and accentuate variability of rainfall affects in crop production.

Khar

The village falls under Tsurangkong range, presently covered under Mangkolemba block. The village is located 75km fromMokokchung Town. The village isa hilly terrain withundulating topographical features, at an altitude of 300-1200 msl. It has a geographical area of 5034 Ha and lies between latitude 26°25'31"N and 26°30'39"N and longitude of 94°24'57"E and 94°31'33"E. The village is surrounded by Mangkolemba, Longsemdang and Mongchen on the North, Longjang and Longpa village on the East, Japu, Changki and Chungliyimsen on the West and Chungtia and Mopungchuket on the South. It has of total population 3614 with 848 numbers of households.

The village falls under sub-tropical and tropical type of climatic conditions. It receives an annual rainfall of about 900-1600 mm with a temperature of 10°C to 30°C. Soil order type are deep, excessively drained, fined loamy soils with moderate sloping side slopes of hills having loamy surface with moderate erosion hazard. The region is known for its wide agro climatic diversities, this diversity is manifested through irregular rainfall and similar fluctuations are witnessed in temperature, sunshine and relative humidity.

Agriculture is the main occupation for their source of income. At present, out of 848 household 40 household are engaged in Jhum cultivation. The cycle of Jhum has been

reducedto 8 years.Besides Jhumming, most of the household in the village are engaged in various agricultural activities like horticulture, plantation crops and animal husbandry and livestock rearing. Majority of the villagers are engaged in agri-based activities. Piggery and poultry are widely practiced by majority of the household. Basket making and carpentry are also practice for own use.

Tree species like Hollock, Naganeem, Gamari and Khokon are found to grow naturally in this forest belt. Local species like Mesang, Sinsa and Miset are found to grow widely in this area. Horticultural crop which is mainly cultivated in this village are orange, passion fruit and banana. Plantation crops/Economic tree plantation like Gamari, Hollock, and Khokon are widely cultivated

Field Survey Observation of Khar Village during 2018-19

1. With the reduction in Jhum cycle, fertility of the soil content has been reduced to a great extent.
2. Many Jhum fields after cultivation are left fallow as a result top soil which is very thin are mostly eroded easily by physical agents.
3. Extinction of varieties of exotic floras and endangered faunas.
4. Drying of natural perennial streams and ponds in the village areas.

Changki

It is believed that some people migrated from a place called Changki in South East Asia and settled in the present village. Hence the name of the village was called Changki. Other versionof the meaning of the village Changki means Rice (Chang) Bowl (Ki). It is believed that Changki village was established in around 1250 A.D. It lies between 26°21'33" N and 26°30'27"N Latitudeand 94°18'49"E and 94°25'46"E Longitude. The

village is bounded by Moayimti, Chungtiayimsen, Japu&Atuphumi village in the north, Chungliyimsen and Aliba village in the east, Shihaphumi and Wokha district in west and Aliba and Wokhadistricttowards the south. It has a geographical area of 9557 hectares.The village has a total population of 2486 with 690 households.

The village has sub-tropical and tropical type of climatic conditions. The annual rainfall of the village is about about 900-1600 mm with a temperature of 10°C to 29°C. The type of the soil of the village is deep, excessively drained fine soils on gently sloping side slopes of hills with clayey surface having moderate erosion hazard and very slight stoniness. The region is known for its wide agro climatic diversities, this diversity is manifested through irregular rainfall and similar fluctuations are witnessed in temperature, sunshine and relative humidity.

The village has a rich vegetation with semi-ever green to evergreen forest cover. A wide variety of vegetation is available in the region as a result most of the household in the village is engaged in agriculture as main occupation for their source of income. Out of 690 households, 250 householdspractice Jhum cultivation. Various agriculture activities taken up by the villagers include terrace, Jhum, horticulture and some plantation crops. Almost every household is engaged in livestock activities these include poultry and piggery. Other components such as fishery, dairy and bee keeping are also taken up but at a lesser scale.Cottage industries such as pottery, basket making and carpentry etc are taken up by the people for economic activities.

Horticultural crop which is mainly cultivated in this village are Paddy, Areca nut, Cashew nut, orange. Potato, cabbage and chilli are some of the vegetables which also flourish well in the village. Plantation crops and commercial tree plantation like Gamari, Hollock,

Bamboo and Teak plantation are widely cultivated. Tea is also grown at a marginal scale.Besides, some few households are engaged in coal mining. During the year 2000-2010 there was around 120 laborers engaged in mining activities, but it has been drastically increased to more than 300 during the year 2010-2020. Today, extensive unplanned extraction of coal mining is being carried out at many places in the village thereby degrading the land and its fragile ecosystem especially the water bodies. As reported by the villagers for 30 years nothing grows in the area and within the area where mining is done.

Field Survey Observation of Changki Village during 2018-19

1. The practice of large felling of trees for agriculture, timber and firewood in individualandprivate land has brought massive destruction on land.
2. Domination of tall grass like broom and shrubs is common in the entire areas.
3. The study revealed that many water sources of Changki region are unprotected and contaminated by Acid Mine Drainage (AMD) which originated from coal mining operation and degradation of water quality in the area is evidenced.
4. Potential changes in surface drainage patterns and topographic features are pre-dominant.
5. Dumping of mine waste on the roadside and around agricultural land thereby exposing sulphurous coal dust creates both health and environmental hazards in the area.

Anakiyimsen&Anaki C

Anakiyimsen&Anaki C village lies between 26°41'45" N and 26° 46' 51" N Latitude and 94°42'20"E and 94°45'33"E Longitude. It is located at an altitude of 110-890 msl. Its topographic feature is plain landform, with sub-tropical agro-climatic condition. It has a

population of 840 with 181 households (2011 census). The village is bounded by Assam and Longleng district in the north, Assam and Kangtsung in the east, Longleng in west and Kangtsung and Longleng district towards the south. It has a geographical area of 2816 Hectares.

The village has a tropical and sub- tropical type of climatic conditions, with a temperature ranging from of 10°C to 32°C. Annually, it receives an annual rainfall of about 900-1600 mm. Soil order type mostly found include Inceptisols with fine clay and loamy texture and Ultisolswith clay texture are also found in this region..However in the recent times, their has been drastic changes in the climatic condition which is felt by the people due to development activities, deforestation and pollution. All these activities have lead to climatic change resulting in drought, landslides, flood, global warming, and effect on the quality of water resulting in decrease crop production.

Forest vegetation around the village is thick but the lust green forest is fast disappearing due to rampant destruction of the forest for agriculture, firewood, timber and mining. This has also brought down the forest area to an alarming rate and has endangered many faunal species found in the area. The economy of thevillage is dependent on agriculture crops such as orange, Banana, Passion fruit, Papaya, Mango and leafy vegetables. Main plantation crops are Rubber and Tea. This region in Mokokchung district is blessed with rich natural resources. At present, coal mining is being carried out in small pockets deposits. But, unscientific and poor land management capability has resulted in Environmental degradation.

Field Survey Observation of Anakiyimsen&Anaki 'C' Village during 2018-19

1. The problems of water quality degradation and its adverse impacts on availability of potable and irrigation water is increasing.

2. Degradation of soil quality, agricultural productivity and rich biodiversity in the area has been increasing.

3. Degrading features of environment is due to felling of trees for firewood and timber.

4. The primary cause of degradation of water quality, land and the declining trend of biodiversity in the water bodies in the village is attributed mainly to the Acid Mine Drainage (AMD) form mining area which makes water highly acidic and rich in heavy metal concentration.

Watiyim

Watiyim village is located in Merangmen Block of Mokokchung district. The village lies between 26°31'23"N and 26°32'46"N Latitude and 94°42'20"E and 94°24'02"E Longitude. Its topographic feature is plain landform located at an altitude of 90-168 msl with sub-tropical agro-climatic condition. It has a total population of 728 with 169 households (2011 census). The village is bounded by Chungtiayimsen and Longpayimsen in the north, Longsemdang and Japu in the east, Chungtiayimsen in west and Chungtiayimsen and Japu in the south. It has a geographical area of 255 hectares.

The village has a tropical and sub- tropical type of climatic conditions with a temperature ranging from of 10°C to 34°C. Annually, it receives an annual rainfall of about 900-1600 mm. Soil type mostly found in this village is fine clay and loamy and clay texture. Out of 169 households, 12 household are engaged in Jhum cultivation. The socio-economic status of the village is not so good, more than 80 per cent of the villagers are subsistence and they solely depend on agriculture. Of the total cultivable area, almost entire area is Jhum fallow land, with scrub forest located in an around the village, most of the area are fallow

land The village maintains a Jhum cycle of 8-10 years but now it has been reduced to shorter Jhum cycles Fertility of the soils content has also been decreased a lot which inversely affects in crop production. Today, almost every household is engaged in livestock activities which include poultry and piggery Fish farming is also adopted by few household to meet their basic needs

However in the recent times, therehave been drastic changes in the climatic condition which is felt by the people due to Jhum cultivation, development activities and deforestation. All these activities havelead to climatic change resulting in water scarcity and decrease in crop production due to quality of water Major sources of income of the village comes from agricultural crops, fruits, vegetables, livestock rearing - pigs and poultry Besides these, fisheries play an important role in their economy.

Field Survey Observation of Watiyim Village during 2018-19

1 Repeated Jhum Cultivation in short cycle cause irreparable damage to the top soil with low yields.

2 Perennial streams have dried up and natural forest canopy are rare due to deforestation

3 Invasion of more weeds is common in the paddy fields

4 Due to late monsoon time of sowing seeds are affecting to a large extent.

From the field survey, in all the villages its was found that Jhum cultivation still dominates the pattern of land use It was also found that Jhum cultivation is declining as shown in **Table 3.10 and Table 3.11** as farmers are now engage in different types of land use i.e., horticulture, livestock farming, plantation, tourism, etc. for their livelihood.

Expansion of terrace cultivation is also going on, especially in the low lying areas of Mokokchung district. The Bamboo Mission under the Government of Nagaland has also startedtree plantation (afforestation) with proper conservative measures over Jhum abandoned land in hilly areas by financing the farmers. State Agriculture Research Station at Yisemyong, Mokokchungis taking great initiative in giving awareness on organic farming. Besides all these activities, majority of the rural population are giving importance to soil conservation and its management by building gully plug, check dam, physical barrier, etc., which protects soil erosion and helps in the growth of plants. Today, with all these initiatives and development Jhum cultivators in the villages are decreasing and a shift to plantation and cash crops cultivation has been noticed.

MAPS OF SAMPLE VILLAGES

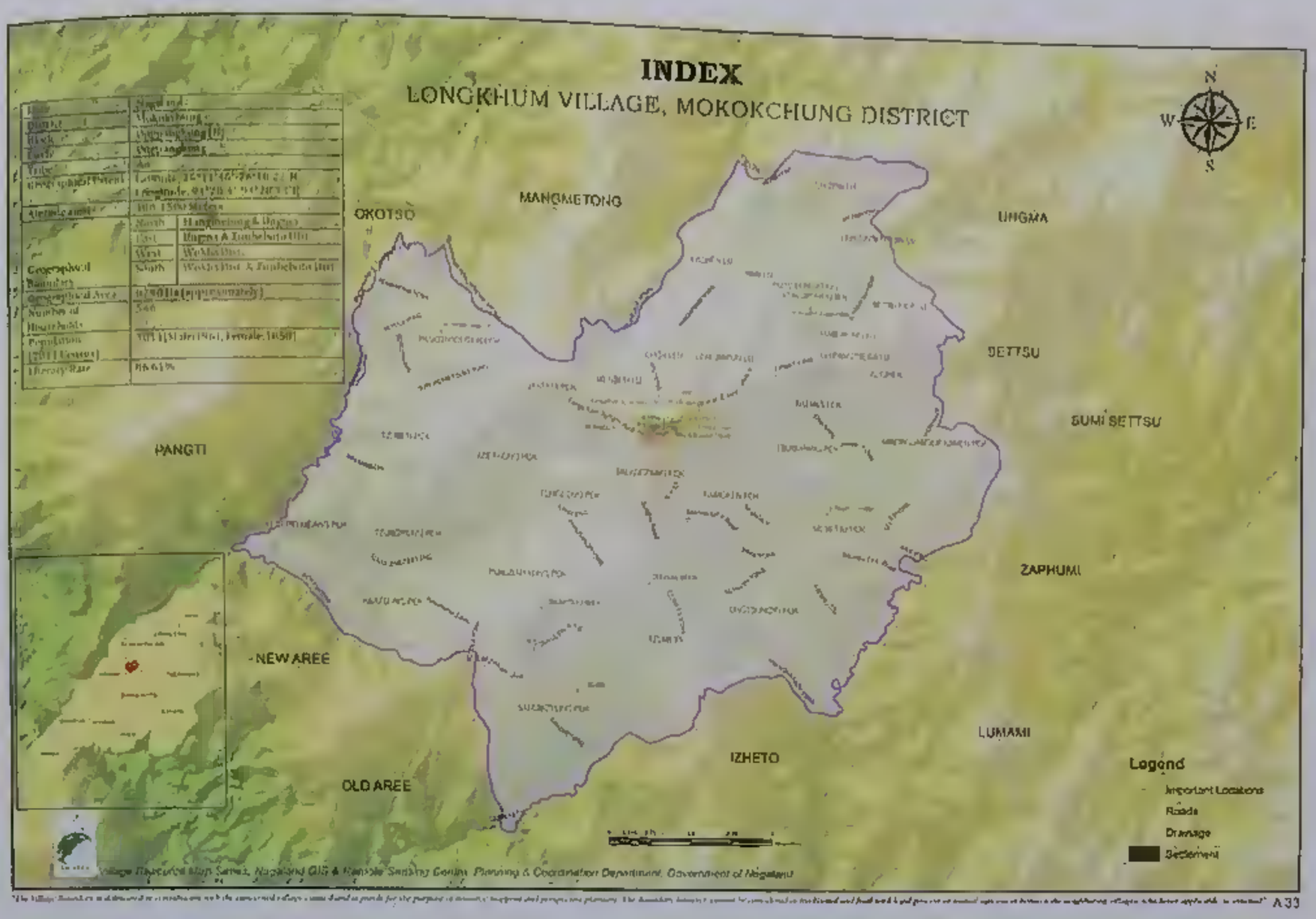


Fig. 3.13 Map of Longkhum Village

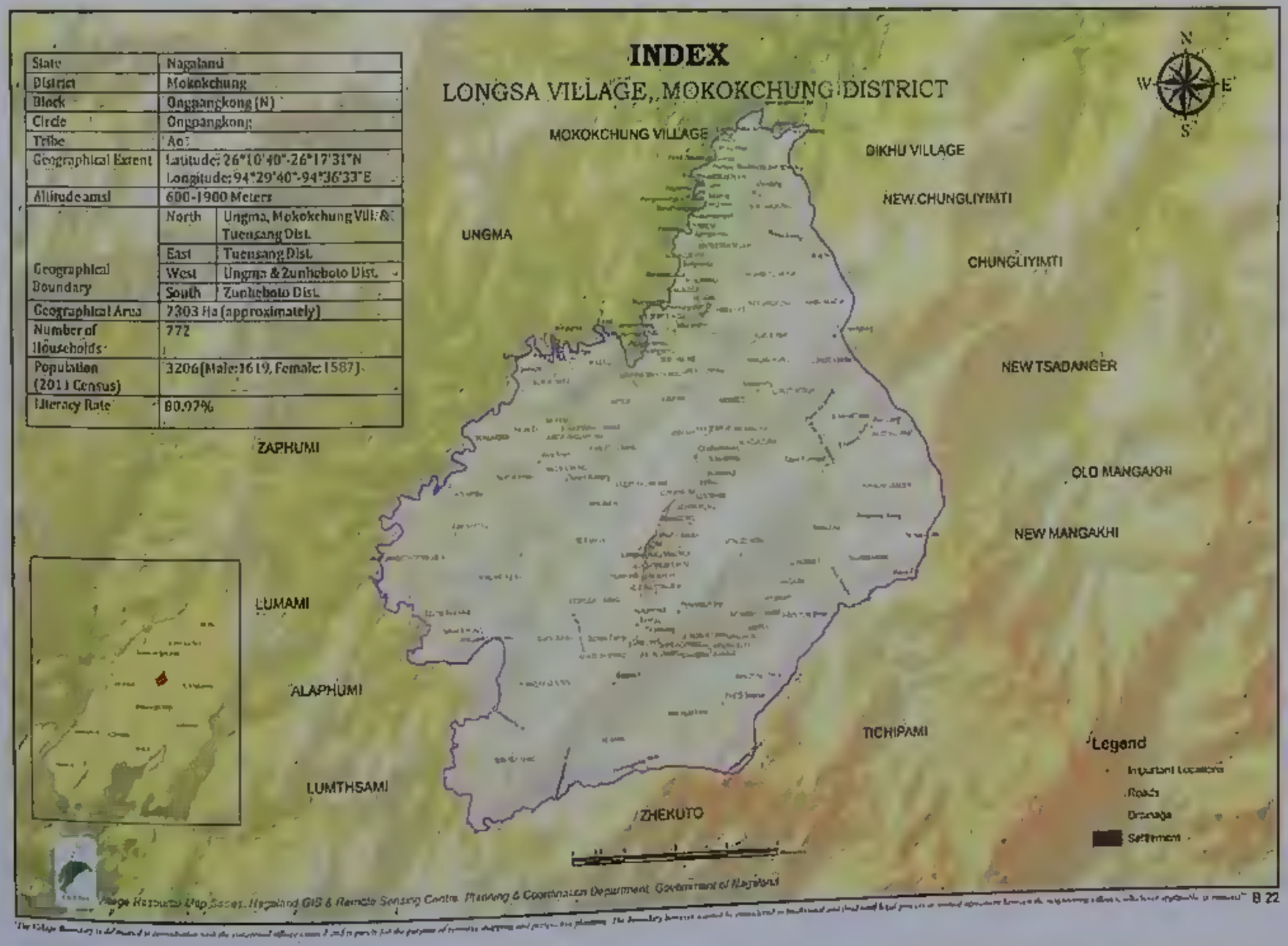


Fig: 3.14 Map of Longsa Village

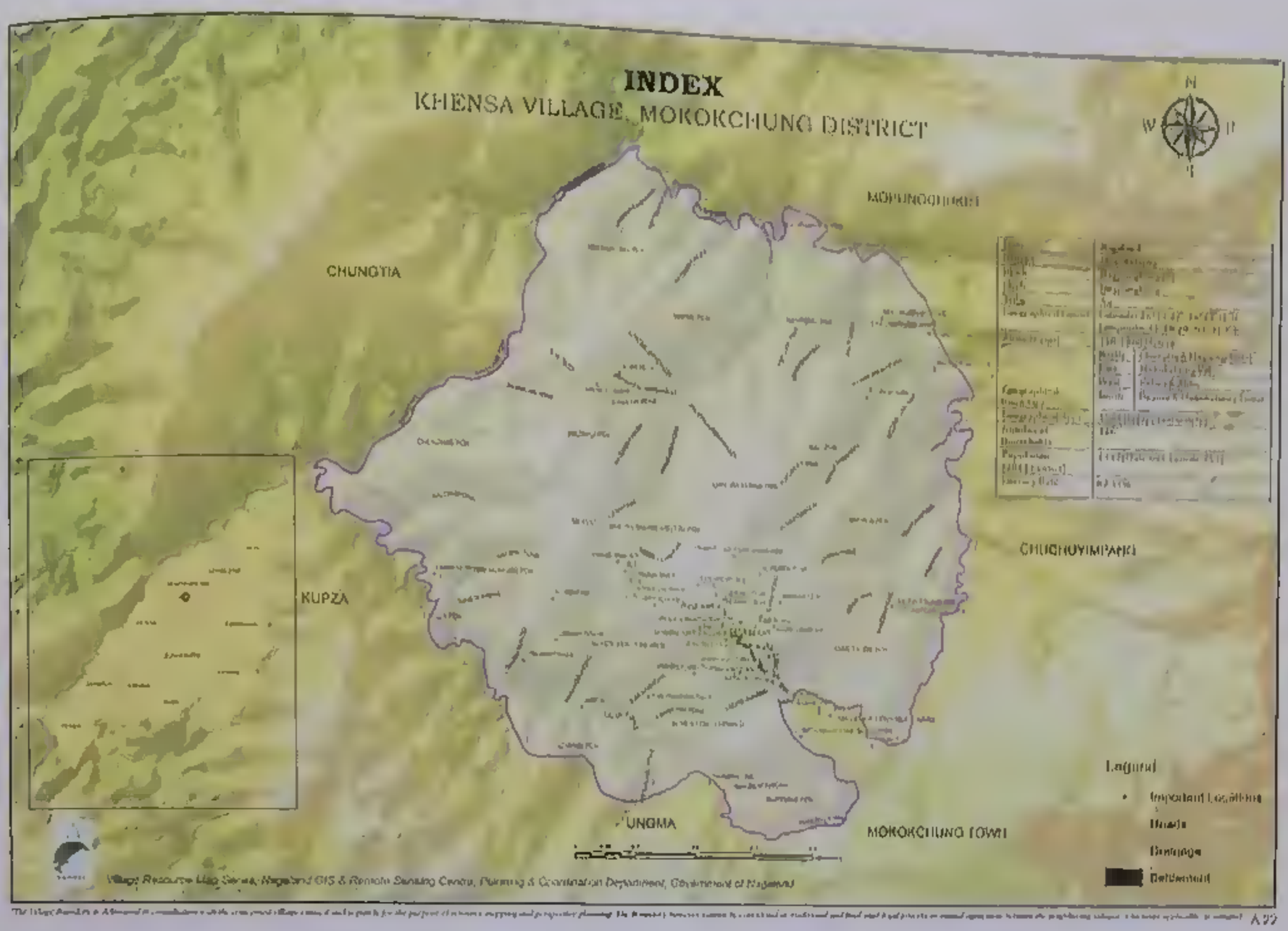


Fig. 3.15 Map of Khensa Village

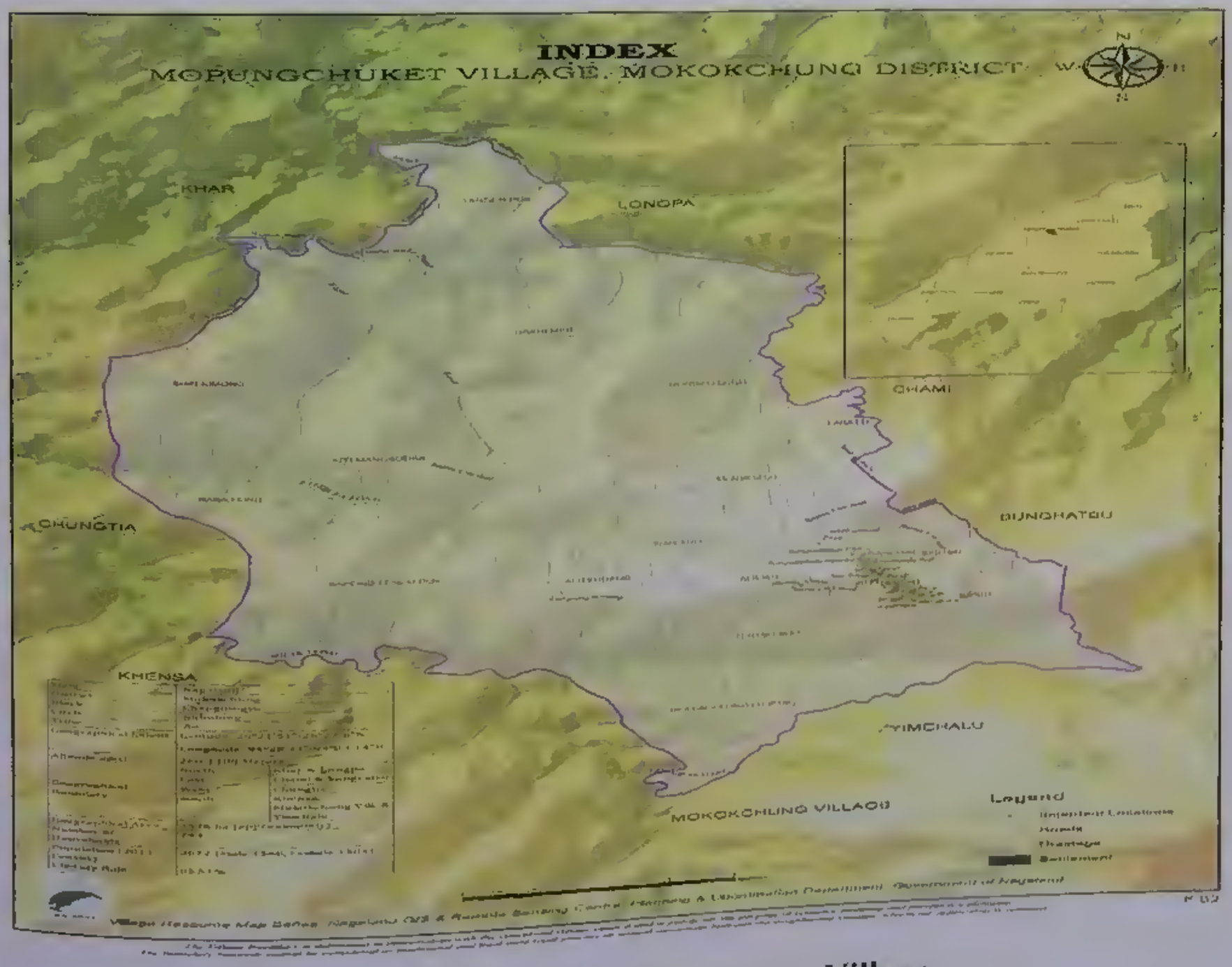


Fig: 3.16 Map of Mopungchuket Village

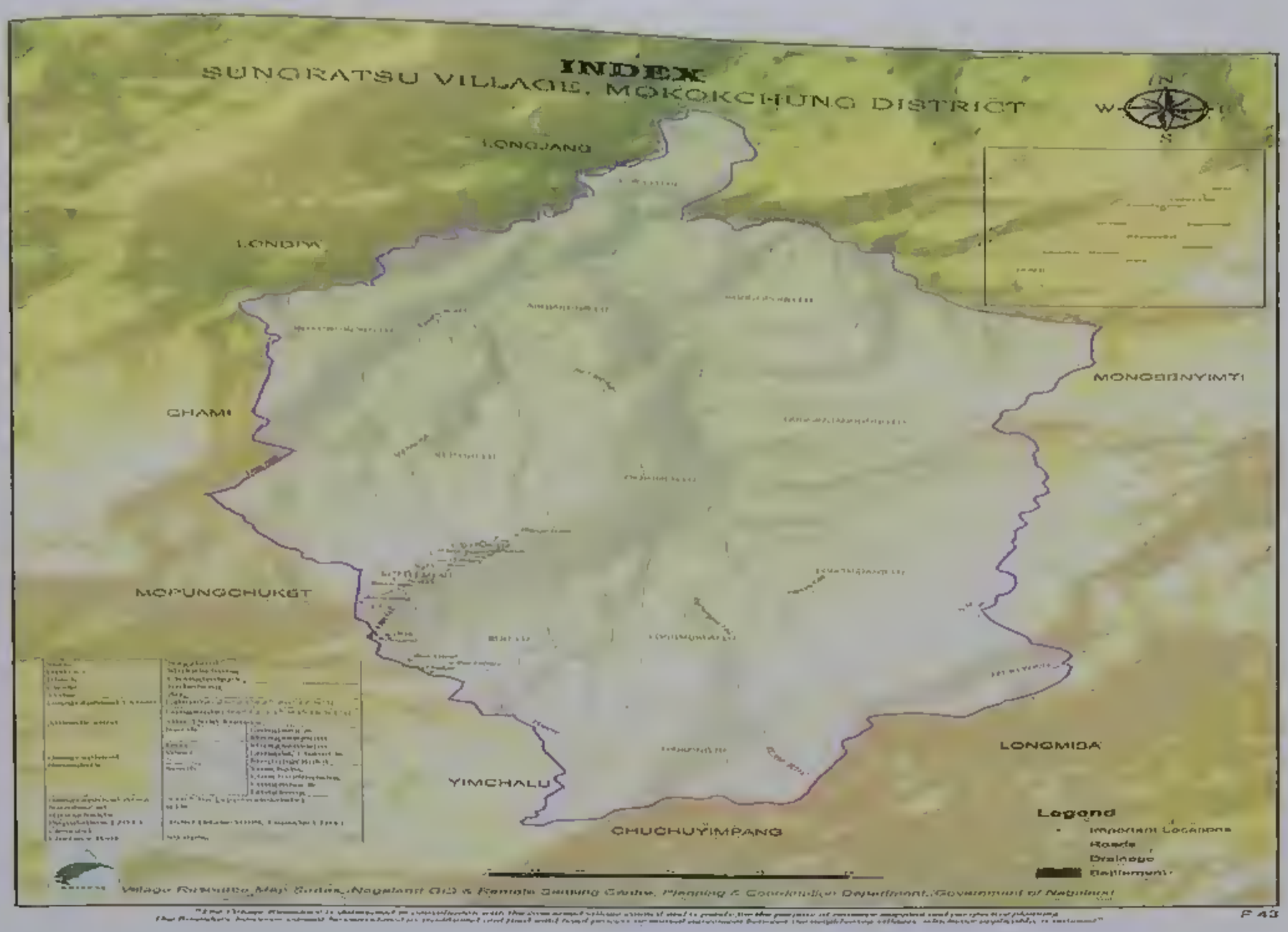


Fig: 3.17 Map of Sungratsu Village

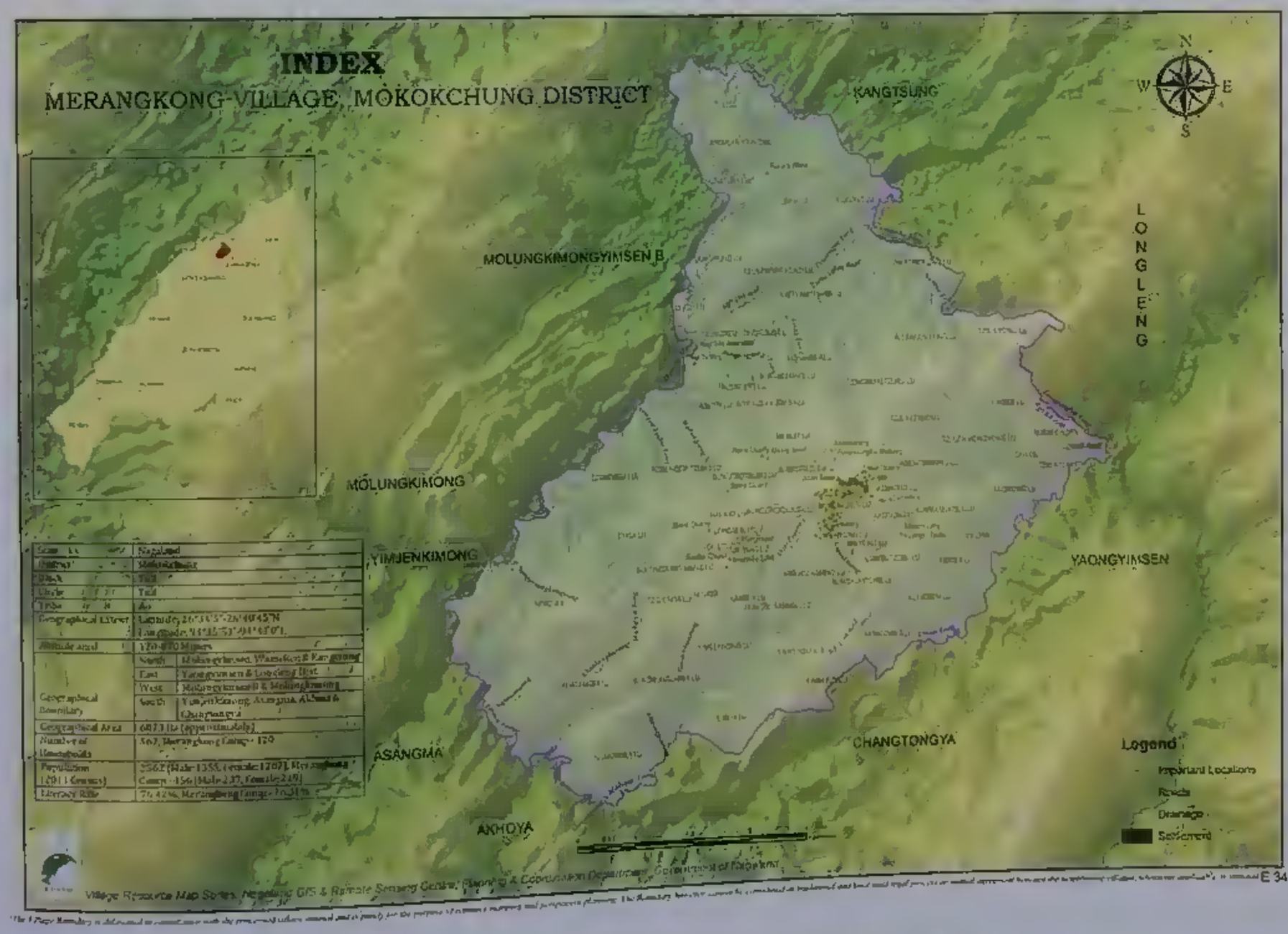


Fig: 3.18 map of Merangkong Village

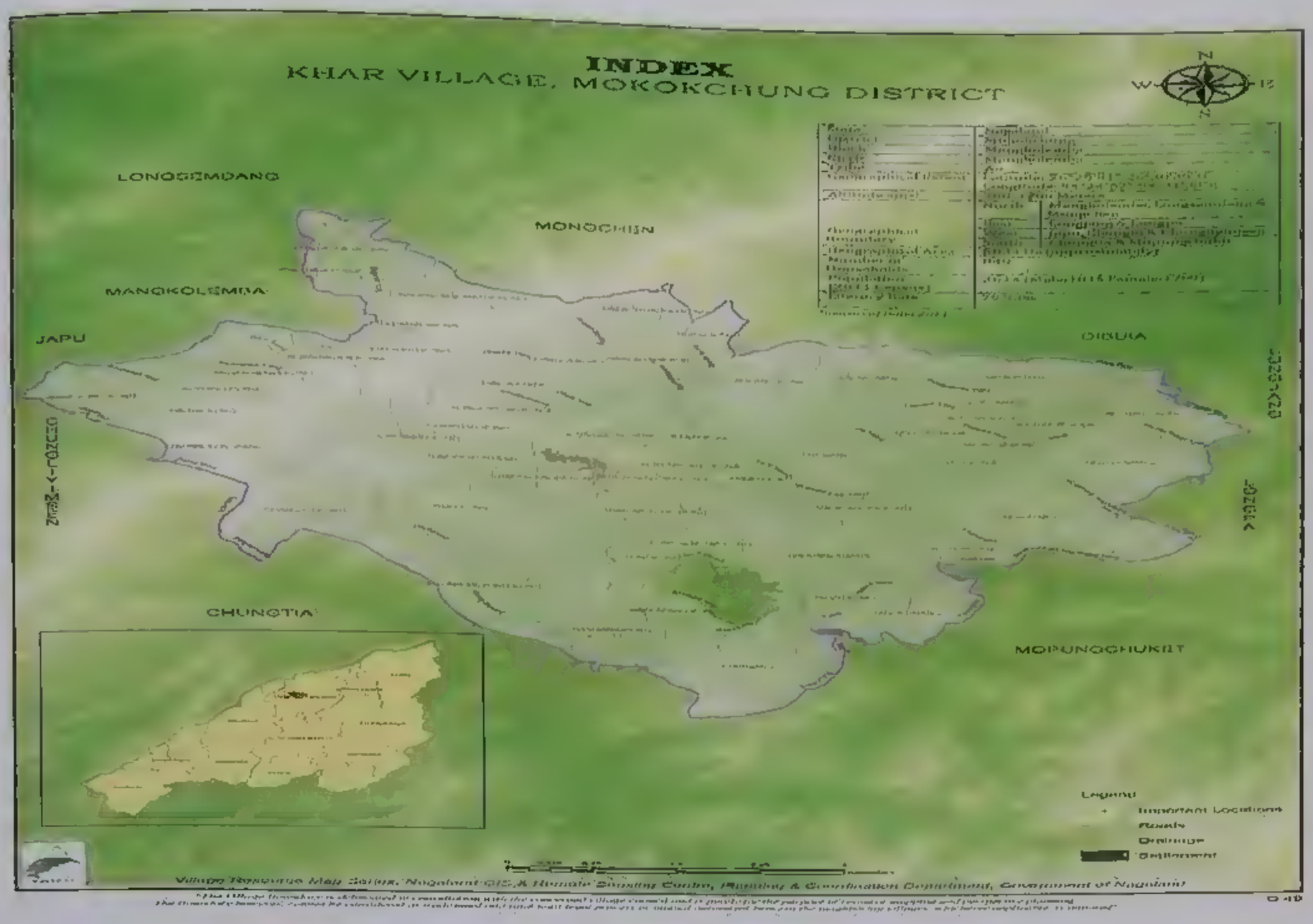


Fig: 3.19 Map of Khar Village

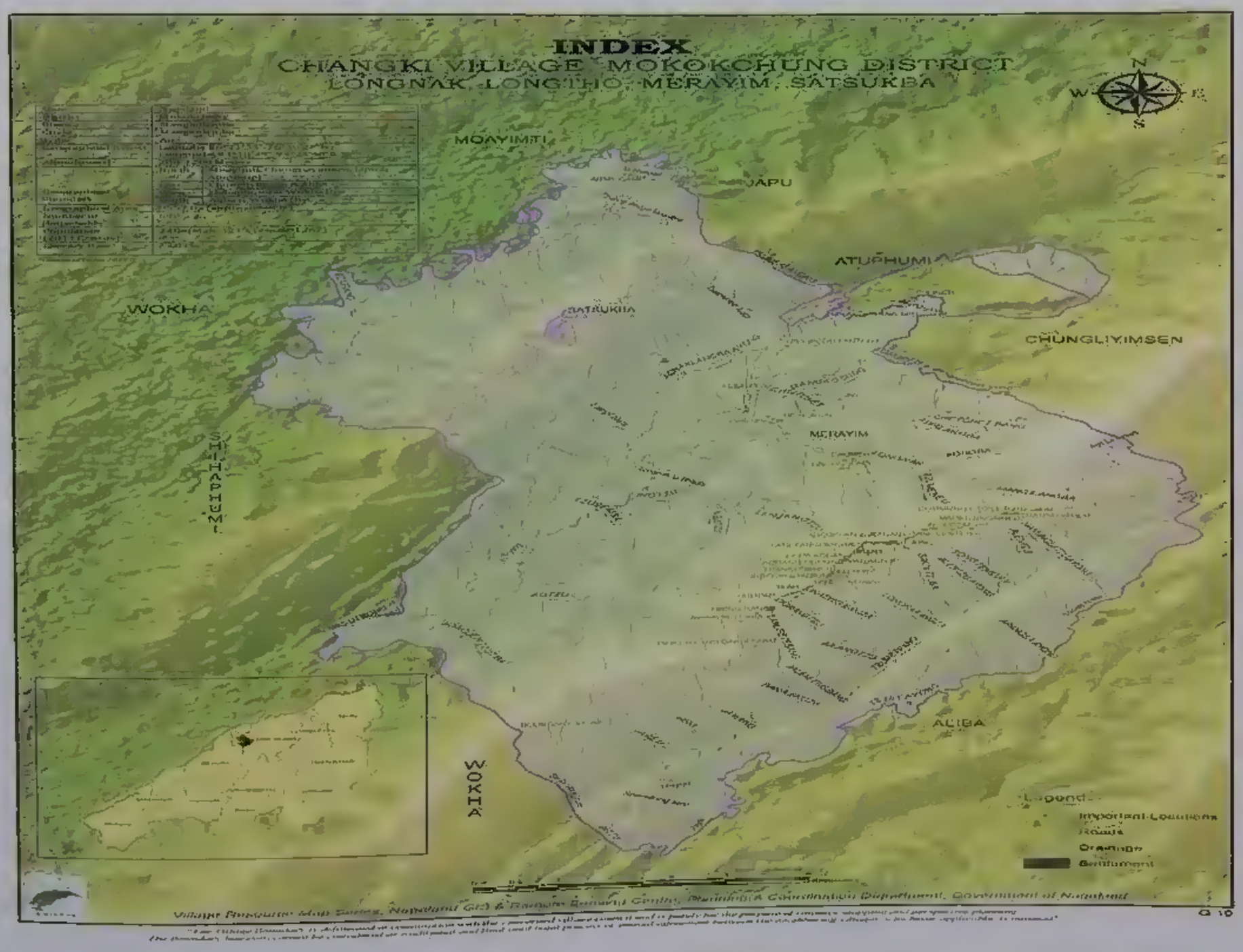


Fig:3.20 Map of Changki

Fig: 3.21 Map of Anakiyimsen and Anaki C Village

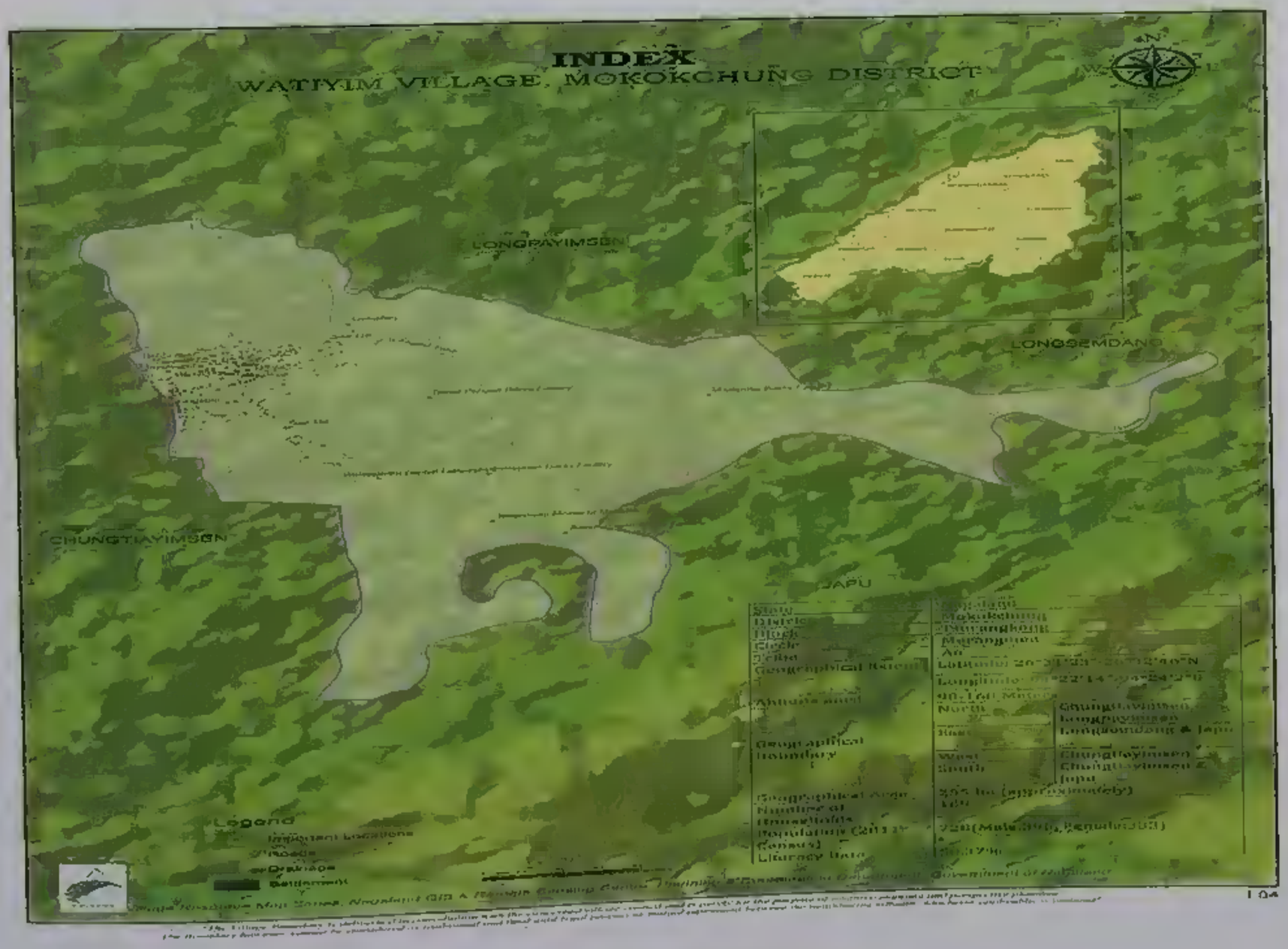


Fig: 3.22 Map of Watiyim

CHAPTER: 4

LAND USE PATTERN AND ENVIRONMENTAL DEGRADATION

CHAPTER: 4 LAND USE PATTERN AND ENVIRONMENTAL DEGRADATION

4.1 Introduction

Land is the prime, fixed and complex natural resource to human beings. It is not a private property, in the sense of a main factor of production of a state or a nation as a whole. The modern world is gradually proceeding in a dynamic way i.e more synthesized in all disciplines. As a matter of fact, pattern of land use development (change) is going on through system approach for macro, meso and micro-regional levels, is a vast difference between life style of urban and rural inhabitants as regards the landform and land utilization. Land use as Vink (1975) defines as "any kind of permanent or cycle human intervention to satisfy human needs either material or both from the complex of natural and artificial resources which together are called land".Das (1980) points out "land use presents as extremely complex pattern, falling into different types. This complex land use pattern is the result of centuries of human settlement representing the interaction of physical, historical, and economic factors". Such a vital resource needs to be used in a meticulously planned way in complete harmony with the various components of land. Unscientific and unplanned or ill planned use of land are fast resulting into its gross misuse and abuse leading to progressive ecological imbalances which, if not arrested in time, may lead to systematic and secular low-cast of human beings. At present, the prospects and pattern of land use development (change) planning of a micro region is that all the sites and resources viz., from forest to town, from low-lying tracts to highland tracts, be soundly developed so that the population will be evenly distributed to utilize the resources rather than to nullify or to destroy its natural endowments.

Land use refers to the management and modification of the natural environment or

wilderness into built environment, semi-natural habitat, arable fields, pasture and managed woodlands. It also describes the arrangement of activities and input that people undertake in certain land cover types to produce change or maintain it (FOA 1997; FOA/UNEP, 1999). Land use changes in areas such as forestry, farmland and around waterways are being driven by the need to provide food, shelter, fibre and water for more than seven billion people of the world (Foley et al., 2005).

Shifting cultivation is an important form of primitive agricultural land use to meet the needs of the society. In this system forest area is cleared by slash and bum techniques. Till 1950's shifting cultivation, under its diverse forms of slash-and-burn system was a traditional method of cultivating tropical highland and mountain soils, mostly for providing a minimum subsistence to the peasantry (Jasbir Singh, 1997). For primitive cultures, the cultivation was a remarkable innovation which is based on the revolutionary transition from forest based food gathering to agriculture based food production. The cycle of rotation was also long having enough time to renew the soil. With the increasing population, more pressure on land increased with shorter Jhum cycles. In course of time, various adverse effects arise due to shifting cultivation practice. Short fallow periods were no longer adequate to restore the soil productive capacity resulting to decline in crops yield and with the increase in population pressure on the land, the Jhum cycle decreased. The main reason behind the persistency of this system of cultivation lies in its compatibility with the physical environment.

The sparse population, steep and undulating topography, community land tenure system and other socio-economy and cultural factors are some of the reasons that went in its favors, in Northeast region where shifting cultivation is practiced by most of the hilly people.

There are various effects of shifting cultivation with large scale deforestation causing undesirable ecological imbalances. Since, the hill tops particularly the catchments areas are the source of water, deforestation in the hills has lead to elimination of the sources of water. The clearance of forest causes deforestation which accelerates soil erosion and accentuates the variability in rainfall distribution. Burning of Jhum land can be considered as one of the worst impact on climate because it gives scope in high rate of soil erosion and soil erosion structural stability by runoff and winds. The availability of water in the soil for the crop production also decreases which is vulnerable to climatic variation. As the farmers cultivate the same plot of land for two years in some village, fertility of the soil decreases with its debilitating impact of crop production. The fragmentation of natural habitat loss native species and invasion of more exotic weeds arise and burning down of sun-dried vegetation pollutes the air with carbon- monoxide, nitrous oxide and many other harmful gases are some of the consequences of shifting cultivation on environment.

4.2Land Use Changes in Mokokchung District

Land use refers to the uses of land for different purposes, which includes wildlife habitat, forest, agricultural land, settlement etc. It plays a vital role for many planning and management activities concerned with the surface of the earth.

Soil is a natural gift bestowed to human kind. It is basic to life. It is the primary means of food production directly supporting the livelihood of most rural population and indirectly to everyone. It is essential component of terrestrial sustaining their primary producers (all living vegetables and decomposers (micro-organism, herbivores, carnivores), while providing major sinks for heat energy, nutrients, water and gases. (Wild, 1993). Infact, all forms of life on the

land system derive their nutrition either directly from the soil or through other system controlled by soil. The soil combined with water determines the potential of an area for development.

Commenting on the significance of the soil, the great thinker Aristotle described soil as the stomach of the plant, Even now over 90 per cent of the world's food comes from the soil and less than 10 per cent from both inland water and the ocean. Being finite and highly heterogeneous for different uses, it is under competing demands for different purposes to meet the requirements for food, fodder, fibre, mineral, settlements etc., for the ever-increasing population.

Land is the most basic asset among the Ao-Naga community. Slash and burn agriculture method, popularly known as Jhum or Shifting cultivation still exists. Traditionally it is the chief form of agricultural practices among the village which involves the customary laws to regulate the practice of its cultivation.

Like any other Naga tribes of the State, ownership and management of land in the district is governed by village council, clan and individuals. Agricultural activities dominate the occupational pattern of Mokokchung district and it is well reflected in the use of land as 49.33 per cent of the geographical areas belong to the category of agricultural and Jhum land.Out of the district geographical area of 161500 hectares, the total cultivable area is 110482 hectares. The current Jhum covers an area of 11605 hectares followed by terrace rice cultivation or wet rice cultivation(TRC/WRC) and mixed farming with 6940 hectares (Table: 4.1). Area underTerrace cultivation is cultivatedin the low lying areas ofChangki, Tzurang and Tuli areas. The district maintains an average Jhum cycle of 10-15 years, but

now the duration of the cycle has been drastically narrowed down due to encroachment of more land. Out of 102 inhabited villages (2001 census) with six ranges, Ongpangkong range is the highest cultivator in the district. The village of Longsa has the highest Jhum cultivators with an area of 205 hectares under Jhum land. The villagers cultivate both Ludi (new Jhum filed) and Pentong (old Jhum field). Along with the Jhum paddy field, they also cultivate cash crops like chilly, tomato, potato, cauliflower, many others. In the past in many of the Ao villages the Jhum cycle have been maintained within a range of 10-15 years. However, over the last few decades it has drastically narrowed down to 7 to 8 years respectively.

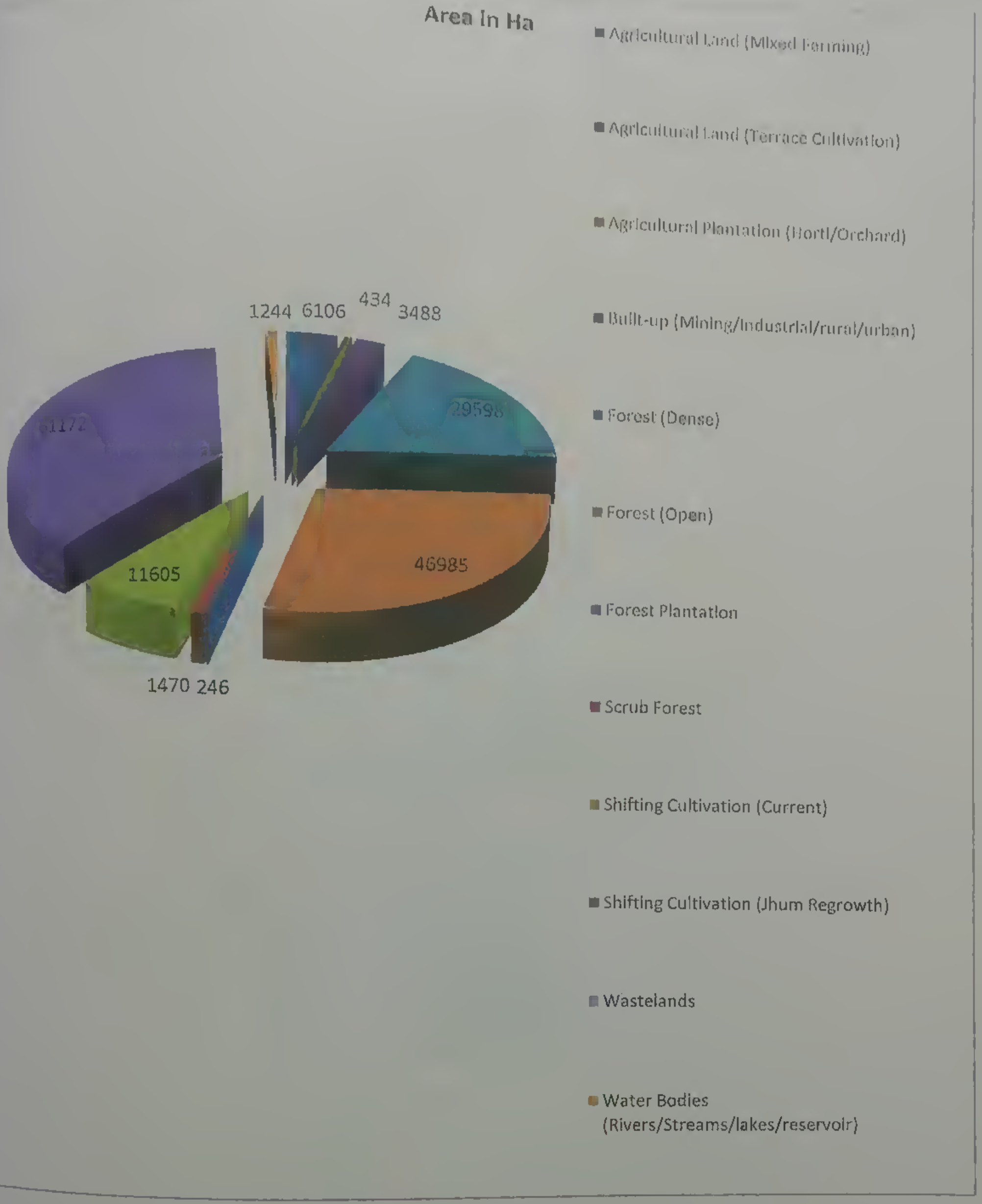
Table: 4.1 Types of Land use in Mokokchung District

Types of Landuse	Area in Ha	Percentage (%)
Agricultural Land (Mixed Farming)	6106	3.78
Agricultural Land (Terrace Cultivation)	399	0.24
Agricultural Plantation (Horti/Orchard)	434	0.26
Shifting Cultivation (Current)	11605	07.18
Shifting Cultivation (Jhum Regrowth)	61172	37.87
Built-up (Mining/Industrial/rural/urban)	3488	2.15
Forest (Dense)	29598	18.32
Forest (Open)	46985	29.09
Forest Plantation	246	0.15
Scrub Forest	1470	0.91
Wastelands	46	0.02
Water Bodies (Rivers/Streams/lakes/reservoir)	1244	0.77

Source: Nagaland GIS & Remote Sensing Centre ,Planning & Coordination Department (2013)

(Based IRS P6 LISS IV, satellite imagery, 2013, with very limited or no ground verification done. Need to cross check on ground. The output may be suitable only for district level broad study)

Fig: 4.1 Graph Showing Status of Land use Mokokchung District



Source: Nagaland GIS & Remote Sensing Centre , Planning & Coordination Department (2013)

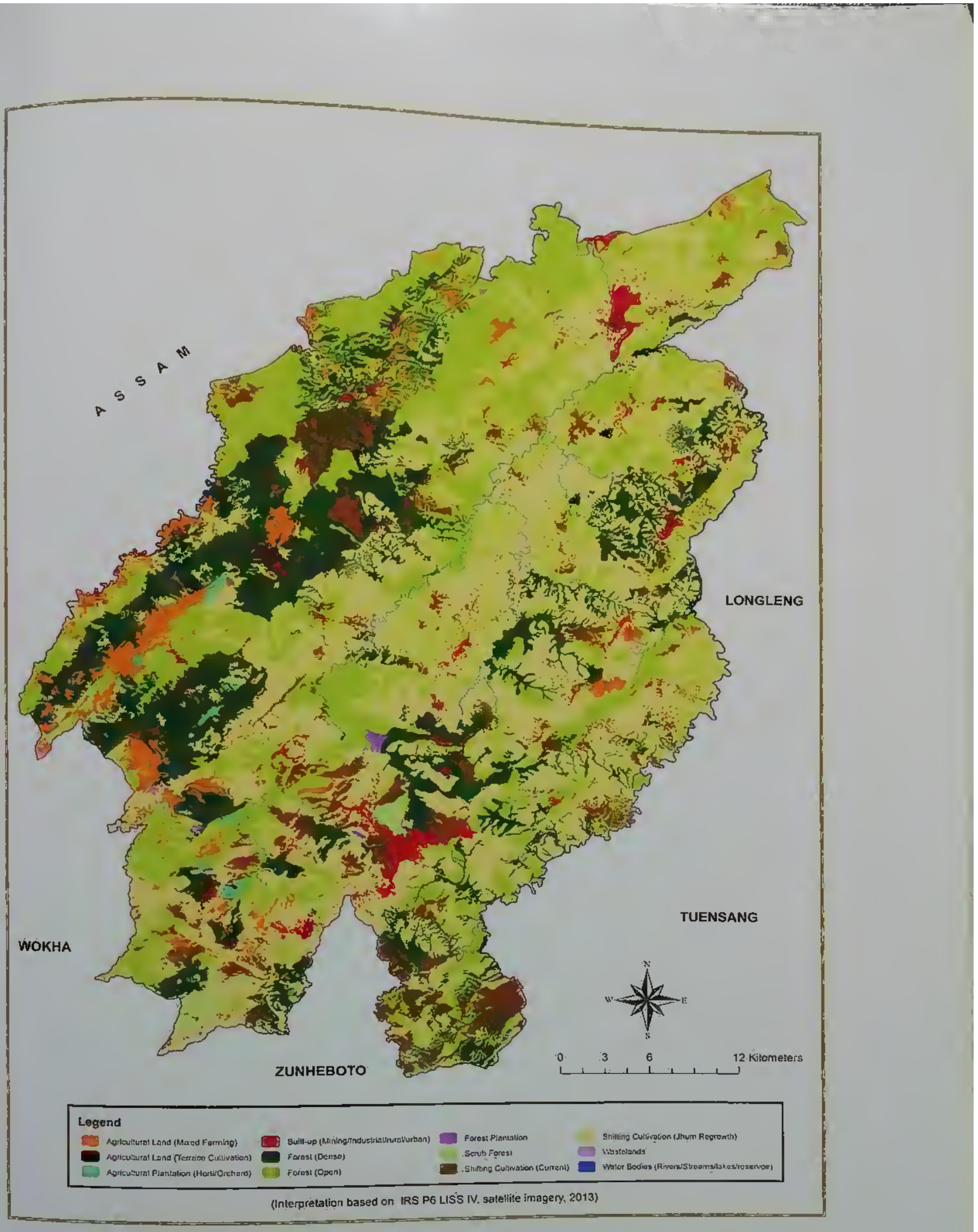


Fig. 4.2 Land use Map of Mokokchung District

Interestingly, in the case Merangkong and Sungratsu village huge forest area under its jurisdiction converts Jhum land into cash crops. In Merangkong village out of 60 per cent hectares of Jhum land, 30 per cent of the Jhum land has been converted into tea and rubber plantation and it has been flourishing to a large extent. Sungratsu village has an approximate area of 150 hectares under Jhum land. The village entire traditional community Jhum land has been converted into a model farming village where sedentary farming activities for production of cash crops and vegetables are being revealed.

Under the supervision of Horticulture Department, Government of Nagaland, in Mopungchuket village nearly 60 households are engaged in tea plantation and orange projects (Field Survey 2017-18). The Bamboo Mission under the Government of Nagaland and Department of Land Resources and Development has started different mission and project to restore ecological balance by harnessing, conserving and developing natural resources i.e., land, water, vegetations. Expansion of terrace cultivation is also going on. This shows that the Jhum cultivators in the villages are decreasing and a shift to plantation and cash crops cultivation has been noticed in all the villages. A number of enterprising farming families have started settling in this farming village and under the bamboo Mission.

Besides agricultural land use, the second major land use component is the forest (47.75 per cent). The share of forest land is relatively higher compared to many other land uses. Typologically, forest of Mokokchung district consists of both deciduous and evergreen forests. The forest region is richly endowed with wide diversity of flora and fauna.In economic sense, Sal and Teak are the two dominant species that it produces. Forest is found to have influenced in shaping the economic life of the area.

Mining, Industrial, rural, urban, etc comes underbuilt up land use category which comprises of 2.15 per centthe third major in the block followed by water bodies with 0.77 per cent. The component ofwaste land shares 0.02 per cent the lowest percent among the other categories.Thus, with increasing population growth increases demand for land, it is imperative to protect the quality and improve the productive potential of available land resource and to save thisscarce and vital resource for the future generation from all degradation processes (i.e., watererosion, water logging, salinity, alkalinity, gullies, and ravines, shifting cultivation, mining etc.) through appropriate conservation measures.

4.3 Land Use and its Impact on Environment in Mokokchung District

It is needless to say that agricultural system of any country of the world is largely the result of interaction between man and environment (Zimmerman, 1972).Environment and land use pattern is most significant for place like Mokokchung as its livelihood is dependent on agriculture. In Nagaland, major land use pattern continues to be shifting cultivation known as Jhum, which covers 72 per cent of the total arable area of the state. This practice is mostly concentrated in the district ofMokokchung, Mon, Wokha, Zunheboto and Tuensang. Shifting cultivation is a system that has beenpracticed overtime and revolves around an agro-eco system of cultivation based on traditional knowledge and indigenous practices.

For land use, shifting cultivation which is the most complex and multifaceted form of agriculture has become a subject of debate and intervention since the colonial era. The practiced has been criticized by numerous scientists, environmentalist, foresters, policy makers as well as the general public as being primitive, destructive, unproductive and exploitative and causes widespread environmental degradation. Shifting cultivation in many

forms are destructive to the environment because forest areas are being converted to agriculture land use which destroys the area under primary forest. As a result shifting cultivators are blamed for the destruction of the world's tropical forest, land degradation, atmospheric pollution and global climatic change. It has brought lots of changes in the ecological settings of the surroundings environment. The loss of forest cover influences the climate that contributes to loss of biodiversity, siltation, flooding and soil degradation affecting the economic activity and threatening the livelihoods and cultural integrity of forest-dependent people. The cause of deforestation and environmental degradation are complex. It has been identified that agricultural factors, socio-economic factors, developmental factors and demographic factors add more pressure on rich land resources. Some of the factors are stated below:

1. Shifting cultivation
2. Deforestation
3. Forest Fire
4. Population, Development and Human Activities
5. Mining & Brick Kiln

4.3.1 Shifting Cultivation

The district of Mokokchung is a land of village with 105 inhabited villages (2011census) and the people of the rural communities depend on environment for their livelihood subsistence. The land belongs to the individual, clan and community. Shifting cultivation which is also known as slash and burn cultivation is an old age practice deeply rooted within the Ao-Naga community. Approximately 70 per cent of the cultivators practice shifting cultivation.

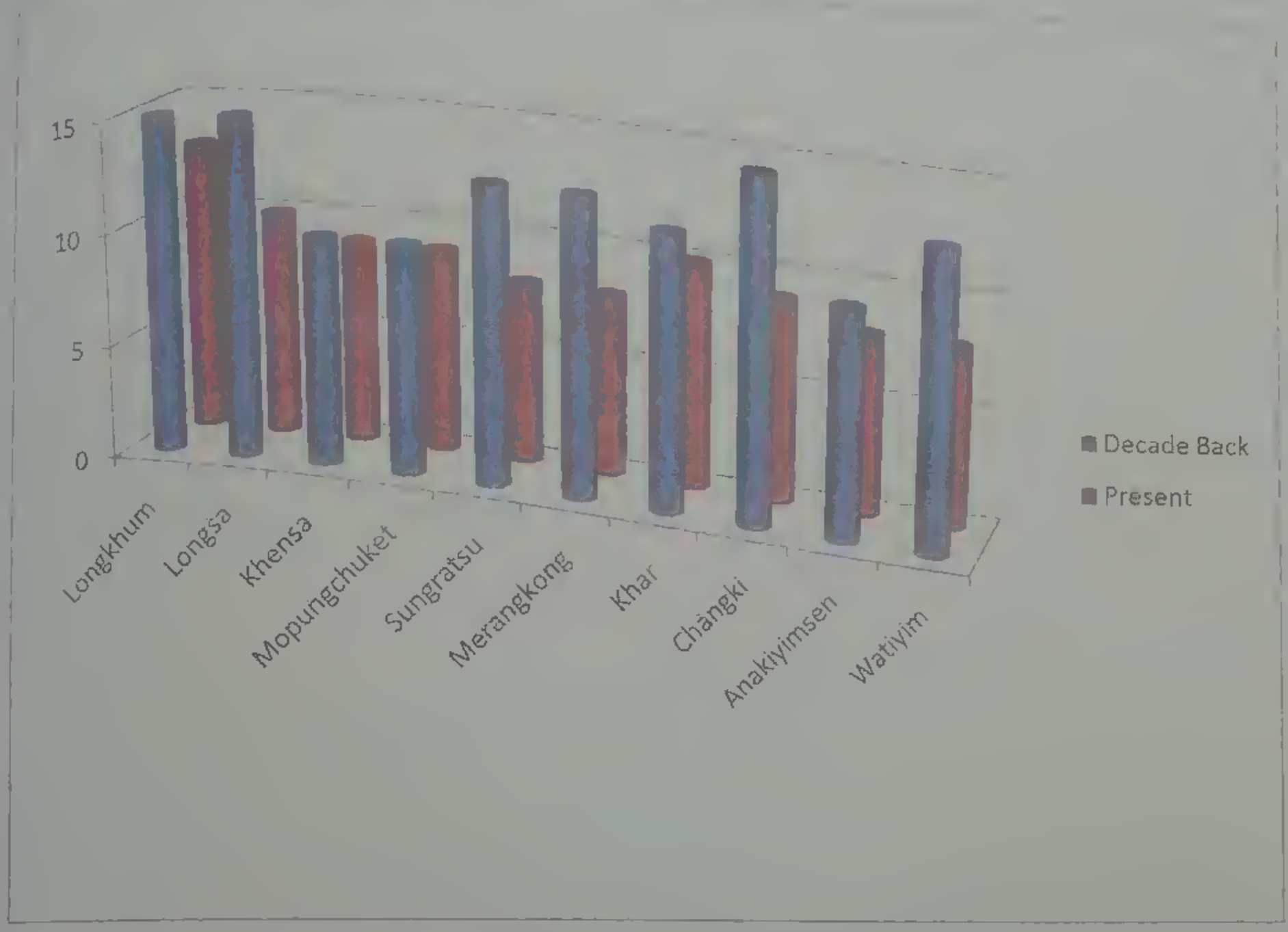
According to Nagaland Jhum Land Act 1970, Jhum land means such land which any member or members or a village or a community have a customary right to cultivates by means of shifting cultivation or to utilize by clearing jungle or for grazing livestock and includes any beds of rivers provided that such village or community is in permanent location. The study reveals that Jhum cultivators in the district are constantly modifying and innovating upon their traditional practices to improve but it still has a negative impact on the environment and their economy. The district was once known to be rich diversity today it has been exploited a lot due to population pressure on agricultural land and by various human activities on environment. Over the years, the district has witnessed serious depletion on forest cover as well as on environmental changes.The burning of Jhum fields has also contributed gradually to the change in climatic variations.At present the Jhum cycle has drastically narrowed down due to high growth rate of population and limited scope for livelihood.All together 10(Ten) villages had been selected to find out the reason for status of Jhum cycle in the state.The selected area/villages have been shown in Figure.

Table: 4.2 Changes in Jhum Cycle in Mokokchung District

Sl.No	Village	Decades Back	Present
1	Longkhum	15 Years	13Years
2	Longsa	15 Years	10 Years
3	Khensa	10 Years	9 Years
4	Mopungchuket	10 Years	9 Years
5	Sungratsu	13 Years	8 Years
6	Merangkong	13 Years	8 Years
7	Khar	12 Years	10 Years
8	Changki	15 Years	9 Years
9	Anakiyimsen	10 Years	8 Years
10	Watiyim	13 Years	8Years

Source: Field Survey (2016-19)

Fig: 4.3 Narrowing Down of Jhum Cycle



Source: Field Survey (2016-18)

It has viewed that the land resource for agricultural activities should be assessed on the basis of slope, dissection index, soil and vegetation cover and land- use of a land at micro-level (Wagh, et al., 1984).There is no doubt that shifting cultivation is destabilizing the environment by means of deforestation, soil erosion and emission of carbon dioxide by the burning of Jhum fields.

The view is that shifting cultivation is wasteful and inefficient mode of crop production. It is true that productivity from the point of land use is low under shifting cultivation (Barkakoti, 1990). Nevertheless, the cultivators are left with no other choice

because there is no suitable for alternative method tosubstitute. Some views of the people's perception are:

1. The hill topography permits only the slash and burn method of cultivation, cultivation of terrace needs low-lying areas and it involves huge money.

2. For most of the people living in rural areas there is no source of income unlike the people living in the urban areas, their only source is encroachment of more land under agriculture and depend on the forest resources.

4.3.2 Deforestation

Forest has played a significant role and provides a wide choice for an independent spirited Naga to wonder in forests for hunting, fishing,and gathering.Forests have been traditionally looked as a great source of economy by the Nagas as they greatly depend on forest for their livelihood.Forest is the most important asset to Nagas because it not only provides food but also maintains the delicate ecological balance,conserve soil and recharge underground water resources.The state is witnessing rapid population growth in the last few decades,as a result large tracts of forests were cut and cleared as demand surged for timber,fuel,pasture,settlement and agricultural land.This trend still continues and forest cover continues to dwindle in terms of both quantity and quality,the primary forest are cleared or degraded for logging and cropland.Population growth is one of the most pertinent reasons for the present forest crisis.There is a definite inverse relationship between trends of forest areas and population at the global scale. It has been found beyond doubt that in countries with rapid expanding population, the forest areas are rapidly contracting. Conversely, where the population is stagnating or growing very slowly,the forest land is stagnating or expanding slowly (Kailash Chandra Bebarta,2004).

Besides Jhum, no other methods of forests exploitation have been as destructive as logging because in some parts of Mokokchung most of the century old trees were felled systematically.It may not be an exaggeration to say that this type of logging has destroyed nearly all the virgin forest of Nagaland within a short span of time (Alphonsus D Souza 2001).Consumption of firewood has increased both in rural and urban areas because of the pollution growth.Fuel wood now accounts for more than half of the annual world harvest of wood and it is being cut more rapidly than it can grow back in many developing countries.Today more than half of those depending on fuel wood are facing current or potential shortage (William M.Marsh and John Grossa.Jr 2005).India is one such developing country where forest degradation has taken place on account of unsustainable fuel wood consumption for house hold energy significantly contributing to pressure on forests.Consumption of wood (Timber and fuel wood) in India is considerably (4 to 5 times) higher than what can sustainably be removed from forests.In 2000,the estimated excess (mostly unrecorded) removal of fuel wood from forests was about 3.10 million tonnes which has increased to 4.26 million tonnes by 2017(FSI,2020).High population densities have led to wide spread forest degradation from fuel wood and fodder harvesting ,cattle grazing,land invasion and shifting cultivation,and timber harvesting for local construction (FAO,1997).

Shifting cultivation has become unsustainable and has been blamed for the forest degradation in the district. In recent years the Jhum cycle has narrowed down in almost all parts of the state.Shifting cultivation has been identified as one of the principal causes of deforestation in most of tropical regions of the globe ,accounting for 70,50,and 35 per cent respectively in Africa, Asia and Tropical America. About 500 million people and 240 million hectares of closed forests are involved in shifting cultivation,which is increasing at an

average rate of 1.25 per cent.More than 5 million hectares of new forest fallow are created annually(Lanly,1985).

Deforestation is also cause by forest fires. The phenomenon of forest burning is responsible for killing of fauna, wildlife, forest species of plant and animal kingdom. Wild fires commonly occur on the onset of Jhum during the dry seasons of February and March months. Though using of fire is an integral part of land management in both agriculture and forestry, it has a number of negative environmental impact.According to the State Climate Change.

Projection, the temperature in the mid-century starting from (2020-2050) is likely to experience an increase in annual average temperature between 1.6°C and 18°C. While the southern districts show higher increase in temperature with Kohima, Wokha, Phek, Zunheboto and Tuensang districts showing an increase of temperature between 1.7°C and 1.8°C. The northern districts of Mon and Mokokchung are projected to have an increase in average temperature of between 1.6°C and 1.7°C. This shows that deforestation contribute to heating of the earth.

The forest cover in the Mokokchung,as per Forest Report 2015 is 1344 km^2based on interpretation of satellite data of November 2010-February 2011.In terms of Forest canopy density classes,the district has 3 km^2 very dense forest, 514km^2 moderately dense forests and 827 km^2 open forest.

Table: 4.3 Forest Cover of MokokchungDistrict(2015)

District	Geographical Area	2015 Assessment				%	Change	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Mokokchung	1615	3	514	827	1344	83.22	-16	39

Source: State of Forest Report 2015

Table: 4.4 Forest Cover of MokokchungDistrict (2017)

District	Geographical Area	2017 Assessment				%	Change	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Mokokchung	1615	2	504	816	1322	81.86	-20	29

Source: State of Forest Report 2017

Table: 4.5 Comparing Assessment of 2015 and 2017 matrix change

Sl.No	2015 Assessment		2017 Assessment		Net Change
1	VDF	3	VDF	2	-1
2	MDF	514	MDF	504	-10
3	OP	827	OP	816	-11
4	Scrub	39	Scrub	29	-10
5	Total				+32

Source: Department of Environment, Forest & Climate Change, Nagaland

Forests cover in different canopy density classes and scrub along with the change compared to 2017 assessment is given in the Table-4.4.Comparison of the forest covers during the year 2015 and 2017shows a loss of 32 km^2.The change Matrix reveals that there has been a decrease of 1 km^2 in the very Dense Forest,10 km^2 in the Moderately Dense Forest, 11km^2 in open Forest and 10 km^2 in scrub. According to the forest department,the main reason for decrease in forest cover are shifting cultivation and other biotic pressure on the forest lands.

Table:4.6 Sources of Loss of Forest Cover in Mokokchung District

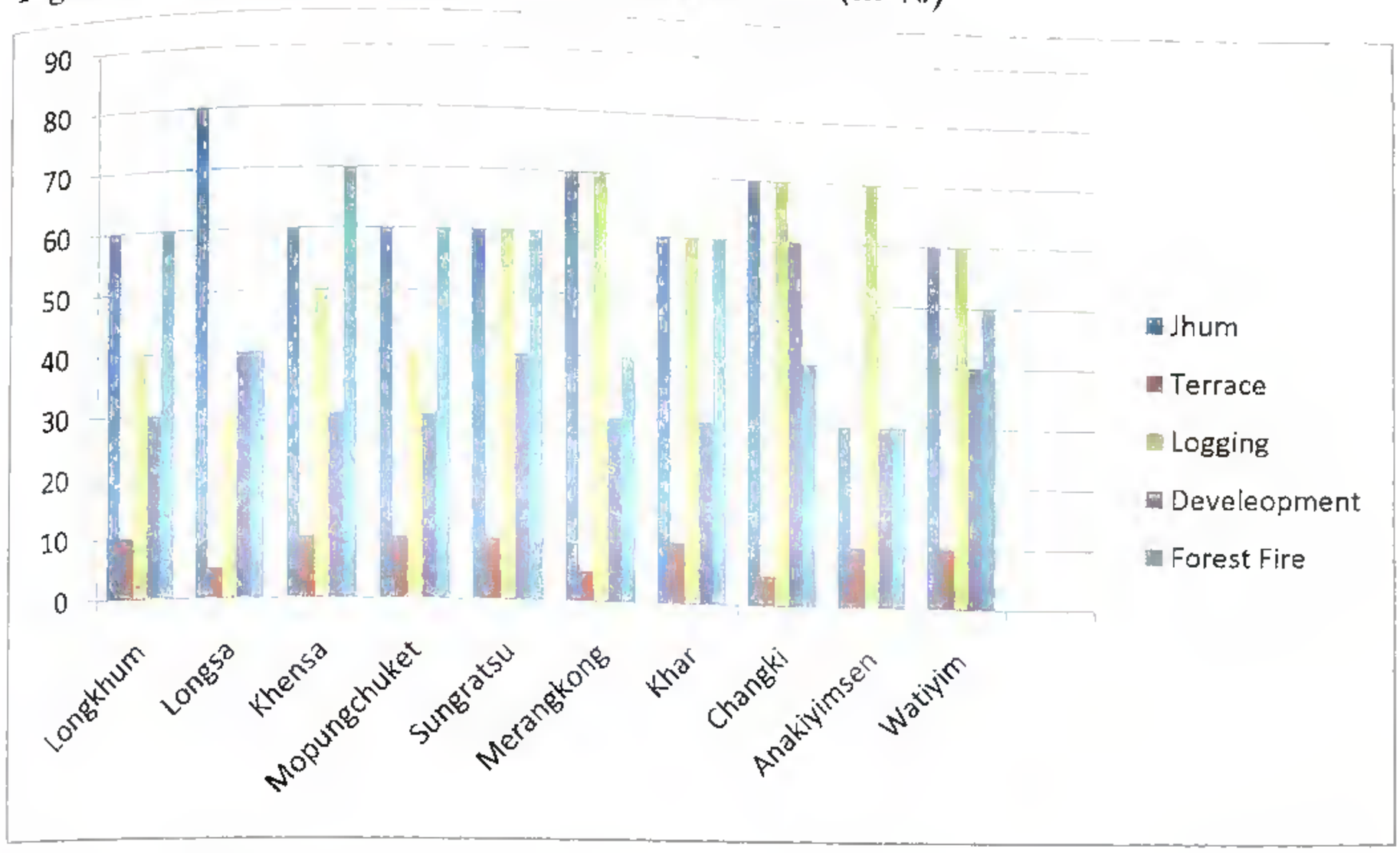
Sl.No.	Sources	Impact
1	Population Growth	Increase in Agricultural Activity
2	Fuel Wood	Both Rural and Urban population in Mokokchung district is depended on wood as fuel for domestic purpose contributing pressure on forest cover
3	For Commercial	Though banned by Supreme Court, timber extraction still continues.
4	Forest Fire/Jhum	Every year large areas of forest are burn down intentionally and unintentionally by jhum burning, hunters, etc.
5	For Economy	Both Rural and Urban population use Forest Resources is largely for their basic needs.
6	Management Failure	Illegal logging, hunting, uncontrolled fire, etc.
7	Modern Development	Construction of Road, settlement, institution, etc.
8	Political Instability	Illegal exploitation of government owned forest by people in guise of every form.

Source: Field Survey 2016-18

The problem of deforestation is caused by human intervention by different activities. (Fig: 4.3) shows from the Field Survey respondents under different sampled villages. The overall deforestation is caused by shifting cultivation in which the highest response was in Longsa village followed by Longkhum village. Logging and wild fires is also another problem of deforestation which are all inter-linked with the practice of shifting cultivation. In almost all the sampled villages cultivation of terrace is low; this is due to the hill topography. The deforestation status was also carried out in different villages to know more about the management of forest and deforestation. It has been observed that, forest cover in all the different ranges has been decreased to a large extent due to the pressure of Jhum

cultivators and logging. Langpangkong, Tzurangkong, Japukong and Changkikong ranges have large hectares under forest cover with thick and dense vegetation.

Fig: 4.4 Deforestation cause by different activities (in %)



Source: Field Study (2017-18)

The destruction of virgin forests causes more landslides which are common in these ranges. Numerous natural abode diversity of fauna and flora are also disappearing due to destruction of evergreen and moist-deciduous forest. The destruction of the world's tropical forest, which is disappearing at an alarming rate, is one of the today's most urgent global environmental issues (K.C.Agrawal, 1998). The indigenous plant species Rhododendrom Arboretum (locally known as Metsubennaro) which once abundantly embellishes the forest of Longkhum village has reduced expressively.

Plate: 4.1 Jhum Paddy Field in Longkhum Village

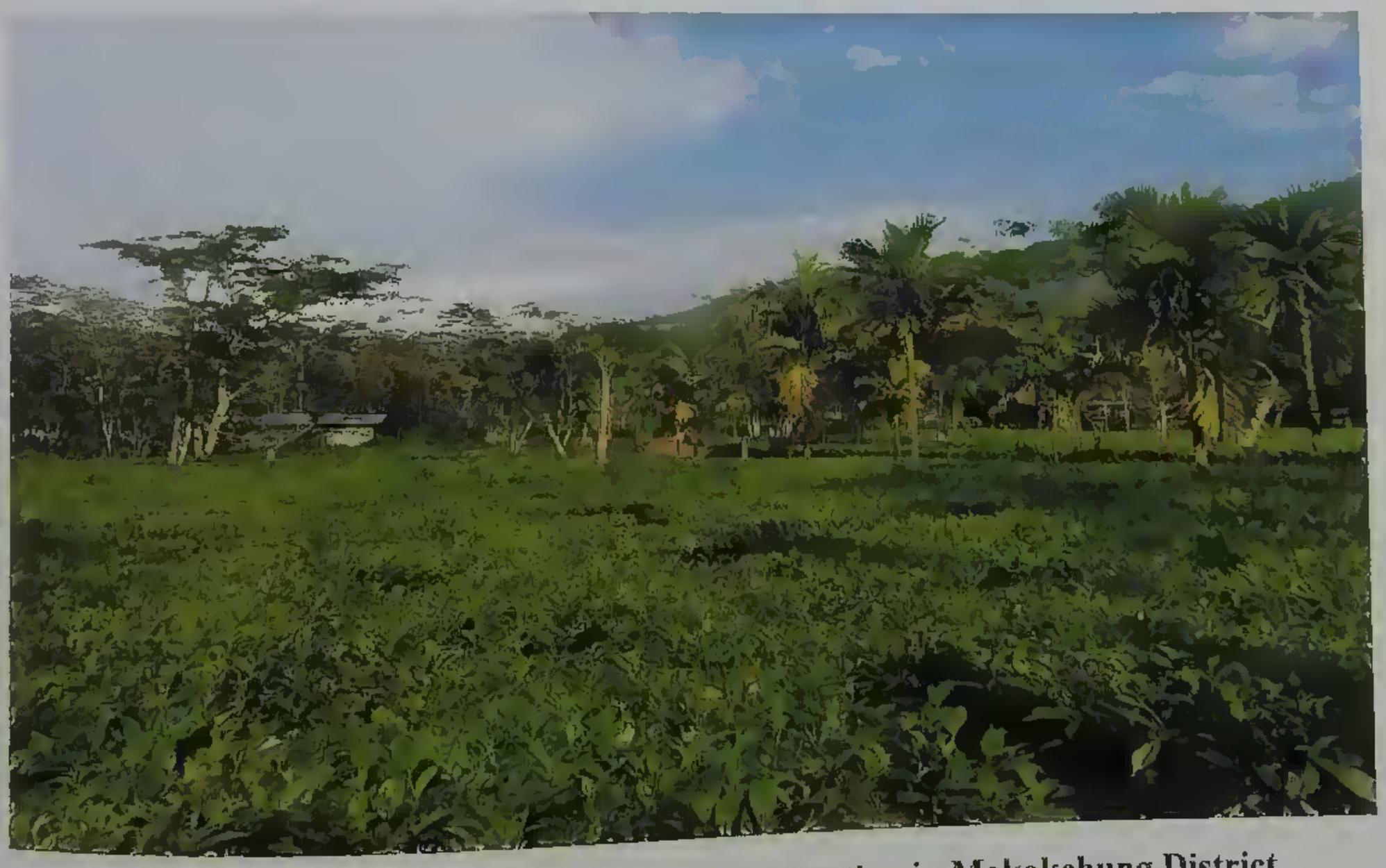


Plate:4.2 Tea Plantation with cash Crop Plantation in Mokokchung District

Plate: 4.3a,b Cash Crops Cultivation

4.3.3 Forest Fire

There is considerable lost of forest resources, soil, flora and fauna due to frequent burning of forest. Some forests are ecologically adapted to fire. However, forest fires have a wide ranging negative environmental impact. There is ample evidence that large proportions of wild fires that occurs each year are caused by human intervention (Bebarta K.C 2004). Lots of initiatives have been taken by various NGOs and government agencies to deal with the problems of forests burning in Nagaland. The state Government is penalizing villagers for any forest burning incident even if they are not directly involved in setting the fires. The Government of Nagaland has banned jungle burning since 1996 but it wasn't adhered to. Following the government move, many village organizations have banned jungle burning and hunting in demarcated areas of their villages example, in areas where Jhum or slash and burn cultivation is practiced, traditional method of fire protectionmechanism are used so that the fire doesn't spread to the jungles. Despite of the measurement and banned by Government and village councils, forest fire had destroyed some few thousand hectare of forests cover in 2009 alone.It is evident that large portions of wild fires that occur each year are caused due to burning of Jhum cultivation. This has caused numerous changes in the forest cover which eventually brought changes in the environmental condition of the district.The district which has a tropical climate has raised its temperature by a few degree Celsius undergoing slight changes in the climatic condition. This slight alteration in degrees eventually affects in crop production.

Notable forest incident in 2019 namely Longkhum, Ungma, and Khensa of Mokokchung district,the study reveals that the wild fire that occurs each year were caused by human activities especially by farmers while burning their Jhum field, campers, hunters

and in some cases it is burned intentionally by the villagers who has a tradition of burning forest. (Plate: 4.4a,b).

4.3.4 Population, Development and Human Activities

One of the major problems that are being created by human being itself is population explosion. With rapid population growth in the state, demand for food and firewood has increased substantially. Firewood is the main sources of heating and cooking for nearly 80per cent of rural population. In recent time the demand for firewood has increased in urban centers too, as the supply of Liquefied Petroleum Gas (LPG) is not sufficient for growing urban population. To meet endless needs, man has encroached forests land and converted it into food growing fields or space for building houses and other things.

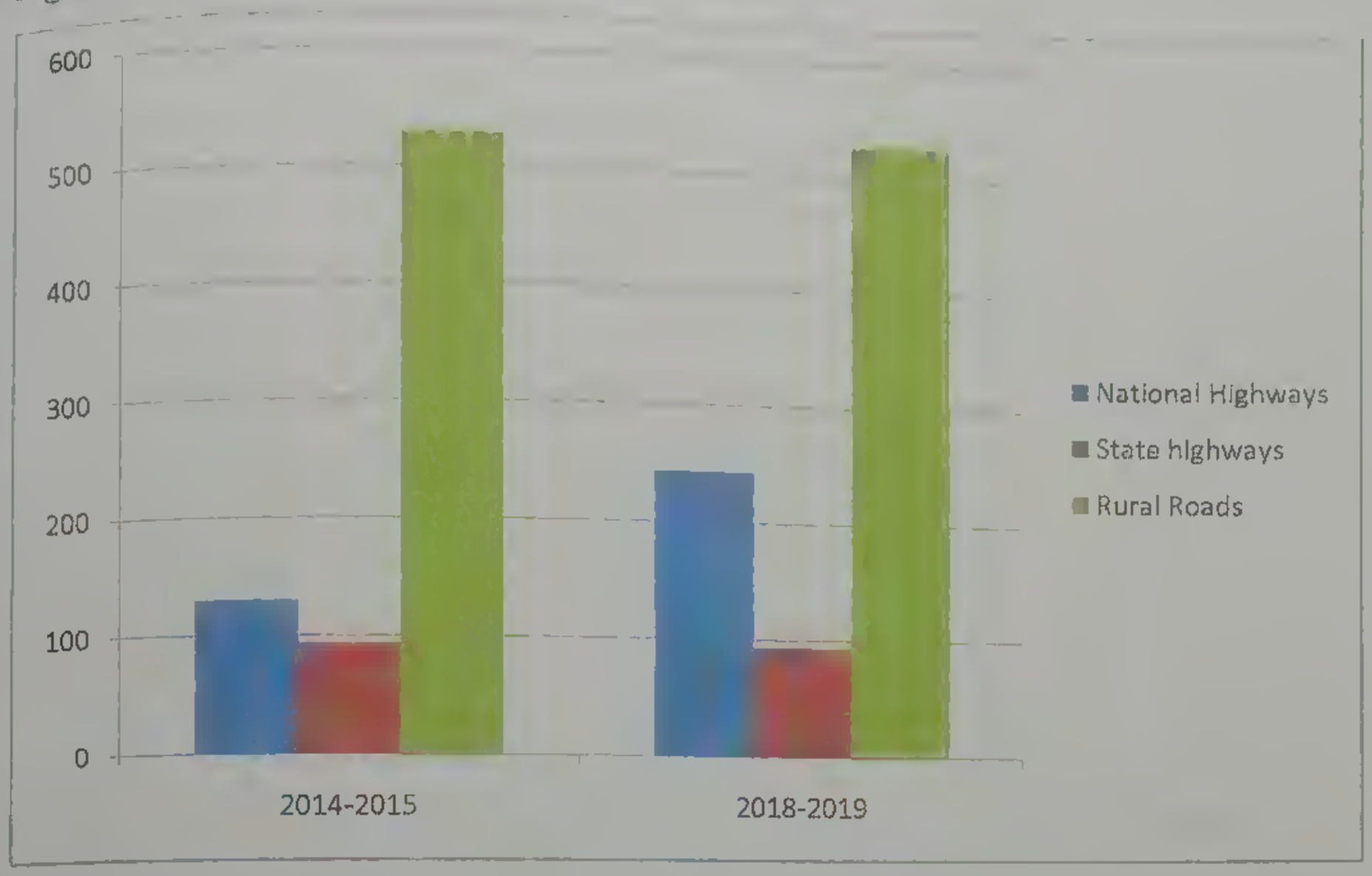
The construction of roads in rural and urban areas under various developmental schemes and central schemes has lead to decline of huge land and forest cover.With the increase and expansion of National Highway and State Highways as shown in (Table: 4.6) the primeval virgin forests of Mokokchung,Minkongison the verge of vanishing. Also, road passing though the agricultural land, farm land, village forest, etc., has damage large area of landleaving farmers at great risk. There are now only a few hundred square kilometers of primeval forests left in Mokokchung district. The opening up of roads to forests that had been previously inaccessible leads to an inflow of farmers, settlers and loggers, whose activities degrade the environment.

Table: 4.7Comparison of Road Development (2014-2019)

Years	National Highway	State Highways	Rural Road	Total
2014-2015	131	94.3	528.6	753.9
2018-2019	243.5	94.3	529.06	866.86

Source: PWD (Road & Bridges)

Fig: 4.5 Roads & Highways in Mokokchung District



Source: PWD (Road & Bridges)

Stonequarries are a necessity for economic growth of many rural populations and for developmental purposes.The study observed that,stone quarries are randomly increasing in Mokokchung district.Villagers leased out their land to business man for stone quarry and in some cases they sale out their land.Although stones are usually used for development activities, its impact on environment cannot be neglected.Stone quarriés in some villages is threatening human settlement as well (Plate 4.9c). Stone Quarries are usually found by the roadside as a result road blocked by landslide/rock slide usually occurs because of the stone quarry located in the vicinity.Today, big machineries are installed on the roadside for the purpose of road construction which occupies large area of forest. Depletion of forest and rendering land unproductive are some additional impact on environment.

4.3.5 Mining& Brick Kiln

Today, mining is the second largest industry after agriculture and has played a vital role in the development of civilization from ancient days. Most valuable materials for human being such as metals, chemicals, fuels for energy, rocks and stone for building comes from mining. The mining activity is a double-edge sword phenomenon. Although minerals are essential for human advancement, it has negative factors due to unprecedented extraction rates. After the completion of the mining activities these areas have been made permanently unproductive.

The field study was conducted in 2019 in Anakiyimsen in Mokokchung district of Nagaland. The village covers an area 2816 hectares located near Assam. The road connecting coal mining area pass through forest and farm land as a result there are number of environmental consequences. There are four coal mines functioning at present. However, most of them are unplanned, unscientific Rat Hole mines carried out by private parties or land owners which poses a high risk for the miners as they are not properly equipped for scientific mining. Mining is a very long and complex process and involved several steps between sampling of mineral ores to concentration and evacuation of final product. Land degradation, deforestation, air pollution, water pollution, noise pollution and vibration, effect on flora and fauna and socio-economical impact are the negative impact of coal mining. Large scale excavation causes land degradation, deforestation and decrease in the number of flora and fauna in the area. The over burden or dumping of waste has covered an area of 60 acres (Plate: 4.20).

As the village population is less as of now there is no displacement/disturbance to human habitat in the area,the only disturbance is found in the fauna.According to the villagers,there were different species of animals over a long period of time but after the mining operation many of the wild animals have vanished from the areas.*Anaki-C in Mokokchung district does not have any fish owing to contamination of water by mineral waste discharged from coal mines in the area*[2].The impact could be the sound produce by blasting the machineries. Apart from that,water pollution is another effect of contaminations the water becomes unfit for drinking.Socio-economic impact of mining has got both negative and positive impact in the area.The good activity is that it provides opportunities to earn for their economy, the bad effects include effect on water table, disturbance of fauna, deforestation, land degradation and in future it may further affect overall agricultural production.

Brick making is a dry season activity that can be started as soon as the monsoon rain stops.Unfortunately,brick kilns are mostly situated on fertile agricultural land and is turning fertile agricultural land into unproductive lands.Out of 10 villages,only one village,Watiyim comes under brick kilns and has only one brick kilns running at present. According to the research finding nearly 1.40 acres of the land has degraded due to those kind of activity.

4.3.6 Land for MilitaryNeeds

The process of militarization and expansion of armed police under central and state policy is leading to loss of large tracts of community land. After the 1997 ceasefire between

[2] *The Morung Express, 2 April 2008*

the Nationalist Socialist Council of Nagalim (NSCN-IM) and the Government of India, all the development agencies of the army and military forces have speeded up their developmentalactivities all over Nagaland. They have also been restoring places they have previouslyabandoned and replacing all the temporary army/military camps with concrete and permanent building.

On the pretext of maintaining 'law and order', military camps are being set up in civilian areas which contravenes all existing norms for military installation besides creating a war-like environment and inciting fear psychosis in the mind of the innocent public by their very presence in large numbers. Further, almost as a rule, the military always occupy the most prime location in the town, hence appropriating valuable community land.

Militarization in the state has not only led to alienation of community land for security reasons, but gradual loss of land for other purposes of the military are also taking place. A point in the case is the Assam Rifles in MokokchungTown, CRPF in Minkong Hillock, DEF in Chuchuyimpang Village, 2nd NAP at Alichen have set up play ground, tennis court, indoor stadium, field firing areas, etc for their pleasure, a luxury which requires large tracts of land, clearly exhibiting the extend which militarization in the state is depriving indigenous people of their land. Today, a lot of land is held by defence services, ordnance factories and by para-military organizations. As pressure mounts on land resources due to rapid growth of population there is bound to be demands to examine the actual needs of security forces. The following shows some areas occupied for military purpose in Mokokchung district.

Table:4.8 Military Occupied Land near Mokokchung Town

(Figures given as inform by the land owner)

Sl.No	Location	Area in Ha.
1	Assam Rifle Camp, Near Sewak	80
2	Assam Rifle Camp Near DC Office, Mokokchung Town	1
3	Assam Rifle Camp Near ISC	1
4	Assam Rifle Camp at Mokokchung Village	2
4	NAP Camp at Watch Tower, Mokokchung Town	1
5	DEF Camp at Chuchuyimpang	30
6	CRPF Camp at Minkong Hillock	10
7	2nd NAP Alichen	70

Source: Field Survey (2017-19)

Plate: 4.4a,b Burning of Jhum Fields

Plate: 4.5 Absence of soil cover and steepness give high scope for soil erosion

Plate: 4.6 Consequences of Jhum

Plate 4.7a,b Destruction of Forest for timber and firewood

Plate: 4.8a,b Installation of Big machinery on the side of the highway

Plate: 4.9 a,b,c Stone Quarry- A threat to environment and human settlement

Plate: 4.10 Large Area of Land occupied by Assam Rifle in Mokokchung Town

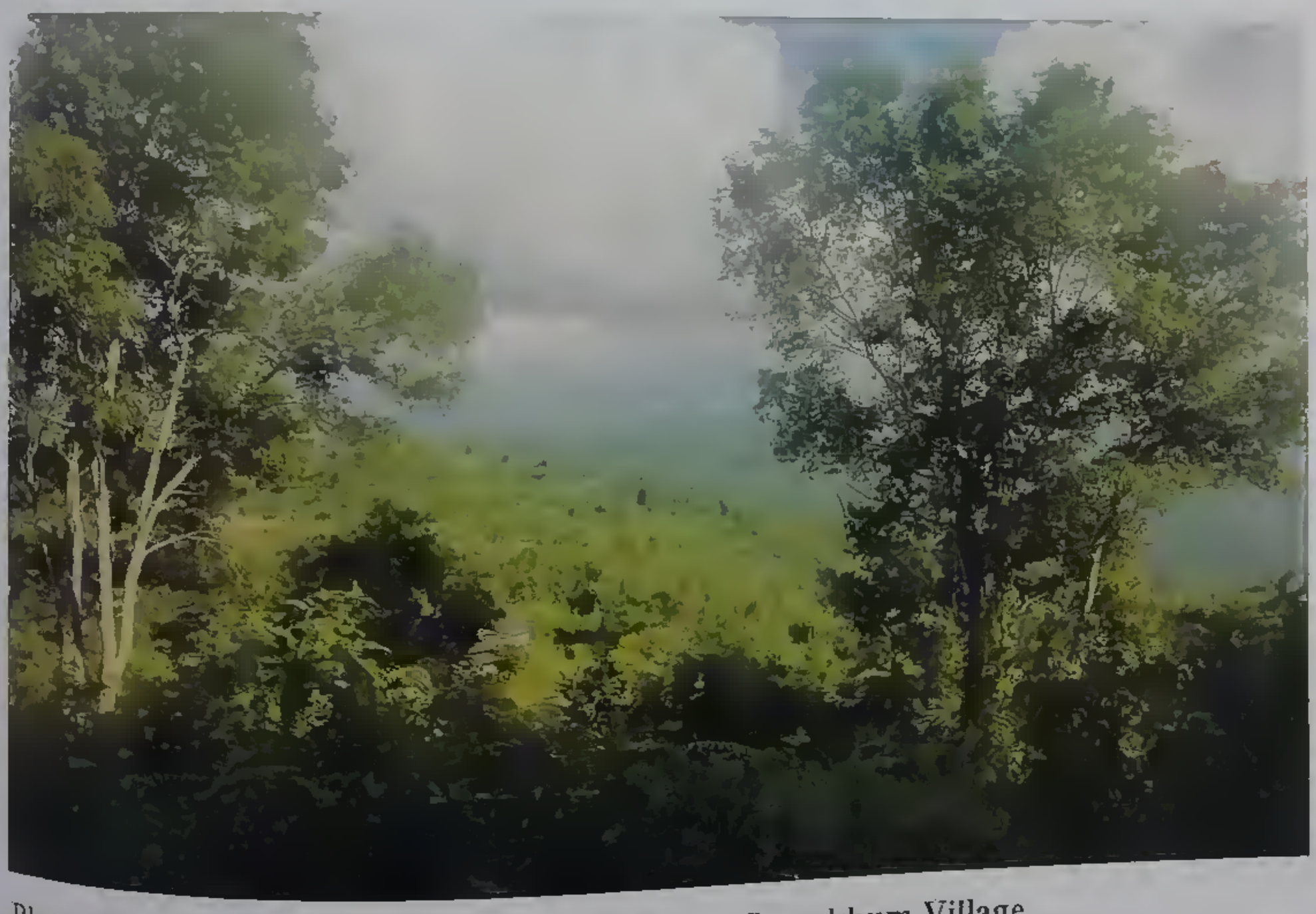


Plate: 4.11 Area occupied by 2nd NAP at Alichen, Longkhum Village

Plate: 4.12 Abandoned Fishery Ponds

Plate: 4.13 Unscientific construction of Fishery Pond in rural area

Plate : 4.14 Road without proper drainage

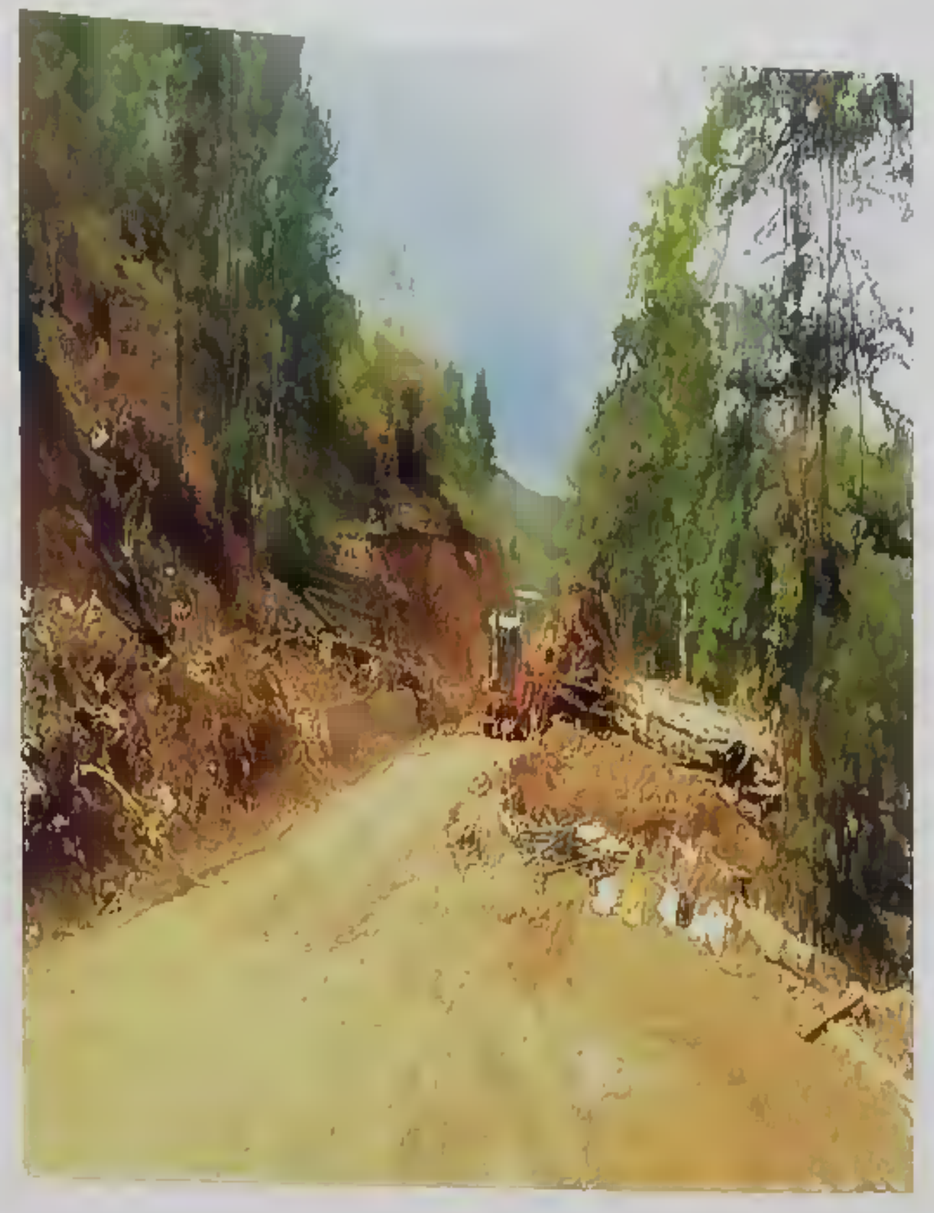


Plate : 4.15 Highway construction- a hazard to Environment

Plate: 4.16 Highway passing though the field

Plate : 4.17 Site for Electric Tower left abandoned

Plate:4.18 Incomplete playground lying deserted for more than 20 years

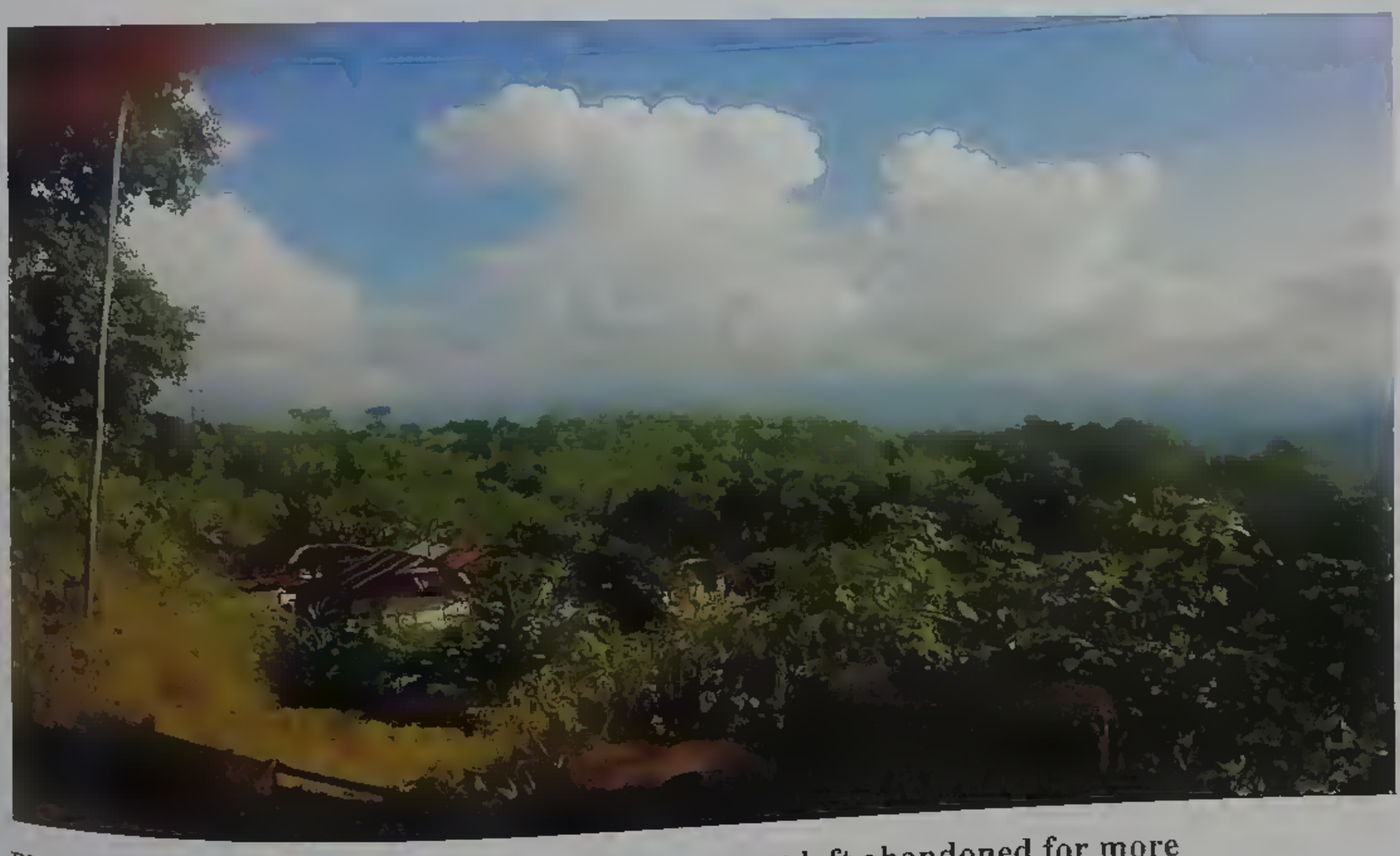


Plate: 4.19 Forest land for Tourism Development left abandoned for more than 10 years

4.3.7 Tourism and Recreation

The variety of demands on land and the variety od uses actually made on it are a constant source of wonder. Among the important no-agricultural land uses like urbanization, industry, defence, mining, etc.. One important land use is in the field of tourist industry. Land is needed for tourism infrastructure and facilities, and for tourism associated business and services. To a large extent, tourism development triggers an economic boost in certain regions. Mokokchung being a hill section with majestic landscape, pristine natural environment and rich variety of indigenous cultures have great potential for tourism. However, given its complex and dynamic forms of land use, tourism development also causes changes to land use demands and patterns in tourist regions, which directly and indirectly interfere with environments.

The study discusses the effect of tourism in land use changes and various developments for tourism. It is determined that tourism development causes a quantitatively increase demand for land for construction therefore, access to land becomes a primary requirement. It also causes continuous spatial interference with landscapes and the land regulation policies become an important factor. As there are not enough government owned land for tourism development in Mokokchung district, access to private lands i.e. community land, clan land, individual land is important and tourism industry succeeds best if run in the private sector as a business, new steps to foster tourism like expansion of accommodation, transportation, professional tourist guide and location map, technology, management, etc need to upgrade. However, the complex system of traditional ownership of land that dates back centuries, the political and cultural dynamics, and the land policies and institutions have

been factors in the slow performance of the tourism industry in many tourist village except Mopungchuket village.

4.4 Impact of Land Use pattern on Environment in the district observed during Field Study 2015-2019

Land is being degraded and lost due to the effects of increased traditional method of farming, logging, quarrying, land erosion by the unplanned and haphazard land use of people and modern developmental projects. Growth of population in the last decade demanding development in various spheres of life directly and indirectly led to the disturbance of natural ecosystem. The expansions of urban areas lead to construction activities such a human settlement, new administrative buildings, new roads, etc. has led to degradation of natural environment.In general, land has been affected by population pressure, law of inheritance, misuse of irrigation facilities, deforestation, unplanned developmental project, environmental disaster both natural and manmade.

Field survey was conducted in the sampled villages to know more about the tremendous and massive destruction on environmental and the social implications brought by land use during the past few years. It was carried out based on personal interviews and questionnaires.

1. Within a span of nineteen years from (2000- 2019) rainfall is in irregular pattern.
2. The volume of water in most of the river within the village has been reduced to a great extent.
3. Vast forest destruction causing loss of natural biodiversity habitat during the onset of Jhum.

4. Domination of tall grass like broom and shrubs is common in the entire areas.

5. Invasion of more weeds is common in the paddy fields.

6. Landslide is frequent.

7. Shifting cultivation has become non-sustainable.

8. Increase in population and pressure on agricultural land has brought huge forest under shifting cultivation.

9. Rising of a temperature by a few degrees Celsius.

10. Decline in soil fertility with low yield is common in all the ranges.

11. Late monsoon and warm climate.

12. Roads play a crucial role for a country's economy but most roads have inadequate drainage, poor surface conditions and suffer severe environmental degradation and to the extent of loss of lives due to accident.

13. Stone quarry on the roadside is another factors causing large area of loss of land in the form mudslide, rockslide and landslide.

14. Mining, though in small pockets is another threat not only on land but pollutes both air and water.

15. Lack of civic sense also contribute to environmental degradation.

Plate: 4.20 Water Contamination through Coal Mining Wastes at Anaki Village

Plate: 4.21 Land Degradation in Coal Mining area in Mokokchung District

Plate: 4.22a,b Lack of Civic Sense (Improper removal of waste in drainage leads to flooding on the roads)

Plate:4.23 a,b.c **Integrated Farming (Livestock farming, Animal Husbandry, Fishery & Plantation.)**

Plate: 4.24 Mixed Plantation (Tea, beetle nut and rubber tree)

Plate: 4.25 a,b Traditional Method of Soil Conservation

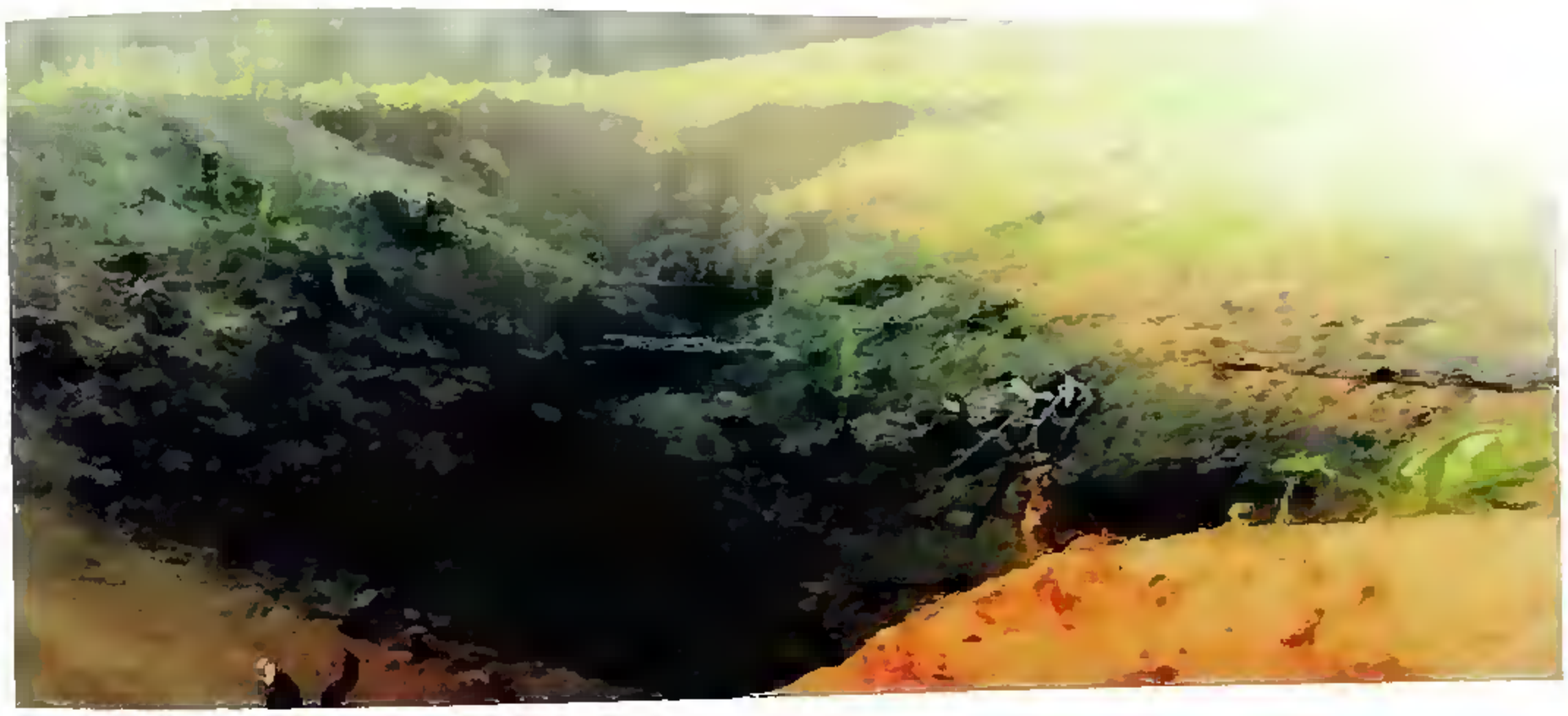


Plate: 4.26 Check dam to protect soil depletion

Plate: 4.27 Gully Plug to protect soil erosion

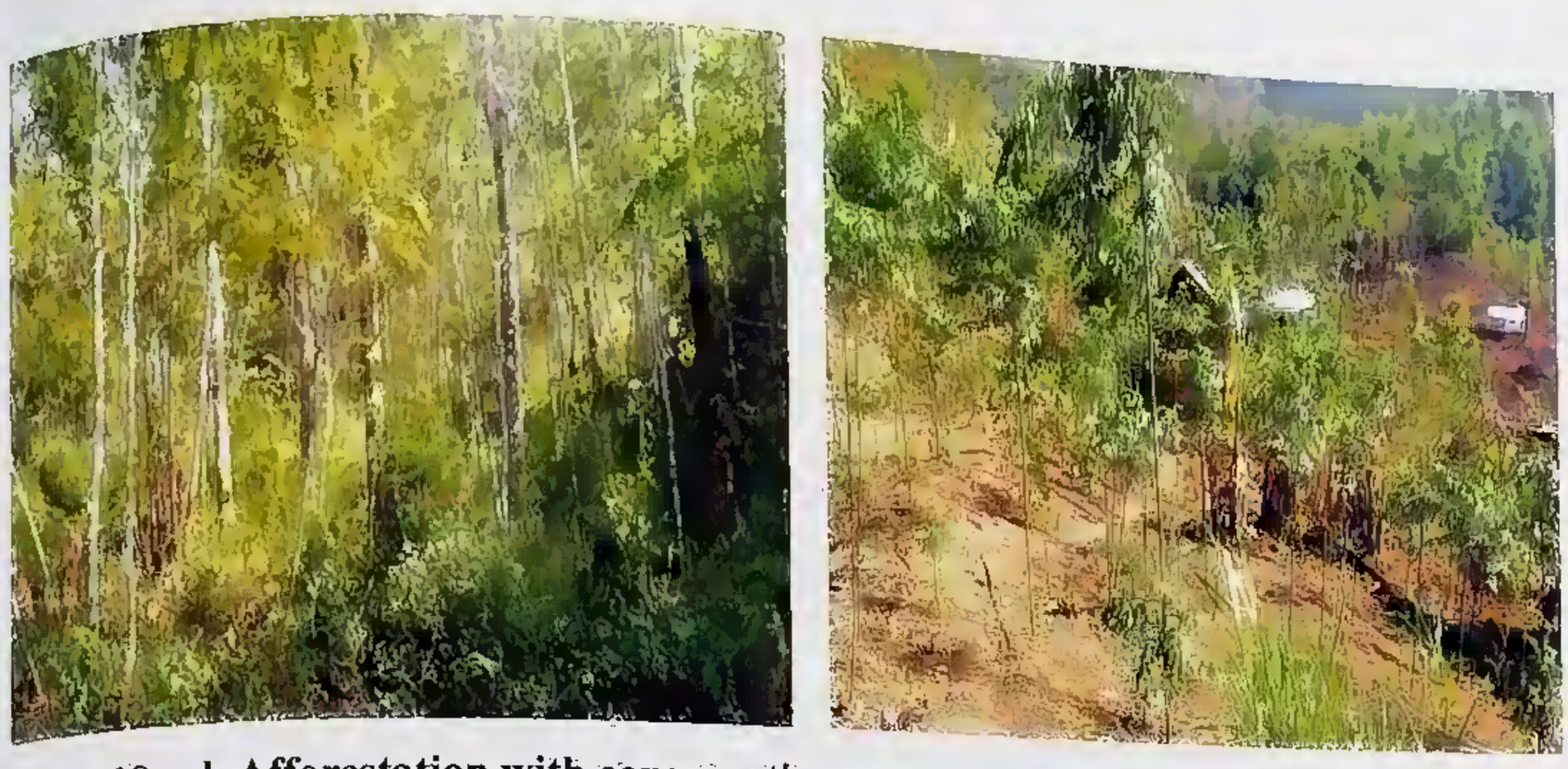


Plate: 28 a, b Afforestation with conservative measures

Plate: 4.29 a,b Public participation for Roadside Plantation

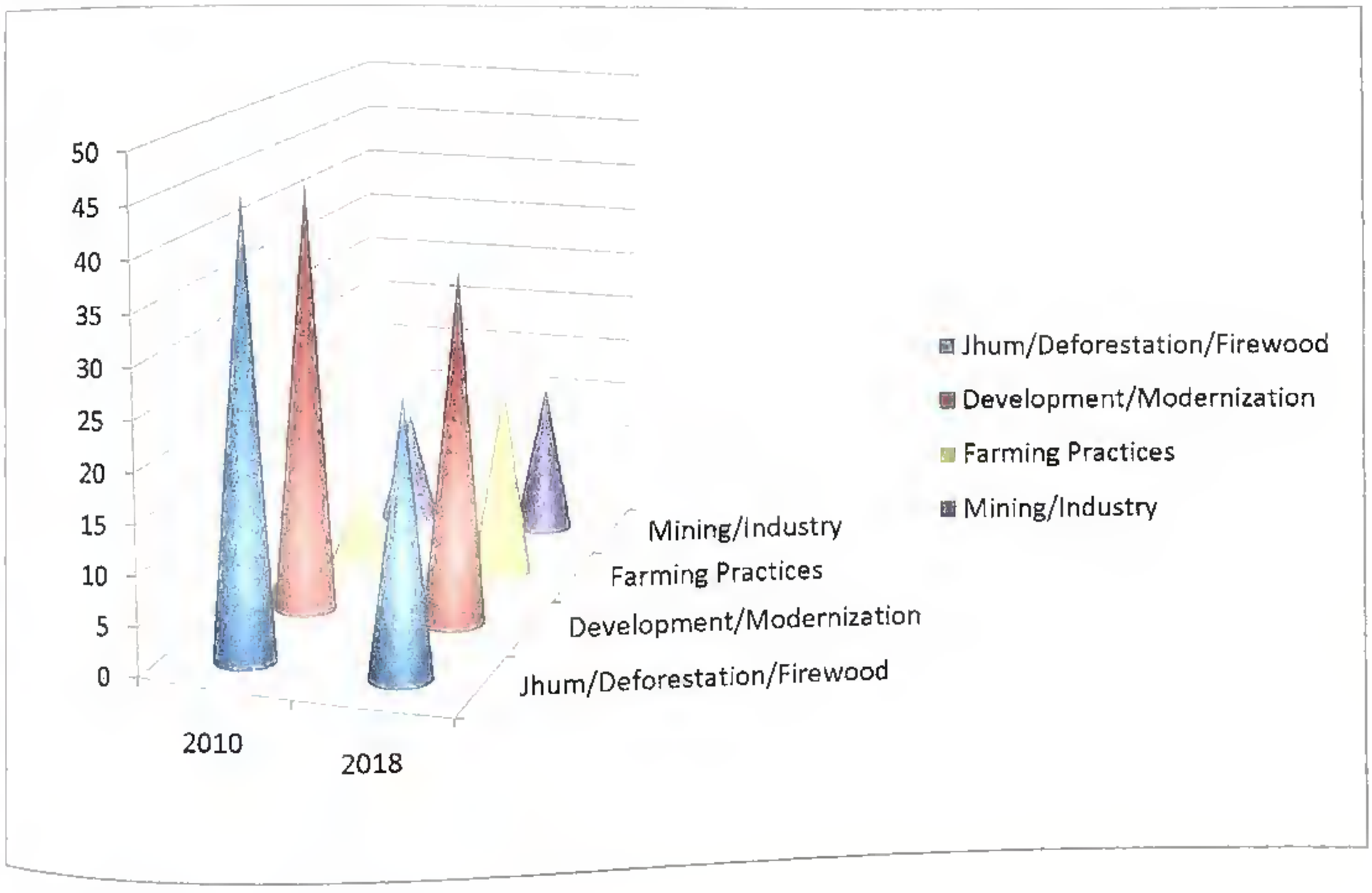
Plate: 4.30 Organic Farming in Mokokchung Village

Table: 4.9 Comparative study of Environmental Degradation 2010 – 2018

CAUSES	YEAR-2010 PERCENTAGE (%)	YEAR-2018 PERCENTAGE (%)
JHUM/DEFORESTSTION/FIREWOOD	46%	28%
DEVELOPMENT/MODERNIZATION/ SETTLEMENT	34%	36%
FARMING PRACTICES	8%	20%
MINING/INDUSTRIES	12%	16%

Source: Field Survey (2010-2018)

Fig:4.6 Causes of Environmental degradation



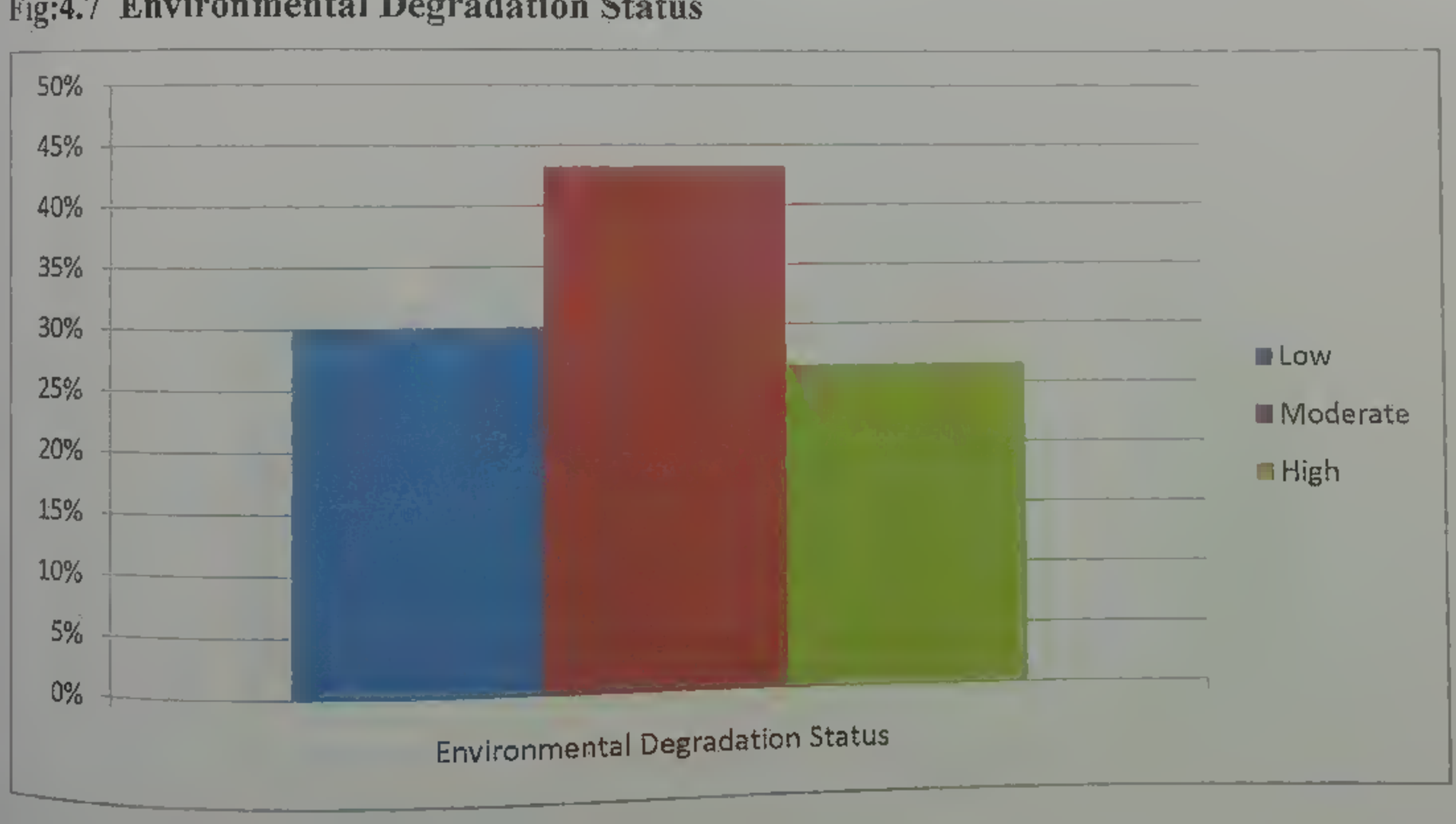
Source: Field Survey (2010-2018)

Table: 4.10Environmental Impact Assessment of Mokokchung District
(Types of people interviewed: Experts, Elders, Farmers)

Types of People	No. of People	Environmental Degradation			
		Low	Moderate	High	Total
Department Experts	20	7	9	4	20
Elders	20	6	7	7	20
Farmers	20	5	10	5	20
TOTAL	60	18	26	16	60
Percentage	**%**	**30**	**43.3**	**26.6**	**99.9%**

Source: Field Study (2018-2019)

Fig:4.7 Environmental Degradation Status



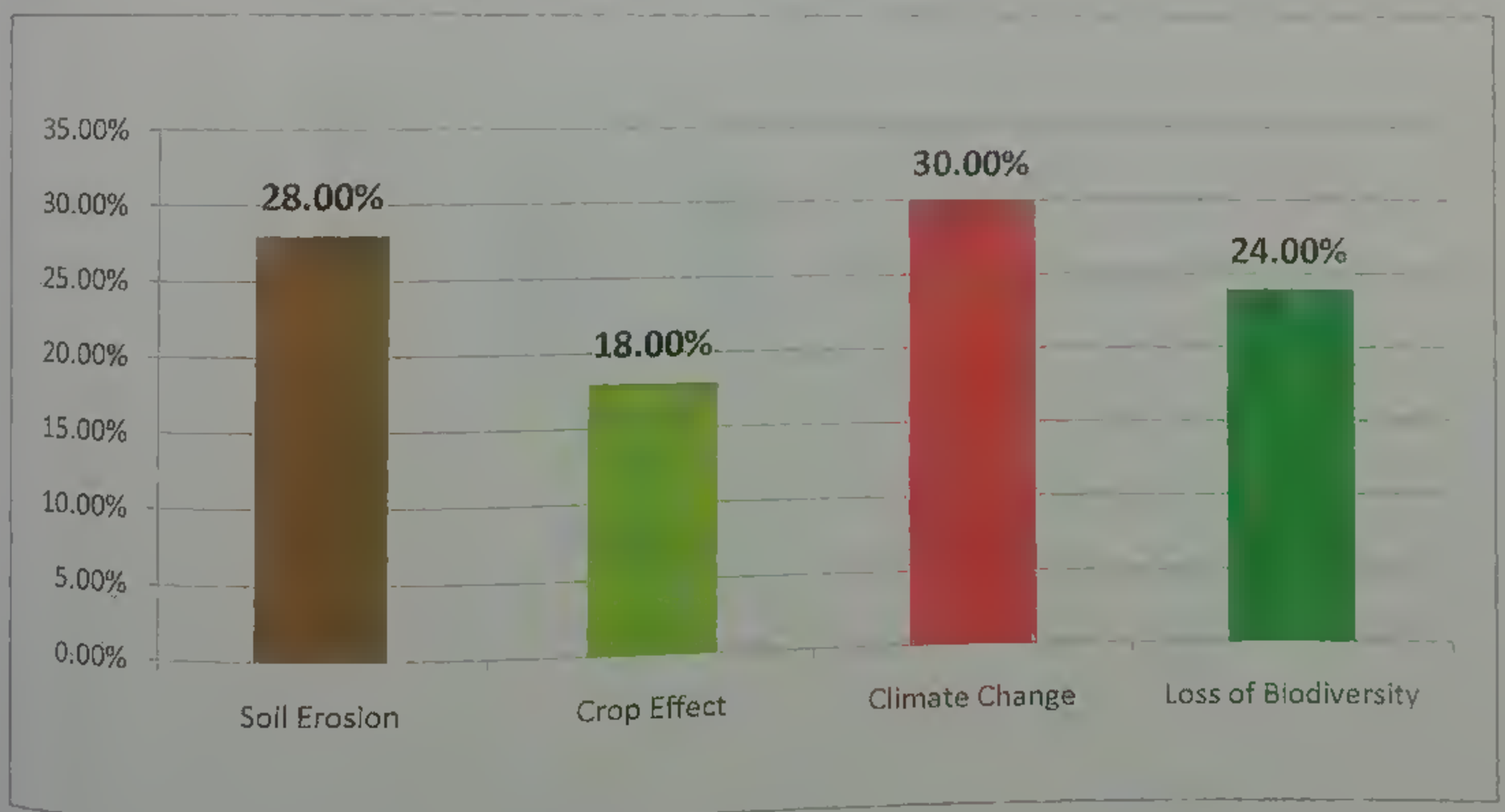
Source: Field Study (2018-2019)

Table: 4.11Impact of Land Use pattern in environment: (2018-2019)

Sl.No	Village	Soil Erosion	Crop Effect	Climate Change	Loss of Biodivesity	Total
1	LONGKHUM	6	2	6	6	20
2	LONGSA	4	4	6	6	20
3	KHENSA	5	3	8	4	20
4	MOPUNGCHUKET	4	4	8	4	20
5	SUNGRATSU	8	4	4	4	20
6	MERANGKONG	5	4	6	5	20
7	KHAR	6	5	4	5	20
8	CHANGKI	8	2	4	6	20
9	ANAKIYIMSEN	6	4	6	4	20
10	WATIYIM	4	4	8	4	20
	Total	56	36	60	48	200
	Percentage (%)	**28.0%**	**18.0%**	**30.0%**	**24.0%**	**100%**

Source : Field Survey (2010-1019)

Fig: 4.8 Environmental Impact in Sampled Village (in %)



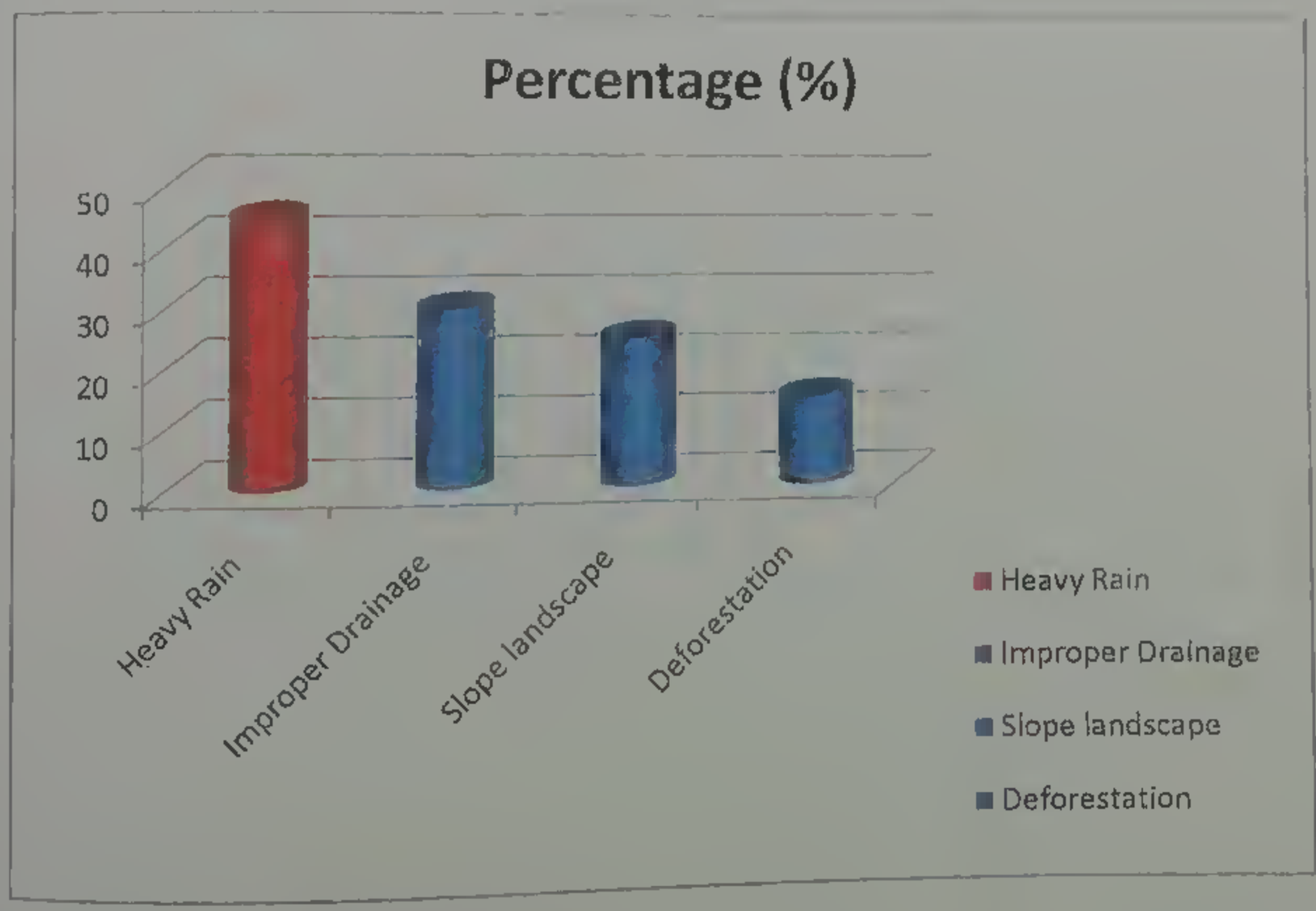
Source: Field Survey (2010-2019)

Table: 4.11 A Survey on sources that causes Landslide in Mokokchung District from 115 respondent

Causes	Percentage (%)
Heavy Rain	45
Improper Drainage	30
Slope landscape	25
Deforestation	15
Total	115

Source: Field Survey (2018-19)

Fig: 4.9 Bar graph representations of people interviewed



Source: Field Survey (2018-19)

4.5 People Awareness on Environmental Degradation and its Implication

Environmental Degradation is one of the major alarming global concerns today. The random destruction of forest and other natural resources in the district is increasing. Considering the present increasing rate of population, rise in temperature, scarcity of water, deterioration of the overall productive potential of the soil, decrease in agricultural crops, etc., environmental awareness has become a must in the district. The study reveals that maximum of the respondents in every village in the district are unaware of environmental degradation in the district as shown in (Table: 4.12).

The respondents comprises of Government servants, entrepreneurs, university and college students and farmers/cultivators.

Table: 4.13 Sample Villages on Environmental Awareness (in%)

Sl.No	Village	Aware	Unaware	No Comments
1	LONGKHUM	42.6	46.2	11.2
2	LONGSA	36.8	48.4	14.8
3	KHENSA	42.4	47.2	10.4
4	MOPUNGCHUKET	44.6	49.2	6.2
5	SUNGRATSU	38.8	44.6	16.6
6	MERANGKONG	36.6	42.6	20.8
7	KHAR	40.2	44.6	15.2
8	CHANGKI	43.2	46.8	10.0
9	ANAKIYIMSEN	26.4	58.5	15.1
10	WATIYIM	24.6	61.8	13.6

Source: Field survey 2016-19

Fig: 4.10 Graph showing awareness of Environment

Source: Field survey (2016-19)

The opinion of public interviewed with regard to environmental degradation awareness is mentioned below:

1. Jhum and Deforestation are the major factor in Mokokchung which is causing environmental degradation. Since, and ownership system is unique unlike other state majority of land belongs to the people and is owned by every individual, clan and community and reserves the right to do whatever he wants on his land as a result imposing law becomes impractical.

2. Creating public awareness can be the best solution because people are ignorant about the fact that their activities and lifestyle can cause environmental degradation. For example, they think that felling of trees from their own lands for Jhum or fire wood is too negligible to be causing any harm to the environment. What they don't understand

is there may be thousands of people who are thinking the same. So, at the end, acres and acres of forest covers are removed causing major damage to the ecosystem.

3. Even after so many forest laws have been enacted there are lots of destruction going on in Nagaland which means people are not serious about awareness.
4. Few decades ago, the streams and creeks were flowing fully with fresh water, water scarcity was unknown. But presently trees are cut down almost everywhere and almost everything has vanished or under extinction. It is time to act right otherwise it will be too late to do something about it. Towns and village dwellers should plant trees in terms of millions to replace those destroyed ones.
5. It is necessary to stop all the logging and start planting various kinds of trees both ornamental and forest trees so that water source will rejuvenate although it will take years.
6. Human activities have already destroyed what the nature takes years to produce, it is time to take necessary actions right away.
7. The vanishing forests, scarcity of water(especially in towns)is just enough for us to realize that our environment is changing.
8. The best way is to encourage individuals and communities to have reserve forest. This will also ensure conservation of wildlife and biodiversity. The Government can also encourage communities to take up afforestation programmes by giving them grants and aids. This will not only rejuvenate the wastelands but also control environmental degradation.
9. Some farmers/cultivators known about the climate change but they don't have any alternative.

10. Govt. must provide subsidy and other options to farmers so that they can at least change their way of cultivation.
11. This issue of environmental degradation is too modern for the average Nagas. Many Nagas even do not know what climate change is because so far there is less awareness campaign. Once the average Nagas realize how the change in climate patterns affects their cultivation, they will have no choice but take notice of it.
12. Public awareness is essential, majority of the Nagas do not know and they will end up being the suffers because they don't know the consequences of climate change.
13. Nagas need law, unless a law is enacted on climate change, Nagas will think that the issue of climate change is not important. It is ironic that a law is required just to even acknowledge that the Environment degradation is affecting our society.
14. Public is aware about the Environment degradation, but does not care as long as it is not affecting them directly. It is better to enact laws strictly and see to it that the public abides by it.

4.6 Concluding Statement

Environmental Degradation in Mokokchung district is mostly related to land based activities. The causes of environmental degradation in the district can be attributed to Jhum, deforestation, logging, coal mining, brick kilns and rock quarry on land. Shifting cultivation which is considered to be non-sustainable is the main cause of soil degradation as the land remains barren for long. According to NPCG some 40 tonnes per hectare of top soil is eroded annually in Nagaland. Forest degradation has become a major issue in the state, as the forest

resources belong to people there is a random destruction of forests. Even the government protected forests are not free from exploitation. Mokokchung is basically a land of agriculture, with 70 per cent of the population engaged on it. Though, Jhum cultivation is non-environmental friendly as mentioned by environmentalist it is the main stay of livelihood for the villagers. Wet Terraced Rice Cultivation (WTRC) is widely practices in low lying areas. Dependency on Jhum has increased due to increasing population and lest opportunity for employment. Jhum cycle is narrowing down in many parts of the state. Slash and burn methods of cultivation has become the subject of intense debate in recent days. To discourage Jhum methods Government has initiated horticulture, animal husbandry, livestock rearing, plantation crop, etc. in many villages of the district. The impact of horticulture methods is not much affective due to lack of marketing facilities as well as the strong connection of Jhum with the culture of the Nagas. The development and utilization of mineral deposit in the state is very slow because of various obstacles and constraints, though in some parts of the villages, coal mining and stone quarries are going on. As shown in (Table:4.11), nature and human are the main culprit for exerting pressure on land and resources leading to environmental degradation and the lack of awareness of people especially in rural communities towards environmental degradation is a notable factor of Mokokchung district.

CHAPTER: 5

MANAGEMENT OF ENVIRONMENTAL DEGRADATION

CHAPTER: 5 - MANAGEMENT OF ENVIRONMENTAL DEGRADATION

5.1 Introduction

Human-induced changes to natural landscapes were identified as one of the greatest threats to sustainable development of environmental resources utilization in the world, since many developing countries, like Nigeria, are suffering from serious environmental degradation primarily due to rapid growth in population which has not only brought about gross encroachment, damage to natural forest, wildlife, land, water and even air but has also brought unacceptable quality of life conditions in the human community environment (Harvey, 1998). Land use changes can consequently result to environmental degradation, such as distortions of ecosystem health, environmental population, deforestation, erosion and change in stream flow to mention but a few.

The human intervention itself reshapes the natural environment in its own image. It has been indicated as one of the interdependent relations among the components of population, environment, resources, social organization and technology. The fundamental question in the relationship is how people and culture affect the environment and how the physical environment affects culture and people. The environment is a term with several dimensions. It can be subdivided into natural environment and built environment. Natural environment refers to a geographical feature such as mountain, valley and ocean and also environmentalconditions such as temperature, rainfall, flora and fauna. Whereas built environment refers to the result arising out of people alterations of the environment. The inter-relationships between human and ecological components involve around 'Territorial localized system ' (U.A.Shimary, 2007). However for the Nagas, land and their

local environment are the basic foundation of their social, culture and economic system. Generally, Naga economic system revolves around the ecological parameters like village territory, land and forest (Berry, 1976). For centuries, human settlement and cultivation have left their impact on ecosystem and the high land-human ratio has helped to conserve its natural heritage. The increasing population pressure and hectic process of encroachment on forest resources and with the practice of traditional agricultural system has cause a heavy toll on the environment. The practice of traditional cultivation thus affects the ecosystem that result into severe environmental hazards. Such as frequent landslides, soil erosion, extinction of valuable plants, herbs and rare species of animals and birds. It eventually affects the paradigm shift in the climatic condition of a region.

Some scientists have expressed concern that changes in terrestrial insolation and a globally warmer situation will intensify desertification. Desertification in turn, if not quickly mastered could degrade large areas in the tropics. We can foresee that magnitude of the impending problem by the fact that the area of cropland already subjected to desertification is about 30% of the world's land surface, If we are to survive we cannot be reckless and ignorant to our scarce natural resources.

Since environmental equilibrium is the prerequisite for the survival of human civilization and any aberration in it is bound to deter its survival,interventions to improve livelihoods and strengthened the natural resource management practices for food security and environmental sustainability management must be done in a culturally appropriate way that involves all the communities.

Environmental conservation and management is an imperative derivation of a secured livelihood management The management of natural resource such as soil, water, land and forest assume a paramount importance for the maintenance of ecosystem of a particular region. Environmental management is the process to improve the relationship between man and environment so that the quality of both the environment and human society maybe improved. This improvement of relationship between man and environment may be achieved through check on destructive activities of man conservation, protection, regulation and regeneration of nature. Conservation and management of environment is a mass which must tackle down through active community participation, institution, environmental scientist, and farmers.

5.2 Range-Wise Conservation on Environment

Mokokchung district has a total number of circles with six ranges stood at different altitudes. It has a geographical area of 161500 hectares, constitute with 105 villages. The district dominated by sub-tropical humid climate which is covered with moist deciduous and evergreen forest. The variation in topography, climate and soil conditions favours a luxurious rich biodiversity. During the past decade, the indigenous communities maintain an intimate relationship with their natural environment for their sustenance harnessing what the nature stores for them.

The last few decades in the district has witnessed high growth rate of population thus, pressure of land use increased and vast expansion of shifting cultivation has brought tremendous change in the environment. The district once known for its rich forest and bio-

resources is experiencing a drastic environmental crisis which has been almost derived on by human interference on land use. The practice of traditional cultivation is partially responsible for depredating the forest area in the district as it is marked by slash and burn method. This ultimately creates deforestation loss of habitat of plants and animals which are all interlinked with environment.

The forest cover in the district is made up of Jhum fallow land, the process of leaving the land fallow incite the re-growth of trees and the vegetation give rise to rejuvenate secondary forests. The systematic land use pattern and the method of practice of agriculture has arise a burning issue in the present century as the human interference lead to climate change, soil erosion, loss of forest cover, low yield crops, and massive extinction of floras and faunas. Such impact is witnessed globally and the district is also facing the same problem.

It has been observed in the study area that the conservation of environment has been tackling on by the people under different ranges. The practice of traditional method of cultivation has created lot of environmental impacts with low yields comparing to last few decades. In Tzurangkong range, the villagers have made a mandatory to increased Jhum cycle by atleast 10 years so as to regenerate the forest cover and to stabilize the status of the soil fertility.

Conservation towards environment has been taken up by many agencies through seminars, presentation and booklets. Under this, different department's has come forward like agriculture, horticulture, forest, water and resource management etc., by spreading out positive message towards conservation of environment and land use patterns.Today, much of the Jhum lands are converting to monoculture and plantation farming. In Merangkong village

under Langpangkong range approximately 30 per cent of the Jhum land has been converted into tea plantation farming and terrace cultivation are also practiced in small patches. It has been observed that bamboo cultivation is also been cultivated initiated by the Bamboo Mission, government of Nagaland by financing the Jhum cultivators for clearing up the jungle, plantation and for maintaining them. This is how the villagers have the advantage of cultivating paddy along with bamboo cultivation for about two years. The Jhum cycle in Changtongya village has also been decreased to 7-8 years as the village does not have much land under its jurisdiction for cultivation. In recent years, some Jhum cultivators have started cultivation of monoculture farming where used of salt to control weeds in the field is banned.

Today, farmers in rural areas have undertaken land use change to meet increasing livelihood, and market factors. This enhances in conserving the environment in many ways. One noticeable transformation observed during the field survey was the conservation of traditional Jhum areas into permanent forest or cash crops plantations.

For instance, Sungratsu village under Asetkong range has converted an entire traditional community Jhum site into model farming where sedentarised farming activities for producing cash crops and vegetables were encouraged. With the change of land use from Jhum to intensive cash crop farming the number of families engaged in Jhum has drastically reduced from 150 to 30. This result into reduction of area under Jhum cultivation by giving substantial increased in forest cover. Today, the village council has set aside a portion of their Jhum land into a wildlife reserve. Change in land use system not only change the farming systems but also influenced a stable environment.

The extraction and indiscriminate removal of major and minor forest has resulted in deteriorating the physical environment. One of the main reasons of deforestation prevailing

in the district is due to shifting cultivation. It is marked by slash and burn method before being cleared, during this period large tracts of forest cover are being felled down. At the same time demand of firewood and loggings, forest fires also creates deforestation. It has been observed that the villages under different ranges are trying to implement laws and orders to conserve community forest area under the village jurisdiction. Community Reserved Forests are going at large in every range. Following are some of the community reserved forest under different ranges.

Ongpangkong range

1. Kongyung forest (Chuchuyimpang village)
2. Amalongpang forest (Longkhum forest)

Langpangkong range

1. Kanglutu Biodiversity Reserved (Changtongya village)
2. Sungkongtsuyong Bird Sanctuary (Merangkong village)

Asetkong range

1. Yangeimanglupok (Core zone)-Mopungchuket village
2. Meyongpentong forest (Longpha village)
3. Shengtakbalopok (Longjang village)

Changkikong range

1. Anujakong (Molungkimong village)
2. Aleptoi (Dibuia village)

Japukong range

1. Retongkong (Japu village)

Tzurangkong range

1. Yimkup (Longpayimsen village)

The year 1999 has been declared as the tree planting year by the Government of Nagaland under this theme, the district has been perceived and organized by the people to plant trees in their Jhum fields. It has been organized around the town and at the community land. NEPED and other NGO's have also organized workshops, seminars on environmental protection and ecological development at the grass root level.

Laws on hunting and poaching are also implemented in all the sample villages to maintain the extinction of rare faunas. The range of Langpangkong, Asetkong and Tzurangkong are also implementing on plantation like rubber and tea. Nearly, 560 hectares of land is under plantation crops. Home garden which are small farms are also cultivated and managed by the farmers. Vegetables, fruits, medicinal herbs etc., are grown. Waste drainage water from the kitchen can be used to start seedling or irrigate annual crops. Home gardens through small and total area are important in the overall production system by maintaining stable ecological environment.

5.3 Village Council and Management of Forest

In Mokokchung district, the local communities have their own specific institutions and laws according to their traditions and base on village wise category in the management of natural resources.The local institutional structure and function reflects that forest is an important asset which is recognized. In some community in Nagaland, the village council has no power to stop the individuals but in the case of Aos the village council act as an important forest management institutions to promote and protect the forest in the rural areas. The village council has the power to regulate and decide the land cultivation and the villagers and no individuals are allows cultivating at other site, going against the decision of the village council invites fines or punishments.

The extraction from forest is another major factor in the degeneration of forest in Nagaland. Among the communities studied, the extraction of firewood is mostly done during a specific period and apart from the collection of fallen dry twigs and dry leaves of which indiscriminate cutting down of trees is prohibited. Excessive cutting down of trees for the production of charcoal for commercial purpose is a major factor for the degeneration of forest cover. The village council has the power to imposed restrictions on the individuals even the private land overriding the individual property rights.

Most of the village councils in the district have adopted measures to check on the forest degeneration through the setting-up of Forest Committees whose responsibility is to protect the forest. The council prohibits the cutting down of trees and punished who violates the rules and regulation. The village council also regulates indiscriminate grazing of livestock's the prohibition for grazing in specific period and areas are also designated for the villagers. The setting-up of Forest Communities within the village council for the protection and management of forest is significant innovation of the local institutions towards the protection of forest in Nagaland. For this certain external intervention has to be adopted in tune with the local socio-economic situations to protest natural resources and to safeguard the environment.

5.4 Land Degradation Management

Human activities are mostly based on land, and quite often are unwise and involve improper use of land resources. A number of stakeholders are involved in land use and land management. The demands of growing population is the prime driving force that lead to deterioration of the quality and quantity of soil and land. A number of policy measures and

practices have been initiated over the years to mitigate land degradation in the state. Some of the institutions involved in addressing issues relating to land prevention and landdegradation in the state are :

(i)Department of Land Resources

(ii)Department of Agriculture

(iii)Department of Soil and Water Conservation

(iv)Department of Irrigation and Flood control and

(v)Nagaland Environment Protection and Economic Development (NEPED).

Major policy of various departments to manage Land degradation are highlighted below :

1. Department of Land Resources: - The thrust areas are,

a. Agro forestry system of framing

b. Rubber development

c. Wetland development

d. Integrated Wastelands Development Project (IWDP)

2. Department of Agriculture: The thrust areas are -

a. Crop production programme

b. Oil seed production programme

c. National Pulse Development Project

d. Accelerated Maize Development Programme

e. National Watershed Development Project for Rain fed Areas (NWDPRA

f. Improved seeds

g. Land and Farm Water Management

h. Agriculture link roads

i. Tea development

j. Integrated Pest Management (IPM)

3. Department of Soil and Water Conservation: The thrust areas are -

a. River management and Water resource management

b. Integrated Watershed Management Project (IWMP)

c. Pasture land Development

d. Nursery Development

e. Watershed Development Project in Shifting Cultivation Areas (WDPSCA)

4. Department of Irrigation and Flood Control: The thrust are -

a. Irrigation works

b. Command Area Development Programme (CADP)

c. Flood control/Anti — Erosion Works

d. Hydro- meteorological observation

5. Nagaland Environment Protection and Economic Development (NEPED):-

The aim of NEPED is to help farmers to improve the land use system, and to protect the remaining forests. The Nagaland Environment Protection and Economic Development (NEPED) project (Now Known as the Nagaland Empowerment of people through Economic Development) was initiated in February 1995, with a view that traditional shifting cultivation

methods need not be eliminated, but modified NEPED has worked at the community level to encourage adopting of agro forestry and enriched fallow management systems by planting trees in Jhum fields. This was the first major project covering as high as 70 per cent of the 1286 inhabited villages of Nagaland. Seven million trees were planted in the first phase of this project.

5.5 Land Husbandry

The term 'land husbandry' has recently been coined to try to overcome the different perspectives for those attempting conservation and to get over the realization that soil and water conservation is really only a part of agricultural production and environmental management. Land husbandry means the care, management and improvement of land resources. It is still a technical approach to management but encompassing a widerrange offactors including biological control. Rather than seeing conservation as a separate strategy with its own approaches and institutions and it fosters the idea ofintegrated management of total production cycle, although, lauded as a new philosophy by Hudson (1992) and perhaps it is for agricultural engineers — land husbandry does not, therefore, directly address soil erosion. However, some scholars call it 'conservation by stealth' on the grounds that land users will practice conservation if it is perceived to be in their individual interests. Although, their primary concerns are production, risk-minimization and livelihood security.

5.6 Ecological Farming

Despite unparallel achievement on food front, conventional farming system has unleashed many agro-ecological problems including land degradation. The alarming land

degradation has led the planners and scientists to find out an ecologically sound crop husbandry practices i.e. ecological or organic farming. This practice basically depends on the principles of ecology. This systems aim at enhancing the agricultural productivity per unit ofland and water without endangering the production environment. It is considered to be capable of fulfilling twin objectives of achieving food security and ecological sustainability. It is ecologically sound, economically viable and socially just and humane. This system is devoid of chemical inputs. Under this system the biological potential ofthe soil and the underground water resources are conserved and protected from natural and human-induced degradation or depletion by adopting suitable cropping models besides natural or biological means of pests,weeds and disease management by which both the soil life and beneficial interaction are also stimulated and sustained so that the system self-regulation and stability as well as capacity to produce agricultural outputs at levels that are profitable, enduring over time andconsistent withthe carrying capacity of the managed ecosystem. It will prove most effectivealternative system that can preventsoil nutrient mining and improve growing sustainability crisis,

5.7 Integrated Nutrient Management

On account of continued decline of soil nutrient with the run of water and decreasing application of organic 'fertilizers to the productivity status of soil is continuously becoming precarious. These are deficient not only in major nutrients but also in secondary nutrients, like Sulphur and trace elements like zinc and iron. Fertilizer confined to major crops and

certain specific areas. This situation is unlikely to be changed in near future to resort to integrated nutrient management with particular ecological farming;

A great deal of work done on conservation in parts of our country indicates that thebenefits of resource harvested and productivity can be enhanced to a considerable extent on a sustainable basis (Sharma et al,1994). Conservation practices can be grouped into four broad categories as follows:

1. Rainwater Management: The measures for conserving rainwater in-situ and its safe disposal includes various types of land configurations namely; ridge and system/graded furrows, raised and sunken bedbroad bed and furrows etc. These measures take care of drainage in growing crops, in-situ percolation ofrainwater and thereby conservation of nutrients and soil results of these techniques have Shown tremendous success in soil and water conservation

2. Soil Conservation Practices: Some land treatments and water disposal have system have been found to control soil erosion from black clay soils. Broaded and furrows, graded furrows and broad based bunds diversion bunds, loose boulder structures and bench terracing are the commonly recommended treatments. Contour bunding has been used as Soil conversation measures in many places, but such conservation structures have been reported to adversely affect the crop yield (Kampen 1974).

3. Biological Methods of resource Conservation: A considerable amount of soil profile-stored moistureis lost during post-rainy season also consequently affecting the soil productivity and exposing thesoil to degradation. Soil mulching, straw mulching, vertical mulch, plastic mulching etc. are thought to be some the effective biological practices for soil and moisture Conservations.

4. Integrated Approach for Water Management: This method has been found useful not only conserving rainwater but also in, draining out excess water and conserving soil erosion.In this method small bunds (25 to 35cm high) aremade around the technique facilities keeping rainwater at a place where it fills, thereby, increasing infiltration deep into thesoil profile and save the field from the soil washes and gullies formations. It presents a holistic approach keeping in view the environmental degradation and ecological farming.In addition to the measures outlined above, there are some low cost methods highly suited for small and poor farmers i.e, contour or terraced farming, mulching crop residue and weed biomass management, strip cropping, minimum tillage, off-season tillage, land leveling, landuse according to capacity and vegetative barrier etc. These measures are more effective and economic in conserving, maintaining as well as preventing land and environment.

5.8 Watershed Management

Many civilizations were said to have perished due to misuse or the negligence in natural resources like soil and water.Watershed is a catchment basin i.e. an area of land that forms the drainage of a stream or river. It constitutes a big area which comprises the down catchment area of the river at the foothills to the steep mountains slopes. Watershed act as a natural reservoir from which the rivers and tributaries draw water. It is an important unit in the process of sustainable natural resource management. Therefore watershed management is essential for conservation of forest, land and water. The main objective of watershed management is to store water, prevent soil erosion and to regulate the flow of streams.

Currently the concept of developing watershed has been one of the major thrust

planning areas in the district under the guidance of state government. This natural unit is evolved through of rainwater with landmass and typically comprises forest area, arable and non-arable land including wasteland and degraded land. Development under its purview include almost every activity concerning land, water and biomass. The entire strategy framework is holistic since it combines the technologies on soil and water conservation with appropriate agronomic practices against the backdrop of alternative land uses. It can produce a distinct change in the condition of soil health. The main motto of the watershed management is the efficient biomass production in the areal unit through protection, conservation and improvement of land and water resources. This technique has been proved to be effective means of in-situ and in-field conservation of rainwater, controlling soil erosion and deforestation, and increasing groundwater recharge.It aimed to enhance the productive capacity of land and its carrying capacity by stressing on the integration and development of onsite resource utilization and management practices. It is the integration of various activities necessary to develop the watershed into one composite whole, which can implement and reinvigorate the existing natural resource and maintain the balance.It involves integrated ecosystem units that include terrestrial and aquatic ecosystem with man and his activities.

It has been observed that, the district forest cover is decreasing to a large extent due to the massive practice of shifting cultivation. This reckless deforestation on hill slopes lead to drainage of water down the slope below so that there is no scope for water shortage on top hill slopes. An efficient function of watershed function is likely to increase in production of fuel wood and fodder, boost horticulture, animal husbandry and pesiculture thereby opening up avenues for job for the people. In addition, it will also reduce downward runoff and flood disaster.

The State under the department of Soil and Water Conservation has taken up watershed management around the villages to ensure sustainable development of the environment. In order to bring about sustainable livelihood and healthy environment, it is therefore imperative to provide soil and water conservation oriented treatment to watershed in an integrated manner by adopting appropriate conservation technologies. Those technologies which can be adopted according to the suitable local agro-climatic conditions and be broadly categories as agronomic, mechanical and afforestation measure and methods. The integrated usage of such techniques is important so as to reduce the runoff of erosion. Rainfall can be obstructed and stored in soil at the place where it is received thereby reducing not only soil erosion but also siltation of river beds and tanks. The water stored in soil can support good crops and also increased in production. This can also encourage luxuriant vegetation growth and coverage of those non-arable lands by conserving the natural environment.

5.9 Traditional Methods on Soil Conservation

The response of society to land degradation is soil conservation, defined as any set of measures that controls or prevents soil erosion or maintains soil fertility (Stocking 1995). Water related degradation comprises major part of the degraded land. Further, water related degradation extends to a number of different agro-climatic regions. Hence different kinds of land degradation can be designated as 'water-related degradation'. The most important ones among them are -- water-caused erosion resulting in gullied or ravenous lands or just sinking away of agricultural land as in several cases in the hillsides and water-logging and salinity (Chopra 1996).Complex community-based processes and traditional laws for managing village land and environment has evolved through years. People have learned that not

everything from the past is effective today. Field study observed that much invaluabletraditional knowledge has been already erased from the memory of the youngergenerations. The reason for the loss of traditional methods of conserving the environment canbe attributed due to the lack of documentation.

In a Naga society, however the traditional knowledge is usually transferred from the fore-fathers after one generation to another. Thus, in response to these new pressures traditional resource management systems have continued to evolve, as they always have done through the generations. Villagers in Nagaland have begun adopting innovative approaches that use more broadly based measures to check the forces responsible for the degradation of environment.

Indigenous knowledge is a valuable resource that exists within a society. Any development initiated in the society should combine conventional know-how and modem techniques with traditional method wisdom. Soil is the medium for growing crops and it is the main source from where the essential nutrients are obtained. Jhum fields in Mokokchung up to 60 degree slope makes them more prone to erosion then flat farms lands in the plains. However, the existence of traditional practices to control soil erosion using both physical and biological barriers which indicates that farmers understand the need for soil conservation practices. Protecting this is therefore an integral part for improving the productivity of crops.

Following are some of the traditionally soil conservation practices :

1. Physical Barriers

Barriers with boulders/ stones- Boulders and stones are place along the contours of the fields. Cultivation is done in the same plot in small patches continuously for years.

Using Poles- The method of constructing mechanical barriers using logs was found very effective in preventing soil erosion. The barriers were placed at regular interval of 2-5 m, and held in space with the help of wooden pegs.

Using split bamboo- This consist of splitting bamboo and makes as mat like frame of 30 centimeter high which is lead across the slope with the spacing 3-5m between the barriers. Soil furrow-While preparing the field for crops like paddy and vegetables the soil heaped in the rows across the slope on which the crops are dibbled. This method not only prevents erosion but also provides enough moisture to the soil zone.

2. Live Barriers

Use of crops- Crops like maize, millets, soya bean etc are planted closely in lines across the slopes to control soil erosion. Crops like ginger and soya bean are known to increase the nitrogen content of the soil. During inter cultural operations, soils are heaped to strengthen the root zone portion .The leaf litter adds organic matter to the soils. These practices not only prevent the soil erosion but also conserve the soil moisture.

Use of Broom grass-Rhizomes of broom grass are planted across the slope at a closer spacing between plants and 3-5 m between rows. It establishes and grows fast with accumulation of high quality of eroded soil was observed.

5.10 Fallow Management

Fallow is the intrinsic part of shifting cultivation. It is a period of time where cultivated land is left unused until the next Jhum cycle. Fallow systems normally occurs

when crop production becomes more difficult with arise in weeds, pests and diseases or declining soil fertility. In recent years, due to increase in population and increase of land use fallow period has been drastically reduced leading to fallow degradation, .pi some cases fallow period has been reduced even up to 4-5 years and this adversely affects the productivity of land. Therefore good fallow management systems that are biologically and economically sustainable are needed for a better production.

Planting of leguminous trees, shrubs and perennial herbs has shown potential to restore soil fertility in a shorter period of time. Fast growing species that produce a lot of biomass are planted and allowed to grow on the fallow lands for a certain period of time to provide an artificial canopy. Trees and shrubs in fallow lands also remove natural weeds and other noxious grass. Planting of locally available fast growing trees species which may be harvested within a few years should be introduced in the fallow period.Some of the fast growing trees species are *duabanga grandiflora* (Khokan), *antocephalus chinensis* (Kadam) and *spondiaexillarias* (Naga Neem) etc.

5.11 Agro-Forestry

According to King K.F.S, M T. Chandler (1978)agro-forestry has been defined as a "Sustainable and management system which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants or animals simultaneously or sequentially, on the same unit of land, and applies management practices that are compatible with the cultural practices of the local population.

More broadly, it is the combination of silvi-cultural, agriculture and other land use technologies so that join application will increase productivity, sustainability, equity or achieve other social cause. Agro-forestry can be effectively practiced on lands subjected to shifting cultivation, on the mountain ecosystems denuded of vegetation from biotic causes and in arid and semi-arid tracts. The main objective of agro-forestry is to optimize production and economic return per unit area especially in the rural areas.

This system of the land use can provide diversified raw materials, field wood, fodder etc., which could contribute stable employment in the rural areas. Apart from these, it can yield medicinal products, edible and non-edible oil seeds.

Through the proper selection of tree species it should be possible to minimize the soil erosion to tap nutrients from the deeper levels than those reached by the roots of agricultural crops. It also replace through leaf fall and fixation of atmospheric nitrogen the nutrients removed in the crops. The leaf fodder trees constitute an important source of fodder in many parts of the world. The agro forestry in the hilly region shall require special emphasis on the cultivation of indigenous trees which have multiple economic and traditionally important and with varied applied fuels like nectar flora for bee keeping, sericulture fibre and pesiculture which will further increase the income of the marginal farmers throughout the agro-based industries.

Agro-forestry land use system plays a significant role in soil and water conservation. The plantation of crop combination like coffee or cacao with Erythrina, Inga and cordial are the characterized by large return of organic matter and nutrients to the soil in litter and

pruning that comes up with a moderate level of nitrogen fixation. Trees species like Acacia spp., Calliendracalothyrus, Sesbania seban, Casurianaequisitifolia, Glyricidiasapium etc., should be planted for potential to regain the soil fertility.

The Nagaland Environment Protection for Economic Development (NEPED) which was funded by the Canadian International Development Agency (CIDA) through the Indian-Canadian Environment Facility (ICEF) was initiated in 1995 to make Nagaland self-sufficient in agro-forestry. Under this project experienced by the government demonstrate the villagers to set aside 6 hectaresof land known as the test plot over two and half years. The plot of land required to plant 1,200 seedlings along with the usual crops under the guidance of the village council and a project team. These were much effective in many rural areas in Nagaland.

5.12 Policies Programmes and Participations

A programme under any Government Policy should be based on a definite policy. After the attainment of Indian independence, the Forest Policy which was inherited from the British, considered as the Forest Government property and treated them as a source of raw material and revenue for industry. In Nagaland, though the private ownership of forest was accepted the policy of treating the forests as a source of raw material was also accepted till the formulation of the National Forest Policy of 1988. It has been noted that National Forest Policy has undergone lots of changes over the years. Likewise, the policy of the Government of Nagaland has also changed.

The most import aspects of this tremendous change are that the village council has been empowered to look after the forest under their Laws and Regulations. At present, the

Government of Nagaland has articulated the Forest Policy which is said to be in consonance with the National Forest Policy. According to the State Government Policy in official publications it states that atleast one third of the geographical area should be under forest cover. It also » states that in the hill areas atleast 60% of the area should be under forest to protect environmental degradation and to prevent soil erosion to as to maintain the stability of the impact of environment. In consonance with these objectives, the State Policy has emerged into:

1. Conversion of Jhum land into economically and ecologically sustainable.
2. Regulation on harvesting of forest resources on the principles ofsustainability.
3. Protect and conserve the endangered species of flora and fauna.
4. Rising of developed local species rather than exotic ones.
5. Protect, conserve and management of biodiversity in Reserve Forests and Wildlife Sanctuaries based on principles of in-Situ conservation.

Soil and water are the natural resources vital for human subsistence is loss causing degradation of land. The cause of this is attributed to the practice of traditional cultivation and improper use of land system. In order to weaned away this problem, proper land use management planning and water conservation techniques like bunding, afforestation, farm forestry, plantation , cash crops and stream bank erosion control strategy should be implemented. The above policy statement that promotes the method of exploitation along with conservation in the areas of Jhum land has been a major concern. This point out a gradual shift in policies by encouraging people to give up Jhumming in favour of settled cultivation. However, conservation of Jhum land is not a simple matter as Naga society has a

close relationship with the traditional cultivation interlinked with its own culture. It is a way of life which evolves as a reflex to the physiological character of land under its sub-tropical ecosystem based on monsoon climate. Keeping this in mind, the nature of Jhumming is not possible to eliminate all together. What is required is the use of an intensive cultivation that includes multiple cropping along with other cultivation to increase its productivity and also for the livelihood subsistence.

The GEF-UNDP Nagaland, under SLEM (Sustainable land and Ecosystem management) in shifting cultivation Areas of Nagaland for ecological and livelihood Security project has promoted Azolla cultivation in all the project areas considering its wide value and application in agriculture practices. Azolla is a nitrogen fixing capability being used as a fertilizer. The rotting plant material releases nitrogen to the rice plants, providing up to nine tones of protein per hectare per year. The use of Azolla increases rice yield by 20-30 per cent Moreover, it reduces evaporation from the water surface and increases water use efficiency in rice.

The Directorate of Wasteland Department of Nagaland aims at regeneration by intervention in the degraded Jhum land through plantation programmes on watershed bases, for conservation of soil and moisture. These enhance in maintaining the ecological balance and protect the environment through the participation of the rural community so as to improve the socioeconomic condition of the community.

A major effort made by the Government of Nagaland is the NEPED jointly funded by the Government of India and Canada by covering 1000 rural areas in different district of

Nagaland. The project envisages the introduction of innovative agro-forest practice with people's participation. Following are the aims and objectives of the project.

1. Conservation of natural forest covers from being encroached upon by Jhum cultivation.

2. Transforming through demonstration of land use cover under Jhum in which agro -forestry techniques will be applied. The aim of NEPED is to make shifting cultivation practiced more productive and profitable.

The most recent effort which was made under the initiative of Department of Land Resources (DoLR) has been actively implementing centrally sponsored scheme on Integrated Watershed Management programme (IWMP) mostly in jhum cultivation areas converting into a multi-disciplinary approach. Under this programme, the department gives capacity building training to villagers, distribute equipments and tools, seedlings, livestock, etc,.The Nagaland Forest Act of 1968 has various rules which deal with the different aspects of forest and their exploitation. The rules are as follows:

1. Rules to regulate the export of forest products.
2. Rules for the protection of conservation of wildlife in reserved forests.
3. Rules for the protection of forest from fire.
4. Rules to regulate the transport of forest resource by land, air and water within and outside the State.
5. Rules to regulate the salvage, collection and disposal of drifts and other timbers.

6. Rules to regulate the removal of orchids from the forests in Nagaland.
7. Rules on the quarrying of stones from all forest of Nagaland.
8. Nagaland settlement of forest coupes and mahals by tenure system rules.
9. Nagaland settlement of forest coupes and mahals by auction and sale system rules.

The rules and regulation are of little significance because in Nagaland most of the forests are under village councils, clans and privately owned. With the Supreme Court order of 1996, banning the extraction of timber has two significant developments. The first System is the Joint Forest Management (JFM) and the other system is the Non-Timber Forest Produce (NTFP). In Nagaland, most of the forest is owned privately, so Joint Forest Management has been implemented rather easily and new afforestation schemes have also been taken up under JFM.

For sustainable land and ecosystem management in shifting cultivation areas of Nagaland for livelihood and ecological security the United Nation Development Programme (UNDP) Project was started with the collaboration of Government of Nagaland. It aims to address the land degradation in shifting cultivation through participatory planning, general awareness programs, building institutions and supports the integrated farm development that enables sustainable land use and ecological management.

The daily weather conditions monitored by the Department of Soil and Water Conservation, Government of Nagaland through its 15th number of meteorological centers that are installed around in different parts of the district at different altitudes is arising an alarm rate. The records indicate that Nagaland is also experiencing a climate change along

with the rest of the world in the form of change in rainfall pattern and rising temperature. During 2016, the State has experienced decrease in precipitation, with rainfall dropping down drastically affecting the yield of crops. The most important contributing factor is the extensive practice of shifting cultivation. This has cause massive destruction to bio-mass by denuding the land of its vegetative cover. The Department therefore, acknowledges that optimum use and judicious management of land and water resources to promote sustainable basic approach towards this are:

1. To put land to optimum use according to its capability and to threat the land according to its needs by adopting appropriate soil and water conservation measure.
2. To encourage permanent cultivation and to discourage shifting cultivation as far as possible.

Land development like bench terracing, counter bunding etc., can be taken up for mitigating soil erosion and sustaining soil fertility and productivity on arable land. Thus, integrated adoption of soil and water conservation measures has the potential to increase production and sustain the increased production and also protect the environmental consequences.

It has been seen that the integrated area development approach in which agro-forestry played a leading role has contributed to the success of programmes for shifting cultivation control. There are also several barriers to realize Jhum cultivation as being an integral part of sustainable land use and ecosystem management strategy in the district as well as in the State. These range from weakness in the policy, planning and institutional environment that influence Jhum to weak capacities at the local level among the village

institutions and Jhum cultivators to promote sustainable Jhum-based livelihoods. It includes the need for better integral local knowledge and technologies to improve Jhum cultivation, concerned departments such as Agriculture, Land Resource and Soil and Water Conservation were included. The aim is to improved Jhum practices as part of SLEM strategy at the community levels.The strategy is to introduce participatory planning processes and to finance priority activities that are identified through the involvement of the entire community in the development of community resources management plans which reflects more productive and sustainable use of the available resources.

National Forest Policy states that at least one third of the geographical area should be under forest cover. And further states that, in the hilly region like the state of Nagaland, atleast 60 per cent of its geographical area should be under forest cover to prevent from the degradation of land and soil erosion so as to maintain the stability of the impact of environment. In regard with these objectives the State Policy has introduced these following policies:

1. To convert Jhum land areas into economically and sustainable woodland.
2. To raise and develop important commercial crops.
3. To regulate harvesting of forest resources on the principles of sustainability.
4. To protect and conserve biodiversity of endangered species of bothflora and fauna.
5. To protect and conserve, biodiversity such as Reserved Forest Sanctuaries based on scientific and in-situ conservation.

Keeping in view that, shifting cultivation is a way of life for the Ao-Naga community leaned with culture, customs and beliefs. Abolition of Jhum cultivation is not a realistic

solution unless alternative methods for livelihoods are available. To ensure sustainable maintenance of the environment and productivity of Jhum cultivation in the district, the following suggestions are important:

1. Introducing of Alder trees (Alnus nepalenis).

2. Encouraged settled cultivation.

3. Topography of the district is undulating, use of broom grass on contours as vegetative barriers to reduce soil erosion.

4. Use of salt to control weeds must be banned as it loosens the soil which leads to soil erosion.

5. Introduction of leguminous crops in Jhum fields during cropping years to enhance land productivity and crop yields.

6. Afforestation must be encouraged under the guidance of village councils, district authorities along with forest department, NGO's and other agencies.

7. Organic farming must be encouraged.

8. Balanced use of fertilizer to maintain soil fertility.

Fig: 5.1 Diagrammatic representation of Land use and Environmental management

5.13 Concluding Statement

The relationship between human being and environment has reached to such a situation where proper management and protection has become an essential part of our development policy. Naga's were traditionally attached to environment for their survival and they had traditional knowledge of managing their immediate environment since time immemorial. Forest and land are two most important and widely used resources in the traditional Naga society. However, the traditional knowledge which is usually transferred from older generation to the young one in the form of anecdotes and physical demonstration of conserving natural resources is fast degrading in the state, as the younger generations are more into modern methods and there is an urgent need to collect and preserve this rich traditional knowledge.

Today, realizing the decline of our environmental values many villages in the district has initiated the policy of converting their village forest to conserve and manage flora and fauna. Taking the financial and technical support of government and NGOs many villages have initiated wildlife conservation. However, in some parts of the district implementation was not successful because of landownership problem and rapid change in agricultural activities. Government has enacted certain laws to tackle / protect the environment. While enforcement of the provisions in the legislation could go a long way to minimize the extent of environmental degradation caused by mining operations, deforestation, shifting cultivation, air pollution, water pollution, waste pollution, industrial pollution, etc., the environmental conservation is the collective responsibility of the society as a whole and the interaction and cooperation of the Government statutory bodies, and the public at large are quite essential for successful implementation of the programmes.

The study provides a sound base to conclude that conservation of soil, water and nutrient can be effected by empioying the technique suitabie for specific area and location to protect both quality and productivity of land. By over exploitation of our production environment we are heading towards a future, which appears to be bleak for the generations to come. Therefore, if we are to survive and lead a reasonably decent life we can't afford to be reckless and rapacious to our environments. We must devise suitable country and area specific strategies for attaining agricultural sustainability without endangering the resource base. Such strategies must address themselves to various socio-economic and environmental conditions and Objectives. It is felt that the quality of land can be protected as well as upgraded through widespread application of environment-farmers-friendly environmental protection measures to restore and improve the ecoiogicai conditions in the degraded ecosystems. Thus, the quality of land could be considerably improved through effective land resource management.

CHAPTER: 6

SUMMARY AND CONCLUSIONS

CHAPTER: 6- SUMMARY AND CONCLUSIONS

A summary of findings of the current research has been presented in this chapter. This research attempts to understand the land use pattern and the magnitude of environmental degradation in the district over the years.

The purpose was to examine the land use pattern and the intervening force of human activity and the nature which by and large affects the environment. The study assumes that the nature of ecology provides the primary basis of developmental activities and the present notion of 'development' creates infinite exploitation of the ecological resource base that affects the lives of the tribal and indigenous communities.

The study area of the district is a part of the Naga Hills which are dismembered branch of the Eastern Himalayas and its is divided into six parallel ranges on the basis of terrain, climate, soil and the type of vegetation cover. The topography of the district is accompanied with hills and has got a number of mountain ranges which are coupled with sharp crust ridges and narrow valleys with few plains. As a result, agriculture is of highly subsistence in nature and supports only a part of the requirements of the people.

Nagas are a distinct group of indigenous peoples. For centuries they have been directly or indirectly dependent on the natural environment for sustenance. Likewise, the district of Mokokchung is a land of villages and the people are mainly depending on environment for their livelihood subsistence. The study reveals that the quality of environment in the district is fast deteriorating due to shifting cultivation which is an old age practice is deeply rooted within the Ao-Naga community. According to Nagaland, Jhum land Act 1970, Jhum land means such lands which any member or members or a village or a

community have a customary right to cultivate by means of shifting cultivation or to utilize by clearing jungle or for grazing livestock and includes any beds of rivers provided that such village or community is in permanent location and there is no concrete policy to monitor and managed it. It is identified that shifting cultivation is a way of life of the tribal people in the hilly areas which are inter-linked with festivals. So, as in Mokokchung district, out of the total population of 1, 93,171 (2011 census), rural population constitute 1, 37,517 and most of the rural people depends their livelihood directly from shifting cultivation. In Nagaland, the ownership of the land including forests is determined by traditional laws which are under the protection of Article 371(A) of the Constitution of India. According to the traditional law there is no land without ownership. However, ownership of land including forest is private and is vested with individuals, clans and the village as a whole.

According to Forest Survey of India, 81.2 per cent of the state geographical area is covered by forests. The comparison study of forest cover (Satellite data of Oct-Dec 2015) shows a loss of 450 km^2 of forests cover. Forest Survey of India points out that the main reason for the net decrease in forests cover was shifting cultivation and other biotic pressure on forest lands. However, it is observed that logging, firewood collection, construction of roads also accelerate the net decreases of forest cover. Apparently forest degradation is witnessed in both private forests and government forests. However, the rate of deforestation is alarmingly high in private forests.

It is significant that the major land use system in the district is under Jhum / Slash and Burn/ Shifting cultivation. Out of the State 91040 hectares of Jhum paddy, Mokokchung district covers an area of 9320 hectares (2018-19). It is evident that, Jhumming has become unsustainable which has brought lots of impact on environment. Several studies have shown

that it is an environmentally healthy practice when 18-20 years Jhum cycle is maintained. It is worth mention that, some few decades back most of the villagers in the district maintained Jhum cycle of 15-20 years at an average. Today, Jhum cycle has gone down due to pressure on land by demographic factor thereby mounting pressure on environment is increasing. It is revealed that in most of the sample villages, where shifting cultivation is the only mode of production, the frontiers of Jhum land have been pushed to the limits. At present, farmers are constantly modifying and innovating upon their traditional farming practices to improve their livelihood. However, despite of innovation to improved Jhum cultivation, it is evident that Jhumming seriously affects environment, climate and economy of the farmers. The problem is that the same plot of jhum land is brought under the cultivation within a short period of 8-9 years which is not sufficient for the soil to regain its fertility and the growth of the forest cover fully. The soil erosion is more prominent in the Jhum land. Traditionally, farmers practices soil erosion control methods by using bamboo, stones and poles. The alder tree based cultivation which the state government is initiating is still negligible in many parts of the district. Despite the growing awareness programmes and project from different department to cultivate cash crops, the farmers are reluctant due to lack of marketing linkages, storage facilities and poor transportation which negatively affect sale of their products.

The traditional method of the cultivation (Jhum) is considered as destructive by many environmentalist, scientist, researchers and Government. Its impact on the environment cannot be denied but removing from the land use system of the Nagas is a big task, as it is deeply interwoven with the tradition and culture. Realizing the fact that shifting cultivation is for the subsistence for the rural people. Abolition of this system of cultivation is not a

realistic solution unless alternative mode of food production for survival of the rural people is implemented. Hence, Jhum cannot be removed altogether, some suggestions to improve the methods of cultivation are mentioned below. First, farmers should be encouraged to practice settled cultivation wherever the topography permit. Second, since the topography of the district in undulating, proper soil and water conservation measures are necessary to prevent soil erosion. Third, use of salt to control weeds must be discouraged because it loosens the soil which leads to soil erosion. Fourth, leguminous plants like soya bean should be grown in Jhum land to improve the production. Fifth, judicious and balanced use of fertilizers and other chemicals is necessary to avoid loss of soil fertility and human health consequences. Sixth, soil erosion must be checked by using logs, pole, bamboos and stones to avoid soil erosion by runoff. Lastly, organic farming should be encouraged which can reduce ground water pollution, threats to wildlife and consumer exposure to pesticides and chemical fertilizers.

Of late, there is a drastic change in the pattern of land use. Modernization has a great impact on the traditional community life of the Nagas. Capitalism and individualism are penetrating every sphere of life which directly affects the landholding and land use pattern in the society. Land, which was once sacred and the most important factor sustaining the community life is now becoming a mere commodity or wealth to many. Today, the land no longer holds sanctity value as it once had in the community. Besides, other exogenous forces and government policies have completely changed the concept of land. Further, under the new administrative system community land is voluntarily or involuntarily being taken over for developmental purposes. But, from the study it has been observed that large lands especially in rural areas intended for governmental use, recreation, school, park, ground,

defence, roads, tourism, etc., are lying abandoned with incomplete structures because of unplanned and irrational policy. For instance, ISBT located at Khensa village is not functioning fully; P. Shilu Memorial Park in the middle of the town is almost wearing away before completion, number of fishery ponds are lying deserted in many villages and a number of villages without proper investigation of tourism potentiality has been declared as tourist village in the name of development by the government occupying large areas with no progress.

The field studies have revealed that in most of the sample villages there was common noticeable changed regarding the conservation of some portions of traditional Jhum land into permanent forests or cash crop plantations. It is also identified that there is an alarming transformation in land use pattern i.e farmers are now replacing Jhum land to agricultural farming, cash crop plantation, development in horticulture, livestock activities, etc as a result there is decrease in traditional practice of Jhum with increase in environmental friendly farm practices. For instance Sungratsu village with 600 families practicing Jhum has been reduce to 60 families within ten years. The villagers converted the entire traditional community Jhum site into a model farming village where sedentarized farming activities for producing cash crops, vegetables and animal husbandry is encouraged. Despite of the fact that, there is restriction, forest cover naturally provides an economic base for hunting, gathering, lumbering and collection of various food and other items for the people. Similarly, fishing is another activity particularly attached to the local people of the sample villages. Abundance of bamboo and cane provides excellent raw materials which are used to make several items of daily use.

The district has own hectares of forest cover which include Reserved Forest, Purchased Forest, Protected Forest, Private Forest, Village Forest and Wildlife Sanctuaries. It is evident that the district forest cover juts decreased from the year 2009 onwards. The total forest cover during 2008-09 was 139500 hectares. However, according to 2018-2019 it has been decreased down to 29022.7 hectares. The main reason for the net decrease in the forest cover within a decade is due to the encroachment of land use for agricultural purposes. It is observed that the main culprit is due to practice of shifting cultivation followed by logging and firewood. The rate of deforestation is alarmingly high in village forests cover. It is evident from the data presentation that there is a drastic decrease in village forest between 2008-2009 and 2015-2016. The rural village forests cover has narrowed down to 24000 hectares only from 134523.2 hectares. According to field study, most of the virgin forest has been almost depleted in almost all the villages. Merangkong, Khar, Changki, Longsa and Sungratsu villages which have strongholds of thick and dense inaccessible forest cover has already deforested followed by Longkhum and Khensa villages even the community reserved forest have already depleted. Deforestation has disappeared numerous diversity of rare species in the district and the felling of trees causes permanent damage upon the habitat of various species. It is evident that, lots of people are of opinion that practice of shifting cultivation and the lack of awareness are the main cause of deforestation. The other reasons for the Government forest, deforestation are due to the negligence of the State Government towards its policies and implementations. The district is facing numerous untold environmental phenomena. Therefore, to safeguard all these environmental consequences the district as well as the state government must implement strict rules and regulations with appropriate policies by approaching the village community to have joint efforts to safeguard

the environment. More consequently, the district should strictly follow the Nagaland Forest Act 1968 and the Biodiversity Act 2002. Joint Forest Management which was adopted by the Government of Nagaland in 1997. It should be made known to the local communities as many of them are not aware of this-policy. Agro-forestry with multiple fast growing trees and commercial species of trees should be introduced.

Unprecedented growth in population adds to the problem in the land use system. The demand for natural resources increases in relation to population growth and rising expectations. Rapid population growth is the main cause of increasing poverty of rural areas. Population trends exert and influence on our livelihood. In fact, it affects the land and water resources. Population growth intensifies the struggle for control of resources, especially land and its repercussion on land threatens our environment, resources, and even our security. Mokokchung district, its population trend comprises of 1,38,897 rural and 55,75 urban population and its subsistence nature of the agricultural production is indicated by small arable areas and traditional methods of shifting cultivation. Though landlessness is rare and growth of population is sluggish in the study area, many landless workers from nearby states migrate to Mokokchung illegally in search of jobs and if this trend of immigration is not checked the spread of poverty is expected in future. Therefore, much higher food production is pivotal for political, economic and social stability of the district. It is important that policy makers, farmers and the community should take the responsibility for ensuring that land resources are not over-exploited. Some suggestions to achieve its goal are stated below.

1) Conserve, manage and develop land and water resources for sustainable agriculture and forestry

2) protect genetic diversity and provide a healthy environment from generation to generation.

3) produce short duration high yielding varieties of seeds.

Increasing pressure on natural resources coupled with degradation of land and water are slowly posing serious challenges to food, social, economic, livelihood and environmental securities in the district. Climate changes and climatic variability are posing new challenges. This vast canvass of livelihood and social net is fragile, complex, diverse, risky and vulnerable. Watershed is a catchment basin i.e. an area of land that forms the drainage of a stream or river. It constitutes a big area which comprises the down catchment area of the river at the foothills to the steep mountains slopes. Surrounding the up-hill forest, which observe rain water and to control its runoff. The main objective of watershed management is to store water, prevent soil erosion and to regulate the flow of streams. It involves integrated ecosystem units that include terrestrial and aquatic ecosystem with man and his activities. The implementation of watershed programme not only aims on the efficient and effective conservation and utilization of soil and water but also on restoration of ecological balance, people's participation; individual and community, employment generation, and development of human and economic resources of the rural people. Today, with the increase in population drastic reduction in fallow period is observed leading to excess pressure on land. This has led to excessive degradation of natural resources and soil condition resulting in low fertility status of the soil leading to low crop yield. Since, majority of the populous being farmers the economic condition of the people continues to remain in pitiable conditions. Several attempts have been made to wean off the people from Jhumming. However, with the implementation of Integrated Watershed Development Programme (IWDP) which has suitably fitted into the system of Jhum cultivation without needing any drastic change, various land – based activities has been taken up successfully along with jhum cycle keeping in view the land capability, site condition, local needs and aspiration of the people.

A sizeable number of mineral reserves have been found in Nagaland but their utilization is limited because of various obstacle and constraints, namely remoteness, lack of infrastructures, lack of industrial culture and political problem. For instance, Nagaland Pulp & Paper Company Ltd. at Tuli, Mokokchung district, the only major industry in the district set up in 1971 is lying abandoned. Most of the bricks kiln and coal mining in the district are owned by private. Rat hole mining at various places in Tulu, Changki and Anakiyimsen is undergoing without proper scientific technicalities by the local people. Stone quarry is another type of mining which is haphazardly operational in the district located on the highways. In fact, these activities give opportunity for investments. There is an urgent need of action policy to streamline the random practice in the district. The main issue is that environmental degradation in the district can be attributed to lack of awareness among the people. According to study, majority of the Mokokchung population are still unaware of the environmental degradation and its consequences. It is vital that the district needs to adopt UNESCO (1971) objectives and guiding principles for developing environmental education which is insignificant at present.

Nagas, from the beginning has been practicing oral tradition; they do not maintain written records. As a result, traditional knowledge are usually transferred from older generation to the young one in the form of anecdotes and physical demonstration. It has been observed that, rich traditional knowledge of conserving natural resources is fast degrading in the district as the younger generations are more into modern techniques where some are not relevant. Today, there is a need to document the traditional knowledge, as land and its forest resources are solely owned by the people and its governance lies in the will of the people. But, for achieving sustainable management of land use, collective participation of the

community, government, policy makers, researchers, environmentalist and NGO's is indispensable.

The district is also facing numerous wild fires every year. Though using of fire is an integral part of land management in both forestry and agriculture it has wide range of negative environmental impact. Nearly 400 hectares of forests cover in Longkhum, Ungma and Khensa were destroyed in 2019 which was caused on the onset of Jhum field burning. The study reveals that the wild fire that occurs each year were caused by human activities especially by farmers while burning their Jhum field, campers, hunters and in some case intentionally. Owing to this, many reserved forest and endangered species nestling abode were destroyed. Accumulation of carbon-dioxide in the atmosphere during the burning of Jhum fields causes enormous environmental consequences. According to the State Climate Change Protection, the temperature in the mid-century starting from 2020-2050 is likely to experience an increase in average temperature between 1.6° C and 18 ^{0}C. The district has projected an increase between 1.6° C and 1.7° C .This prove that decrease in the forest cover contribute to increase in mercury level. The Government of Nagaland has banned jungle burning in 1996 but still has considerable loss of forest resources, soil, and rich biodiversity.

The district exhibits a number of rivers that runs parallel to the ridges which act as a water divider either northward or southward. The direction of the tributaries is from south-north in accordance with its varying nature of topography conditions. The main rivers are perennial in nature. Milak River is the main longest river which originates from the centre of Mokokchung Town and flows across the Ao-region. The field survey has observed that loss of forest cover has resulted on climatic variation with uneven rainfall and raise of temperature. Drying up of natural perennial rivers and streams are common in all the villages.

It is observed that, removal of massive forest cover not only affects the river flow, stream and water temperature but it also brought changes in stream water chemistry.

Since time immemorial Nagas were managing its resources by way of traditional land use and land policy. In Naga customary law, all land including forest, is privately owned by individual, clans and village community. The government owned land is either a gift or bought by it from the villagers. The customary laws to manage and conserve resources differ from tribe to tribe. The villages also have its own unique laws in regard to ownership and inheritance of properties. Among the Naga tribes, Sema and Konyak tribe have a unique way of managing land and its resources as most of the land are owned by village head/ founder of the village and Angh (Governor) of the village. Except these two tribes, majority of land and its resources are either own by clan or by individual. There is a restriction on transfer or even use of traditional land by people from other community or village in the olden days but at present it is upto the landowner to decide about the land use and transfer of land. There is an upward trend of privatization of land thereby leading to transfer of communal, clan, and family land into private/ individual land. Rapid social change of Naga society has developed a floating culture basically marked by consumerism. This began with the government of India's policy of countering the Naga Movement by pumping money into the state under the guise of economic development. Today, "*Land is no more the God given source of life to which Nagas were so fondly and sacredly attached*"[1]. The landowner is willing to part with his land either for financing the education of children, commercial purposes, or simply for personal pleasure and greed.

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[1]*Sakhrie, ahu. Social activist and educationist, April 2008, Kohima*

The study also reveals that on the pretext of maintaining 'law and order' military camps are set up especially in much prime location in the town and nearby civilian areas, hence occupying huge valuable community land as shown in the data presentation. Militarization in the district has not only led to alienation of community land for security reasons, but gradual loss of land for recreation, pleasure and luxury for military are also taking place. Besides, in the name of development number of projects has been initiated by the Government of Nagaland and many villages are being converted into tourist village, model village, green village, etc. With the introduction of developmental process, there is variety of demands on land and as result land alienation takes place. In future, this activity causes social problems, political unrest and internal violence and strife.

The concept of environmental management has become a significant issue as the relation between nature and human is not harmonious any more. According to the village elders, jungle/forest and rivers were full of life once upon a time. The chirping sound of birds and wild animals had vanished from the forest and numerous fishes of the streams are on the verge of extinction. Today, the gradual decrease in the quality of environment has been felt by the people. There is also increase sense of realization among the people that many of the traditionally valued species could play a major role in the habitat management of the future environment. Many villages realizing the present crisis have taken initiatives to conserve their natural environment within their territorial jurisdictions. Village council, elders and environmentally conscious citizens have realized the long term implications and advantages of conserving natural environment and passed resolution prohibiting any forms of environmental degradation within their jurisdiction which shows a positive result in many villages. This initiative was found to be unsuccessful in few villages because of forest land incursion and ownership problems.

Land use changes according to the changing needs of man. It is essential to analyze the relationship between various uses of land and land use planning. We have already seen that land use is determined by natural conditions and human intervention and our life styles and priorities becomes a determining factors in land use management. If we need a balance between land use and land management, our priority need to be defined and refined with respect to our needs. Land use planning is the process of evaluating land use pattern and other physical, social and economic conditions for the purpose of selecting the kinds of land use best calculated to optimize production and development on a sustained land use basis. It may be at district, sub-division, block or village level. There is great need to create awareness for sustained land use which include environmentally protective, economically productive and socially acceptable to raise agricultural output. Sustainable agriculture will comprise a range of strategies for tackling a variety of problems including the serious crisis in the utilization of natural resources, land degradation, loss of soil fertility and decreasing farm income. Practices that improve soil structure as well as productivity such as nutrient cycling, use of large dressing organic manure, green manure and biological control systems are required to substitute the use of chemicals fertilizers. There is also an urgent need for implementing and adopting new policy for better land use pattern such as establishment of Integrated Blockwise Land Management (IBLM) and Demarcation of Land Zoning (DLZ).

Besides, laws and policies relating to environment enacted by centre and state government, creating awareness towards hazardous effects of environmental degradation in the district is desired. The environmental degradation and limited impact of Environmental Acts in the state can be attributed to the Article 371(A) of the Indian Constitution which clearly recognizes the state customary law in regard to land and its resources. It is due to this

constitution safeguard guaranteed to Nagaland, no act can be executed in the state without complying with the provision of Article 371 (A) of the constitution. But, at present there is an ambiguity and double standard maintained by the Government of India whereby, on the hand article 371 (A) clearly recognizes the state customary laws in regard to land and its resources, whereas on the other hand, complete power is vested in the state administration and judicial system which undermine and completely marginalize traditional laws and practices. Hence, there is an increase of large communal land taken over by governmental as well as private agencies for developmental purposes. It is therefore imperative to frame suitable policies to supplement traditional practices of land use in the district in any behavior. It is also important to give awareness programmes in regard to modernizing the traditional values and systems through equity, transparency and capacity building through proper monitoring. In order to achieve these objectives, government must frame a coherent land use policy. A rational land use policy will encourage genuine utilization of land for human needs and will help promote sustainable economic development and environmental conservation. It is very much necessary that an early adoption and implementation of such policy together with advance technology is needed which will draw community attention to the importance of land use pattern and environmental degradation.

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