IMPACT OF AGRICULTURAL ACTIVITIES ON ENVIRONMENT IN ZUNHEBOTO DISTRICT, NAGALAND

Thesis Submitted

to

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DOCTOR OF PHILOSOPHY

BY

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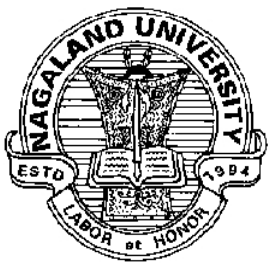

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DECLARATION BY THE CANDIDATE

I, **Ms. Libo Z Yepthomi** hereby declared that this thesis entitled **"Impact of Agricultural Activities on Environment in Zunheboto District, Nagaland"** which I am submitting for the award of the Degree of Doctor of Philosophy in the Department of Geography, Nagaland University, Lumami, is the result of my work carried out under the guidance and supervision of **Prof. Wangshimenla Jamir, Professor, Department of Geography, Nagaland University, Lumami.** I further declare that the work incorporated in this thesis is my original work and has not been submitted anywhere for any award.

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CERTIFICATE

This is to certify that Ms. Libo Z Yepthomi has duly completed her research work for the thesis entitled "Impact of Agricultural Activities on Environment in Zunheboto District, Nagaland" which embodies the original research work carried out by her under my guidance and supervision.

Further, I certified that neither this thesis nor any part thereof was submitted anywhere for any other research degree. I recommend this thesis to be submitted for evaluation.

Place: Lumami (Prof. Wangshimenla Jamir)

Date: Supervisor

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(Libo Z Yepthomi)

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CHAPTER I

INTRODUCTION

1.1 Introduction

Agriculture is the primary economic activities of the people and it involves not only the cultivation of crops but it also includes the rearing of animals which provide food to millions of people around the world. Agricultural activity is one of the important economic activities where everyone can be involved whether rich or poor as all the humans depend on agriculture directly or indirectly. It was the first occupation of man and it is still the main source of economy for the people which help the people in sustaining life. One can survive without cultivating crops but cannot survive without depending on the agricultural products. Agricultural activities involve land utilization, clearing of vegetation etc. Agricultural activities depend on the environment because everything on the earth is controlled by environment. Environment consists of everything that surrounds the earth and it influenced everything on the earth. There can be environment without agriculture but there cannot be agriculture without environment. In early days there was a peaceful co-existence with the environment but as population increased dependence on agricultural products has also increased. This has led to destruction of the environment where there are excessive practices of agricultural activities. Agriculture is one of the most discussed topics everywhere as agriculture is related with people, economy and environment. Agriculture and environment is related with

each other as agriculture depend on the environment and environment can be greatly affected by agriculture as agriculture involves the cutting of trees and clearing of forest specially by the practice of shifting cultivation. Climate and soil are the two important factors which influence the growth of agricultural development and these are the two important factors of the environment which are greatly affected by the agricultural activities.

Different types of agriculture are practiced around the world and the type of agricultural activities varies from one region to the other. The differences on agricultural type also depend on the climatic condition, terrain of the region, type of crop grown, mechanization level etc. Different types of agricultural activities across the world are, shifting cultivation, Sedentary or settled cultivation, Terrace cultivation, Wet or irrigated cultivation, Mixed farming, Dry cultivation, Dairy farming etc. Attempt has been made by different scholars to identify various types of agriculture agricultural practice all over the world. The types of agriculture in the world given by D.Whittlessey are Nomadic herding, Rudimentary sedentary tillage, Pastoral farming or Livestock ranching, Commercial plantation or Tree crop farming, Subsistence farming, Intensive subsistence farming, Mediterranean agriculture, Commercial grain farming, Arable farming etc. In India, Subsistence's farming, Shifting cultivation, Intensive farming, Commercial agriculture, Dry and Wet land farming etc are some of the types of agriculture system practiced by the people. In North east India, Shifting cultivation and Terrace cultivation are two main dominant types of agricultural activities in all the States. Even in Nagaland these two types of agricultural systems dominate the Land Use practices.

One of the common and easiest forms of agricultural activities practiced by the majority of people across the world is shifting cultivation particularly in the

tropical region such as the South East Asia. North Eastern India is also one of the regions where shifting cultivation is one of the main agricultural systems practiced by almost all the people which is considered to be one of the causing factors of deforestation and which has negative impact on the environment. Shifting cultivation is known by different name in different regions of the world and it is commonly known as Jhum cultivation in North East India and the people practicing it are called Jhumian. Nomadic herding is commonly practiced in the arid and semi-arid regions like Northern Africa, parts of Northern Eurasia and certain parts of Saudi Arabia. Nomadic herding is the practice of rearing and grazing of animals in natural pastures and they move with their animals from one place to another in search for food and water for their animals. South America, North America and Australia are some of the regions that practice commercial pastoral farming across the world. Mixed farming is mainly practiced in Europe, New Zealand and Great Britain. Countries that have developed with agriculture are China, India, USA, Indonesia, Brazil, Liberia, Somalia. Most advanced countries in agricultural development are China, Netherland, USA and Brazil. China is considered as the largest producer and importer of food and Netherland is the second largest exporter of food in the world followed by USA and Brazil. Advancement in the development of agriculture sector contributes to the national income, generate income, create employment opportunity etc.

With the increase in population and development of different technologies, there is increase in the input and output of the agricultural productivity. Agriculture still holds the key of Indian economy since it contributes about one-third to the gross domestic product and provides employment to nearly two-third of working population. The entire national economy behaves to the tune of agriculture sector

(Ranjan K.P, 2000). The destruction of forest started with the beginning of the practice of agriculture as it involves cutting down of trees and clearing of large area for cultivation where many species were lost during the clearing and burning of the area. Forest can be regained by planting trees during cultivation but the life of the loss species in that area cannot be regained.

In early days, primitive men live a simple life depending on the nature for their survival and daily activities. In those days depending on the nature with little destruction was quickly restored as there were no such pressures on the environment like in present generation. The advancement of science and technology has increased the ability of man to utilize the available natural resources and environment around them, which as a result has many impact on the environment.

With the increase in population, the dependence on agricultural products increases and with the increase of dependence on agriculture, there increase the destruction of the natural resources and environment. There are many other factors causing negative impact on the environment but agricultural activity is one of the major factors causing environmental deterioration as agricultural activities in modern days include cutting down of trees in large area destroying the forest cover, burning of the field which destroy many species living in that area, and application of the chemicals, fertilizers and pesticides in the field pollute the environment. According to the FAO statistic 2018, world total agricultural use of chemical or mineral fertilizer was 110 Mt nitrogen (N), 49 Mt phosphate (P_2O_s) and 39 Mt potash (K) in 2016 and it increases to 34 percent, 40 percent and 45 percent respectively with comparing to 2002. It is said that in India agriculture and its allied activities provide a source of livelihood to over 70% of the total population and trade in agricultural goods has played an important role in promoting economic development of our

country and the low levels of agricultural return may be attributed to obsolete technology, small size of holdings, scattered fields and inequality in ownership (Jauhri, 2005).

Environment involves everything and the sum of all these living and non-living factors makes the environment of an organism and which sustains all life on earth. The word environment is derived from French word 'Environer' or Environner meaning 'Neighborhood'. Environment is what we live on and what surround us. The quality of the environment depends on the activities of the people. Environment is the source of life on earth and it not only directs but also determines the existence, growth and development of mankind and all its activities (Saxena, 2011). There are many human activities which contribute to the pollution and environmental problem and agriculture is also one of the major factors contributing to the environmental problem. Environmental degradation, global warming, shortage of fuel and fodder are some of the important issues which have received the recent attention of the scientists, environmentalist, planners and others throughout the world. The situation is particularly alarming in arid and semi-arid areas where due to harsh environment and excess biotic activity the degradation of soil and environment are fast taking place (Gupta, 2002). All the organisms interact with the environment and the effects of one ultimately affects the others. Men are the integral part of the environment and depend on environment for his survival but with the passage of time and increase in population, different human activities have exploited environment beyond limit which as a result cause disastrous consequences which threaten the environment. Different activities effect environment directly or indirectly but among all the activities, agriculture is one of the main factors which effect environment. The impact of agricultural activities on environment depends on the agricultural system

practiced by the people in a particular area or the way they manage their agricultural system and it also depend on the cycle of cultivation. In the study area, one of the main problems which affect the environment is the practice of shifting cultivation which is practiced without taking preventive measure. Agricultural activities are the one which depend more on environment for its development and at the same time it is the one which contribute more to the deterioration of environment. Agriculture directly depends on the natural environment and agricultural activities can greatly affect the natural environment even though different measures and plans have been made at different levels to protect the environment. The changes made by the human upon the environment to suit his own requirements can cost his life.

Shifting cultivation is one of the main agricultural activities blamed for the deterioration of environmental quality since the forest cover is decreased and fertile soil are washed away from the field every year under this system of agriculture. Prasad (2009), explain the agrarian system of India and said that the largest portion of the natural resources of India consists of land and by far the largest number of its inhabitants is engaged in agriculture. The Indian economy was by and large, self-sufficient, possessing a fine balance between agriculture and Industry at the time of British arrival and at the time of independence in 1947, Indian agriculture was traditional and stagnant in every respect which was characterized by feudal land relations, primitive technology and resultant low productivity per hectare. Agriculture is a state subject according to entry 14 in List II (State List) of the Seventh Schedule to the Constitution of India.

Agriculture and environment are the two important topics of the present generation as agricultural activities and environment are the two which has great impact in the life of human on earth. In every discussion whether be in economy,

population, development or environment etc there will be a discussion for the agricultural activities as it is one of the important activities of the people which effect the life of the people, their economy and the life style of the people and most importantly it effects the environment if the activity continue beyond the capacity of a particular area or place.

With the increase of the population and improvement in life style of the people, our environment has been destroyed beyond limit through different activities where agricultural activity is considered as one of the major activities which contribute to environmental pollution. Contribution of agricultural activities in polluting the environment starts from the destruction of forest to the pollution of soil, water and loss of flora and fauna which as a result cause ecological imbalances. 'Man is a user of the environment for his developmental activities and always disrupts this natural system and creates a background for environmental degradation. When this degradation is lesser, nature recovers it by its own system of recovery, but whenever its quantity is more, it creates imbalance in nature' (Saxena, 2010). Agricultural activities are the one which depend more on the environment and again it is the one which destroy the environment. The studies and discussions about the causes and effects of the agricultural practices provide the necessary measures for the protection and improvement of the environment.

1.2 History of Agriculture

Agriculture is also known as farming which produce food, fibre and other products by growing different plants and animals. Agriculture is believed to be invented by human during the Neolithic era or the New Stone Age which occur between 7000 and 10000 years ago. The origin of farming traced by Archaeologists

and palaeontologists says that the farming starts around 10,000 years ago. The origin of agriculture has been explained by different scholars with different views. Agriculture is adopted at first on a small scale as an adjunct to chase or herding. It tends therefore to partake of the same extensive and nomadic character as these other methods of gaining subsistence and only gradually becomes sedentary and intensive (Semple. 2009). Dhillon (1992), explain the origin and development of agriculture. He said that from antiquity to the present times, plants, animals and men have remained in an intimately linked position by a complicated web of inter-connections, but still the problem of how, where and when agriculture originated and developed has posed an intelligent challenge to all of us. He also said that different scholars hold different views about the time and place of origin of agriculture. According to him agriculture has a history several thousand years old, but technical changes were remarkably slow until the middle of the 19th century. As today, man in the past was heavily dependent upon the characteristics of his natural environment which especially comprised soil and the attendant flora and fauna of his time. The origin of agriculture explained by Hancock (2004) stated that Human did not start farming until about 12,000 years ago and domesticated plants and animals did not become the major source of food until the last few thousand years. He explains that most of the evidences indicate that human being first began farming in the hills above the Tigris River on the western edge of what is now Iran. Agriculture began independently in different parts of the globe and at least eleven separate regions of the old and new world were involved as independent centres of origin. Wild grains were gathered over 105,000 years ago and people began planting grains about 11,500 years ago prior to their domestication and the first domestication of sheep, pigs and cattle started more than 10,000 years ago. Farming was entrenched on the banks of Nile by 8000 BC and agriculture was developed independently in the far East probably in

China. It is also said that the Zagros mountain range which lie at the border between Iran and Iraq was home to some of the world's earliest farmers.

1.3 Literature Review

Bagchi (2008), said that agriculture is the backbone of the economy of the North eastern states of India in terms of employment and its share in the net state domestic product (NSDP). Although the share of agriculture in NSDP is declining gradually, but in terms of employment it is still a dominant sector. This mean that per capita income of the population engaged in the agricultural sector is lower than that of the non agricultural sector. As far as the agricultural development of North-Eastern state is concerned, the most remarkable aspect is that, there is a huge gap between the potentiality and actual achievement. Whether it is the yield rates of various crops or the use of more productive inputs or diversification of agricultural activities- much remains to be achieved. Baishya (2012), while emphasizing on the economy of Nagaland stated that the economy of North eastern states is mainly rural and agrarian where the region offers scope for cultivation of a wide variety of agricultural crops because of its diversities in topography, altitude and climatic condition. He stated that inspite of agriculture being the main occupation of the people of Nagaland they have to import food items from other states and said that it is due to the fact that people followed unsustainable agricultural practices such as jhumming method which has hampered the growth of the economy in Nagaland. Barik (2007), shifting cultivation, an indigenously evolved age-old system, is sustainable if population pressure is low and length of intervening period between two successive cropping on the same site is longer than a period of 10 years. Much of the changes in shifting cultivation in recent times are oriented towards introduction of cash crops and horticultural crops so as to improve economic

efficiency of this centuries-old subsistence's agricultural system. Bhagabati (2008), said that deforestation may have far reaching environmental implications. It triggers bio-physical degradation of land in addition to alteration of regional drainage and water cycles. The changing pattern of rainfalls, sedimentation of rivers, incidence of landslides and gullying experienced by various parts of the North east may partly be attributed to the extent and intensity of deforestation. Buchi (1997), while explaining the impact of shifting cultivation on forest eco-system said that shifting cultivation is wasteful and low productive value which has devastating effects as it causes springs below the hills to dry up, degrades the forest area, wash away fertile soil land, ruins valuable timber and other forest resources.

Chakrabarti (2003), while emphasizing on the agrarian relations of tribal's stated that the question of agrarian transformation in North east India is very important because of the traditional control over land on the one hand and the increasing pressure of modern techno-economic inputs of land utilization, on the other. Changkija et al. (2012), Nagaland is particularly rich in biological species, genetic diversity with high endemism. Several groups of plants like orchids, rhododendrons, ferns, bamboos, Zingibers and lichens have shown maximum diversity in this state. Nagaland as a part of eastern Himalayas is considered as one of the centres of origin of rice and secondary centre for origin of citrus, chilli and maize. The state is known to possess a great treasure of medicinal plants, orchids, bamboo, cane, bryophytes, and lichens with its rich faunal elements. However, the rich biodiversity of this state is being impoverished disastrously along with the overall degradation of mountainous environment due to human activities in the last few decades. Chattopadhyay and Trivandrum (2015), emphasized the role of human being in changing the earth surface. They said that people not only form part of the

ecosystem but are also continuously engaged to deliberately alter the environment. In the course of shaping and reshaping the nature, humankind continues to superimpose an anthropogenic landscape on the natural landscape. Role of human being as free thinking entity, capable of taking independent decision and creator of built-in environment by modifying the existing system and contributing to the process governing geo-system is well recognized as human are major driver of climate change, deforestation, biodiversity loss and alteration of biogeochemical cycle. Chaku (1992), said that the ecology is a function of various variables accompanying the behavior of all sorts of organisms, their habitat and their relationship. The land, water, air and energy are the key elements which influence the habitats of human beings. He also stated that the quality of environment of any place on the earth is always conditioned by the utilization and management of these elements.

Dhar (2002), shifting or Jhum cultivation has been maintaining a relatively high status in the minds of tribal people of Eastern Region due to their traditional bound approach, intimacy and belief in it. The major advantage of shifting cultivation to the hill people is that it provides a very easy method for the preparation of land for cultivation, where there is no danger from either flood or drought. He also discussed about the bad effects of shifting cultivation which cause soil erosion, deforestation, absence of soil conservation measures, National waste and environmental imbalance. Deori (2005), stated that in many part of the world the interest of shifting cultivation and those concerned with the exploitation of forest and preservation of forest are antagonistic and colonial governments as well as the new states of the third world have tended to stabilized mobile agricultural population resources. He also said that the practice of shifting cultivation was not harmful but was rather useful during the time when it was started.

Gopalkrishanan (2000), said that Jhum cultivation also highlighted a close interrelationship between forest and agriculture. It exerted sizeable influence on the nature of socio-economic institutions. He also mentioned that inspite of the efforts to introduce modern techniques in the jhum agriculture by supplying improved seeds and chemical fertilizers, plant protection measures such as pesticides and insecticides and better irrigation facilities, improved techniques of production and so on, there has not been appreciable improvement in production and productivity. Gupta (2002), stated that jhumming was the only economic occupation of almost all the tribal of the region and it provided them with their requirements. However jhum cultivation has lost its past status among the jhumians of the north east. He said that at present, jhumming does not satisfy their needs as it did in the past. At best, it satisfies their requirements of food for only three to four months in a year. Jhumming can be made productive by introducing new strains of high-yeilding jhum crops, introducing new inputs in jhumming, ensuring that the jhum fields do not have to be abandoned after every harvest and can be cultivated repeatedly without any loss of productivity and minimising pre and post harvest crop losses. Glaeser (1995), giving consideration to environmental compatibility is understood to mean the preservation of the ecological basis needed for the economic process. Within the context of agriculture, which is now as before the most important production sector, this includes prevention of erosion and maintaining soil fertility. Soil, as the most important agriculture resource, must not be overworked or overexploited. Rather, the system of agriculture and its immanent natural processes must be dealt with as an agro-ecosystem.

Jauhri (2005), Agriculture occupies an important position in the Indian economy. He said that the rapid economic development of any State or region without the development of its agriculture is almost impossible. Agricultural output

in India determines not only the per capita income of farm sector but it also influences the standard of living of rural population and the nutritional standard of the poor masses. He also said that the adverse effect of heavy dose of chemical fertilizers out of the agricultural development where the degraded environment contributes to stress and ill-health. Jain (1988), stated that the area cropped more than once or double cropped area is effected by extent of irrigation facilitates, favorable rainfall, moisture retentive capacity and productivity of soils, nature of crops, attitude of farmers, size of holding and facilities of infra-structure etc. Jha (1997), Shifting cultivation has been rightly held responsible for crippling the economy of the people of north eastern region and therefore has attracted the attention of planners and administrators in the past, although without much success. The reason behind this being that most of the studies so far made on shifting cultivation mainly confined to anthropological and social aspects of the problem. He concluded that we should search for technology that will conform to traditional farming system having ability to tackle the socio-cultural and bio-physical problems of shifting cultivators. Jha (1999), explained the vital functions of forest by each letter of the word forest. He said that forest hold a big promise of promotion of some very important externalities such as soil and water conservation, flood control, pollution abatement, prevention of silting of dams and reservoirs, improvement of environment, habitat for flora and fauna, increase of recreational, aesthetic and wilderness values on which depend the future and survival of mankind. He also stated that replacing the earth's nine major ecosystems with subsidized solar powered ecosystem like agriculture and aquaculture is leading to a gradual shrinking of natural ecosystem as reflected in extinction of as many as 300 species of wild animals and birds from our planet. The problems caused by encroachments are probably worse than those caused by clearing of forests for agriculture, on scientific

line. This is perhaps the greatest single factor contributing to the depletion of forests. He suggested that to discourage environmentally negative activities and to encourage environmentally positive activities are the only two ways to avert major biospheric crisis. Jha (2005), stated that demographic growth is seen to create the condition necessary for the adaptation of progressively more intensive method of cultivation. Population pressure is then the cause and not the consequence of agricultural innovation. With increase in population farmers are forced to use new techniques, which by virtue of increased input allow for greater production per unit of land. He also stated that the very backwardness of agriculture in developing countries is the factor for food crisis in these countries. He also mentioned the fact that agricultural technology in developing countries has become highly labour intensive. While now in developed countries it has become extremely labour saving. Johnson (1984), reviewed the major trends in world food production, trade and prices for the past several decades and indicate how future trends are likely to be related to the past trends. He said that during the past two decades there were two occasions when fears were expressed that world food supplies would be insufficient to prevent wide-scale suffering and loss of life. Prospective development in world food supply and demand continue to be of great importance in a world in which almost half of the population lives in countries that had less than $420 gross national product per capita in 1980.

Kant (2005), the change in cropping pattern broadly reflects the change in the relative profit expectations of the alternative crops at different points of time. Kaur (1991), stated that agriculture being an open activity is influenced more by natural forces than any other economic activity on the earth. However, man is not passive in a given environmental set up. With the available technology and other resource at his command, he reacts to the surrounding natural forces and tries to utilize them for his

benefits. He also mentioned that distance affects the location of agriculture to a great extent, not only in the surroundings of a city or a town but also around individual village settlements. Krishna (2010), explained about agriculture revolution in which about 4500 BC people harnessed oxen to plough to add power to agriculture. The next stage was irrigation: taking water from distance sources by canals to dry places. Modern power for ploughing and threshing increased the yield enormously and with these farmers started exploiting nature to the fullest possible extent. He also mentioned that in 1960's plant breeders produced varieties of rice, wheat and maize that have increased food production all over the world but the main problem with these is that they need extensive use of fertilizers and pesticides, which are very expensive to purchase and more than that they cause an extensive permanent damage to the land and overall well-being of the people. Kumar et al. (2012), 'The ground water of semi-arid areas is typical with problem of high salt concentration that adversely affects the crop growth. Such water is continuously in use for agriculture depending on the extent of hazardous constituents. They also concluded that salt concentration in irrigation water reduced significantly the herb yield, oil content and oil yield of lemon grass. Saline water also decreased the phosphorus, potassium, calcium and magnesium contents and increased the nitrogen and sodium contents. Nutrient uptake is decreased by water salinity and increased by nitrogen application'.

Lekhi and Joginder (1996), cropping pattern refers to the proportion of area under different crops at a point of time. A change in the cropping pattern means a change in the proportion of area under different crops. They also said that cropping pattern in India is determined by natural forces like climate, soil conditions and rainfall etc. Although, the impact of green revolution is unevenly low it has led to new pattern. Longchar (1995), stated that the new technologies have brought

imbalances not only to human community, but also to the whole of creation. Ecologically, the earth is one. He said that all eco-spheres are inseparably inter-related. Every individual organism is inter-linked with each other and is interdependent. But today the land, animal, forest, air, water and fire that sustain human existence are in serious jeopardy. Mahanta (2008), said that highland soil became prone to erosion once the virgin forest cover is removed. Plantation of seasonal crops like pineapple, ginger, potato or even semi-perennial crops like coffee or citrus trees can hardly keep the top soil intact. Mishra and Mishra (2015), Agriculture is the most important constituent of man's primary occupations and forms the first vital link of human interaction with environment.

Neog (2006), said that agricultural development is basically a function of six elements and explain the 6 'I's i.e (i). Institution (including land tenure, R&D, training, marketing, credit, stock exchanges in agricultural goods etc), (ii) Infrastructure (including power, irrigation, cold storage, transport etc), (iii) Investement, (iv) Inputs (seeds, fertilizers etc), (v) Incentive, (vi) Information (on technology, prices, costs, quality etc). Orlovsky et al. (2001), mentioned that the main trend in agricultural development for the intensification of production involves not only the introduction of irrigation and drainage, but also the application of fertilizers, herbicides, insecticides, fungicides and other chemicals.

Pandey (1994), while discussing about agriculture development of North east stated that north eastern region is one of the richest regions in the country. Economically it is one of the most backward regions. Its backwardness also reflect on its dependence on primitive types of agriculture practices of shifting cultivation, which besides being primitive method of cultivation is also considered uneconomical. Pirazizy (1992), Environment is a dynamic open system, always in

the process of change, irrespective of place of prevalence. The physical environment, comprising of soil cover, flora and fauna have evolved in absence of man, meaning that either the impact of man on their rate of evolution had been nil, or processes of their evolution dates much beyond the appearance of human species on the scene. Prasad (2000), Forest vegetation and its accompanying soil organism make up as much as 90% of the total biomass on land. Due to deforestation, the stability of many ecological sub-systems has been greatly disturbed. He stated that every species plays an important role in maintaining an ecological balance among the living systems of the earth and these systems must continue to function if life is to survive. Loss of any species threatens the survival of several species inclusive of man.

Rao et al. (2007), stated that shifting cultivation imposes a complex combination of disturbances involving cutting, burning and various other perturbations associated with cropping/harvesting. The viability of this land use depends upon the magnitude of recovery in ecosystem structure and function during fallow phase. Soil fertility and weed potential have been considered to be the most critical aspects in agricultural management. Ray (2007), mentioned that agricultural growth has resulted in a variety of environmental degradations of soils, water, air and biodiversity. The use of chemical inputs and abandonment of traditional practices built over several millennia, and the continuous flogging of land has caused suffering in the prosperous regions and there is despair all around. On the other hand, neglected regions pay heavily for not nurturing their natural resources. Drought and drainage problems bedeviled their lands and assets. Poverty as well as profit motives have led to the degradation of forests. Ranjan (2000), stated that during the post-green revolution period, area under major cereal crops would ordinarily be changing substantially from year to year. The major technological improvement in agriculture

sector is accompanied by an upward trend, both in its area and yield. Factor promoting growths of agriculture are usually the factors, brining about change in crop composition of agriculture. He also mention that, in the absence of irrigation, impact of drought on agricultural output especially on food grains, tends to be more in low rainfall regions.

Rizvi and Roy (2006), Nagaland remains basically governed by an agricultural economy where 90 per cent of the population depends on produce of their fields for livelihood. Heavy rainfall facilitates intensive agricultural activities. The improvised technique of terrace cultivation made it possible to cultivate food crops on the steep mountains slopes. The government is making efforts to establish permanent terraced fields with irrigation channels and popularise permanent cultivation and modern farming. They also stated that slash and burn method of cultivation as practiced by Naga involved immense labour and necessitated the destruction of forests. It not only depends entirely on rainfall but also causes severe land erosion. The agriculture department has intensified various programmes like land reclamation, irrigation, plant protection, supply of improved quality seeds, fertilisers and training to give maximum benefit to farmers.

Rokde et al. (2015), landuse/landcover pattern of a region gives information about the natural and socio-economic factors, human livelihood and development. Roy (2002), shifting cultivation is the simplest method available to the tribal population living in the hilly region. There is no other alternative way of cultivating the land in the hill areas. The shifting cultivation is the natural way of life to the tribal people in the hill areas. He also mentioned that the major advantage of the shifting cultivation to the hill people is that it provides a very easy method for preparing land for cultivation. He also said that the most important evil effect of

shifting cultivation is that destruction of forest in the hill area causes heavy soil erosion due to rainfall. Another most important effect of the shifting cultivation is that it leads to environmental degradation and disturb the fragile ecosystem of the north eastern region. Ramachandra (2006), in his book 'soil and groundwater pollution from agricultural activities' discussed about the impact of agricultural activities on environment and stated that environment pollution is a major concern all over the world where agriculture is listed as a major contributor by deterioration in soil and land quality through the release of several pollutants such as pesticides, animal manure, fertilizers, sediments (due to siltation) and other source of organic and inorganic matter.

Sachdeva (2000), Agriculture with allied activities is the main stay of the North east economy. Despite a large geographical area, the land available for cultivation is limited. He also explained that Jhum cultivation continues to be a major agricultural practice adding to soil erosion and destruction of forests and how the economy of the North east region is mainly agricultural and the present practice of slash and burn (Jhum) cultivation in many of the hilly areas and single crop traditional agriculture in the plains are not conducive to growth. The industrial sector is weak and state sponsored industrialisation has failed to take off. Saikia (2008), Shifting cultivation as practiced in Northeast India, can be used in a modified manner to reap benefits, although this practice is frequently and perhaps not always justifiably blamed for forest loss. Sedjo and Clawson (1984), emphasized on the importance of forest in the world and said that some deforestation may be necessary to best meet the full range of social, environmental and developmental goals. Forest land clearing always involves substantial ecological changes in the area and when the soil surface is exposed to sunlight, it has direct impact of the changes in soil

temperature, microbiology and nutrients. Sharma and Coutinho (1998), said that Agriculture, the most important primary economic activity, is closely related to physical environments, particularly relief, climate and soils. In any 'scientific, viable inquiry into agricultural phenomena', therefore, it is prerequisite 'to pay attention to the basic relationships between these physical determinants and agriculture and scholars since long have been attracted to the problem of explaining how variation in environment affected agricultural landscape. They also stated that man has shown great ingenuity and skill in modifying physical environment not only to raise crops and livestock but also to accelerate their output by using a variety of inputs and practices. The changes in the occupancy of the individual crops can be summed up in the total volume of change, which in turn can serve as an important indicator of the degree of dynamism an areal unit has experienced during a giving period.

Sudarsha and Sinah (1996), said that the human intervention in the ecosystem and reckless exploitation of nature poses real dangers of snapping this delicate relations. The life of one form is closely linked with the life of another form. Singh (2010) argued that due to scarcity of ecosystem specific improved varieties, the rate of adoption of modern varieties has been moderately low and thereby the low productivity. He said that the maximum increase in rice production and productivity has occurred due to three factors i.e high yield variety, fertilizers and irrigation facility. He also mentioned that the serious negative effects of mono-cultural cropping pattern promoted by the green revolution technology has been the loss of soil fertility and productivity, undermining long-term sustainability of yield growth. Singh et al. (1987), said that climate is one of the most important factors which influence the activities of man, natural vegetation and soil etc. they also stated that among the climatic factors temperature and rainfall are the most important. Singh

and Gurjar (2011), emphasized on climate change and said that climate change is emerging as threat to the world population, bigger than any war or natural calamity. The vulnerability differs with income level, state of environment and their relationship with the natural resources. The most vulnerable group includes poor and tribal people who are totally and are directly dependent on natural resources. The vulnerability goes on increasing with depletion of these resources. Singh and Srivastava (2006), while emphasizing on the tribal land alienation stated that tribal economy has traditionally centred on land and other land based resources. They stated that about 11 million hectares of land is believed to be under swidden cultivation or jhum cultivation done by over 4 lakh tribal families.

Thakur (2005), the process of agricultural development in India is essentially a process of transformation from traditionally oriented subsistence agriculture with productivity, to a modernized commercial agriculture with high productivity. It is, therefore, necessary to consider the elements involved in the transformation process, if we want to identify strategies and priorities in agricultural development. Thakur et al. (2016), Human agency initially began to dominate the landscape through the infusion of externally technology and development programmes that sought to integrate such peripheral marginalized area. Tiwari (2007), stated that shifting agriculture system varies tremendously in term of intensity of fire, soil fertility management practices, legal status of land, crop composition and the goal of this land use envisaged by the farmers. He explained the four typology of shifting agriculture practiced in North eastern region of India namely traditional agriculture, distorted shifting agriculture, innovate shifting agriculture and Modified shifting agriculture.

Over exploitation of natural resources to satisfy the human needs for food, fiber and shelter, and the excessive production of emissions and waste are threatening the earth ecosystem. With a steady growing population and achieving food security for all by 2020 will be of major importance and a major challenge (Herren, 1998).

The success of the green revolution in India is largely attributed to the expansion of irrigation network that existed in the country. However, over-exploitation of ground water has resulted in declining water table in some areas while in many of the canal command areas there has been a large scale development of water logging and salinity (Khepar and Sondhi, 1998). Availability of food to the poor is still one of the world's most pressing problems, as nearly 40 percent of its population subsists on amounts of food below their nutritional requirements. Hunger and malnutrition abound in nations which do not efficiently utilize their land and water resources (Pathak and Mishra, 1998). The fast growth rate of urban population has resulted in the expansion of cities at the cost of rural and agricultural land and due to the absence of buffer plantation between industrial and residential areas, the imbalances has been caused in the ecological system (Deol et al. 1998). Alayddin and Tisdell (1998), explained that the new agricultural technology has had several other environmental spillover which include the decline in natural soil fertility due to inappropriate application of chemical fertilizers which are required in greater quantities to maintain crop yields and also the continuous application of pesticides has met with the development of resistance where the increased use of chemical agents has depleted the frog/toad population.

1.4 Importance of the study

Agricultural activities are the major source of economic activities around the world and the development of agriculture depend on environment. But at the same time agricultural activities are the major factors contributing to the deterioration of environment. Agriculture occupies an important position in the economy of a country. The rapid economic development of any state or region without the development of its agriculture is almost impossible. Agricultural output in India determines not only the per capita income of farm sector but it also influences the standard of living of rural population and the nutritional standard of the poor masses. The adverse effect of heavy dose of chemical fertilizers out of the agricultural development is where the degraded environment contributes to stress and ill health (Jauhri, 2005). Nagaland is particularly rich in biological species, genetic diversity with high endemism. Several groups of plants like orchids, rhododendrons, ferns, bamboos, zingibers and lichens have shown maximum diversity in this state. Nagaland as a part of eastern Himalayas is considered as one of the centers of origin of rice and secondary centre for origin of citrus, chilly and maize. The state is known to possess a great treasure of medicinal plants, orchids, bamboo, cane, bryophytes, and lichens with its rich faunal elements. However, the rich biodiversity of this state is being impoverished disastrously along with the overall degradation of mountainous environment due to human activities in the last few decades (Changkija et al. 2012).

Agriculture is the main economic activity in the district and majority of the people practice shifting cultivation which is considered to be a threat to the environment. The main stay of shifting cultivation as an agricultural practice in the study area is because the area is hilly which compels the farmers to go for this type

of agricultural practice and it is also one of the easiest forms of agricultural practice with less investments besides being closely interwoven with the social and cultural life._Shifting or jhum cultivation has been maintaining a relatively high status in the minds of tribal people of Eastern Region of India due to their traditional bound approach, intimacy and belief in it. The major advantage of shifting cultivation to the hill people is that it provides a very easy method for the preparation of land for cultivation, where there is no danger from either flood or drought. On the other hand the bad effects of shifting cultivation are which cause soil erosion, deforestation, absence of soil conservation measure, waste and environmental imbalance (Dhar, 2002).

The practice of shifting cultivation effects the environment directly or indirectly. This agricultural practice leads to the decrease of forest cover, loss of flora and fauna, reduce in the perennial river, degrade the soil quality etc in the study area. The western part of the district which is dominated by the practice of shifting cultivation have less forest cover, receive less rainfall, more soil acidity and more hotter in temperature compared to the eastern counterpart with less practice of shifting cultivation. The direct impact of the practice of shifting cultivation in the study area are soil erosion, decrease of forest cover and indirectly it can slowly effect the environment by reducing rainfall, causing ecological imbalance etc. Shifting cultivation faces huge obstacles both from development and policy making. The farmers have been given little space for support and for innovation within their cultivations and yet the attempts to completely change this system and replace it with entirely different agricultural and horticultural systems have mostly been unsuccessful. Though Zunheboto District is connected by roads to every village but many infrastructure facilities like surfaced roads, training facilities, marketing facilities, storage facilities etc are still lacking in most of the study area. There are

many factors which contribute to the negative impact on environment. With the increase in population the agricultural activities also increases which become a major source of contribution to the negative environmental impact. The present work is an attempt to study the Impact of agricultural activities on environment in Zunheboto District. Increase in agricultural activities has great impact on the environment leading to deforestation, soil degradation, climatic change etc. The study focuses in examining the different methods or activities that are carried out in agriculture and to identify how agricultural practices lead to environmental deterioration in the study area. The outcome of the study will benefit the academicians, scholars, policy makers etc. as the protection or improvement of environment and agricultural development are the two important concerns for the present generation.

1.5 Objectives

The objectives of the research study are as follows.

1. To study the agricultural system and pattern.
2. To examine the agriculture activities with reference to cropping patterns, and agricultural techniques.
3. To study the agricultural activities and its impact on environment.
4. To examine the factor promoting and hindering for agricultural development in the study area.

1.6 Data base and Methodology

The following methods are adopted for the study.

1. **Pre-field work phase:** Relevant data on physical and socio-cultural are gathered from the topographical sheets, satellite imageries, statistical data, etc.

2. **Primary data:** In this phase data are collected through personal interviews, questionnaires, discussion with the farmers, field survey, telephonic inquiry and field observation.

3. **Secondary data:** The secondary source of data are collected from various published books, official documents, newspaper, research report, relevant literature, journals, magazine, survey conducted by the various organizations, census report, internet etc.

4. **Laboratory work:** Digitization work are done from Arc GIS and Landsat 5 and Landsat 8 data from USGS are used for the time series analysis. Data for the months of March-April are used except for 2005 due to non-availability. Shifting cultivation areas are delineated employing on screen visual interpretation for each year starting from the 1997 onwards. The same shape file is again used for updating the attributes and the polygons based on succeeding years' satellite data. The polygons of different years are checked for Jhum attributes in between any two year starting from the largest combination year (eg 1997 and 2017) till shorter combination years (eg. 2013 and 2017) for all the study year. The polygons selected within each overlapped years are allotted a Jhum cycle year corresponding to that year difference. Thus Jhum cycle ranging from 4 years to 20 years polygons are identified.

5. Data analytical works are initiated for explanation and cartographic purposes.

1.7 Chapter Outline

'Impact of agricultural activities on environment in Zunheboto District, Nagaland'

The study is divided into six chapters.

Chapter 1- The first chapter is the introductory chapter which discusses the importance of the study, literature review, objectives of the study, data base and methodology and chapterization.

Chapter 2- Second chapter is about the physical framework of the study area which discusses about the history of the study area, origin of the Sumi tribe, their culture, population, road connectivity, Tourist destinations in the district, geomorphology and soil, geology, relief, drainage system flora and fauna etc.

Chapter 3- Third chapter deals about the agricultural system in Zunheboto District. This chapter studies the type of agricultural activities in the district, the area and production of different crops, the yearly festivals associated with agricultural activities, details about the town and villages involved in different agricultural activities, traditional implements used by the people, cropping pattern, and cultural activities.

Chapter 4- Fourth chapter deals with the theme of the study - the impact of agricultural activities on environment in Zunheboto district. This chapter is a detailed analysis of the different factors contributing to the destruction of environment including human activities. Dynamic of shifting cultivation for the last two decades and soil reactions in the district have also been discussed in detail with maps.

Chapter 5- Fifth chapter is about determinant of agricultural development along with the factors hindering and promoting agricultural development. This chapter also deals about the different plans and programmes done by the government for the

improvement of agricultural development and the vision 2025 by the state government.

Chapter 6- The last chapter is the summary and conclusion with major findings and suggestions.

References

Alauddin Mohammad and Tisdell Clement Allan (1998), *The environment and economic development in south asia – an overview concentrating on Bangladesh*, The Ipswich book company Ltd, Ipswich, Suffolk. Pp. 93

Bagchi K.K (2008), *Agricutural development in North-East India- issues and options*, Abhijeet publication. Pp xiii

Baishya P (2012), *Economy of Nagaland in Transition- a case study on infrastructure facilities*, Global publishing house (India). Pp 205-207

Barik S.K (2007), Spatial and temporal variations in shifting cultivation in north-east India: Is sustainable land use possible with Jhum around?, In: Saxena, K.G. Liang Luohui and Rerkasen Kanok, (eds.) *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood*, bishen Singh mahendra Singh. Pp 53-54

Buchi K Nana (1997), Shifting cultivation and its impact on forest eco-system, (eds.) Mohapatra P.M and Mohapatro P.C, *Forest management in tribal areas- forest policy and peoples participation* (Procedding of the seminar, forest policy and tribal development during 15-16 february 1994 at koraput), Concept publishing company. Pp.92-95

Bhagabati Kumar Abani (2008), environmental problems in Indias Northeast: some obervistions, (eds.) Sujit deka, *Northeast India Geo-environmental issues*, EBH Publishers, India. Pp 130

Chakrabarti B. S (2003), Agrarian relations in the tribal Milieu, (eds.) Subba B. T and Ghosh G.C, The anthropology of North-east India, Orient Longman private limited. Pp 252

Changkija Sapu, Rongsensashi and Mozhui Renchumi (2012), Threatened plants of Nagaland (eds.) R.C. Gupta in *Nagaland University Research communication*, Manas Saikia for Cambridge University press India Pvt.Ltd. pp 127

Chattopadhyay Srikumar and Trivandrum (2015), Human dimension of environmental change with special references to water system and river resdtoration, *Transactions*, Vol. 37, No.2. Pp 155- 159

Chaku (1992), Need to save environment and ecosystem of Siwaliks of Jammu Region, (eds.) Rai R.K, Mohapatra A.C, Goel N.P, *Environmental Management*, Vol. II, Socio-economic facets, Rawat publication. Pp. 113

Dhar P.K (2002), Status of jhum cultivation in the North Eastern Region and strategy to changge such status, (fourth conference of the north eastern economic association) proceeding volume, *agricultural transition in the hill areas of the north eastern region*, published by B. Syiem. Pp 18

Deori Pushpanjoli (2005), *Environmental history of Naga hills*- 1881-1947, Anshah publishing house. Pp 41-42

Deol Sukhraj, Kumar Ramesh, Dhaliwal G.S and Sangha G.S (1998), Impact of changing land use pattern on environmental degradation, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development*, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development, November 15-17, 1997 chandigarh,

India, Indian Ecological Society and Centre for research in rural and industrial development. Pp. 233-234

Dhillon S.S (1992), Origin and development of agriculture, (eds.) Mohammad Noor, *New dimension in agricultural geography- Historical dimensions of agriculture*, Vol.1, Concept publishing company, New delhi. Pp. 97

Gopalkrishanan. R (2000), *Assam, land and people*, Omsons publications. Pp 116

Gupta Das Malabika (2002), Status of Jhum cultivation in the North East, (fourth conference of the north eastern economic association) proceeding volume, *agricultural transition in the hill areas of the north eastern region*, published by B. Syiem. Pp 1, 7

Gupta J.P, 2002, Future and prospects of agroforestry in 2000 A.D for the Arid Tropics, (eds.) Khan. M.A, *Watershed management for sustainable agriculture*, Updesh Purohit for Agrobios (India). Pp. 75

Glaeser Bernhard (1995), *Environment, Development, Agriculture- integrated policy through human ecology*, ULC Press Limited. Pp 51

Hancock J.F (2004), *Plant evolution and the origin of crop species* (second edition), CABI publishing. Pp 129,144

Herren R Hans (1998), Global environmental and food security: Importance of arthropod diversity, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development*, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development. Pp. 32

http://en.m.wilipedia.org/wiki/history_of_agriculture

https://www.environmentalscience.org/history-agriculture

https://geography-revision.co.ul/gcse/agriculture/types-of-agricultural-activity/

http://www.afterschoolafrica.com/47413/top-seven-countries-that-developed-with-agriculture

Jauhri P.K (2005), *Encyclopedia of resource geography*, Vol-2, Anmol publication Pvt. Ltd. Pp. 253-258

Jain C.K (1988), *Pattern of Agricultural development in Madhya Pradesh*. Northern book centre, New Delhi. Pp 102-103

Jha L.K (1997), *Shifting cultivation*, APH Publishing Corporation, Pp. 110-113

Jha Kumar Ramesh (1999), *Deforestation and village life*, Naurang Rai for Mittal publications. Pp 4-7

Jha Jaykar (2005), Biotechnology and sustainable agriculture, (eds.) Thakur Bakeshwar, Sinha V.N.P, Sharma. N, Pratap Rana, Mandal R.B, Singh R.B.P, *Urban and regional development in India*, vol.1, concept publishing company, New delhi-110059. Pp 544-546

Jhonson D. Gale (1984), World Food and Agriculture, (eds.) Simon Julian L and Kahn Herman, *The resourceful Earth- a respond to Global 2000*, Basil Blackwell. Pp67

Kant Surya (2005), Agricultural development in Himachal pradesh, (eds.) Thakur Bakeshwar, Sinha V.N.P, Sharma. N, Pratap Rana, Mandal R.B, Singh R.B.P, *Urban*

and regional development in India, vol.1, concept publishing company, New delhi-110059. Pp 441

Krishna Murali KVSG (2010), *The book of environmental studies*, Savera publishing house. Pp 69

Khepar S.D and Sondhi S.K (1998),Water management strategies for sustainable irrigated agriculture, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development*, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development. Pp. 133

Kumar Rajesh, Sharma. K.Y, Pal. B (2012), Effect of saline water irrigation and nitrogen on yield and chemical composition of lemon grass and salt balance of sandy loam soil, (eds.) R.C. Gupta in *Nagaland University Research communication*, Manas Saikia for Cambridge University press India Pvt.Ltd. pp 119, 126

Lekhi K R and Singh Joginder (1996), *Agricultural economic- an Indian perspective*, Kalyani publishers. Pp III/51

Longchar Wati A (1995), *The Traditional tribal worldview and modernity- focus on North East India*, N. Limala Lkr Eastern Theological College, Jorhat, Assam. Pp 115

Mahanta K.C (2008), *NorthEast India- The horizon of anthropology*, Kalpaz publication. Pp 299

Mishra .N.B and Mishra Pankaj (2015), Agricultural land resource utilization in Trans-yamuna Region in Allahabad District, Uttar Pradesh, *The Deccan geographer*,

Vol 53, No 1, June 2015 (peer review refreed journal), the Deccan geographical society, India. Pp 99-100

Neog A.K(2006), WTO and agricultural development in backward regions, (eds.) Basu Debadhis, Kulirani Francis B, Ray Datta B, *Agricultural food security nutrition and health in Northeast India*, A mittal publications. Pp 11

Orlovsky Nicolai, Glantz Michael and Orlovsky Leah (2001), Irrigation and land degradation in the Aral Sea Basin, (eds.) Breckle S W, Veste M and Wucherer W, *Sustainable land use in deserts*, Publication in part funded by UNESCO, UNCCO and BMBF. Pp 20

Pandey C.M (1994), Agriculture development in the north-Eastern Region science Independence. In: Bhattacharjee B. J. (eds.) *Studies in the economy history of North east India*, Har-anand publications. Pp 305

Pathak M.D and Mishra R.P (1998), Environment and farmer friendly technology for reclamation of waste and marginal lands, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development*, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development. Pp. 224

Prasad N S (2000), *Environment biology*, Campus books international. Pp 157,

Prasad Chandra Shekhar (2009), *Agriculture and rural development in India since 1947*, New century publication. Pp. 3

Pirazizy A. A (1992), *Environmental geography and Natural Hazards*, Concept publishing company, Concept international series in environment-1, General Editor, Paliwal K.V. Pp 21

Ramachandra T.V (2006), *Soil and ground water pollution from agricultural activities*, Capital publishing company. Pp. 1

Ranjan K.P (2000), *Agricultural growth and economic stability- case study of North Bihar*, Rawat Publication, Jaipur and New Delhi. Pp. 11, 15 47

Rizvi M.H.S and Roy Shibani (2006), *Naga tribes of North east India*, B.R.Publishing corporation (A division of BRPC India Ltd). Pp 98-99

Rokde Jyoti, Daripa Amrita and Chaturvedi Arun (2015), Dynamic of land cover/ land use change in Salekasa Tahsil in Gondia district, Maharastra state, T*he Deccan geographer*, Vol 53, No 2, December 2015 (peer review refreed journal), the deccan geographical society, India. Pp 31-32

Roy Niranjan (2002), shifting cultivation in the north eastern region: a concern for sustainabiltiy, (fourth conference of the north eastern economic association) proceeding volume, *agricultural transition in the hill areas of the north eastern region*, published by B. Syiem. Pp 28-29

Roa K.S, Maikhuri R.K and Saxena K.G, Restoration of degraded forest lands in north-east India. In: Saxena, K.G. Liang Luohui and Rerkasen Kanok. (eds.) *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood*, Bishen Singh mahendra Singh. Pp 376, 378

Saikia Anup (2008), Forest fragmentation in Northeast India, (eds.) Sujit deka, *Northeast India Geo-environmental issues*, EBH Publishers, India. Pp 234

Saxena H.M (2011), *Environment geography*, Rawat publication. Pp 1-3

Saxena H.M (2010), *Environmnetal management* (second edition), Rawat publication. Pp 51

Sedjo A Roger and Clawson Marion (1984), Global forests, (eds.) Simon L Julian and Kahn Herman, *The resourceful earth-a response to Global 2000*, Basil Blackwell. Pp. 128-129

Semple C Ellen (2009), *Environmental geography- influences on man on the basis of Ratzel's system,* Dominant publisher and distributors, New Delhi. Pp 67

Sudarsha Cherry K and Sinah K R (1996), *Ecological restoration and global politics*, Commonwealth publishers. Pp 4

Sachdeba Gulshan (2000), *Economy of the North east- policy, present conditions and future possibilities*, Konark publisher Pvt Ltd. Pp 22, 25, 57

Sharma C T and Coutinho O (1989), *Green Revolution Gap- A Geographical analysis*, Rawat publications. Pp 110

Singh A K, Kumra V.K, Singh J, (1987), *Forest resource, economy and environment,* concept publishing company, new delhi-110015. Pp 10

Singh R.B and Gurjar Kumar Ajay (2011), Climate change vulnerability of agriculture in arid region on Rajasthan, India, *Annals of the National association of geographer India*, Vol xxxi, No.1, June 2011. Pp 21

Singh Kr Awadhesh and Srivastava Ashutosh (2006), tribal land alienation: a case study of uttarnchal and uttar pradesh, (eds.) Sarkar R.M, *Land and forest right of the tribal today*, serial publication new delhi. 53

Singh Surjit (2010), Introduction, (eds.) Singh Surjit and Rathore M.S, *Rainfed agriculture in India Perspectives and challenges*, Rawat publications. Pp.8-9

Thakur. R (2005), Problem and strategies of agricultural development in India, (eds.) Thakur Bakeshwar, Sinha V.N.P, Sharma. N, Pratap Rana, Mandal R.B, Singh R.B.P, *Urban and regional development in India*, vol.1, concept publishing company, New delhi-110059. Pp 558

Thakur Nath Som, Kahlon Simrit and Bhutani Smita (2016), Impact of human and environment on landuse/landcover change in Gaddi region, western Himalaya, *The Deccan geographer*, Vol 54, No 1, June 2016 (peer review refreed journal), the Deccan geographical society, India. Pp 6

Tiwari B.K (2007), Shifting agriculture: spatio-temporal patterns and processes in north eastern India, In: Saxena, K.G. Liang Luohui. and Rerkasen Kanok. (eds.) *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood*, Bishen Singh mahendra Singh. Pp 20

World food and agriculture statistical pocketbook 2018, food and agriculture organization of the United Nations, FAO statistics. Pp 8.

CHAPTER II

PHYSICAL FRAMEWORK OF THE STUDY AREA

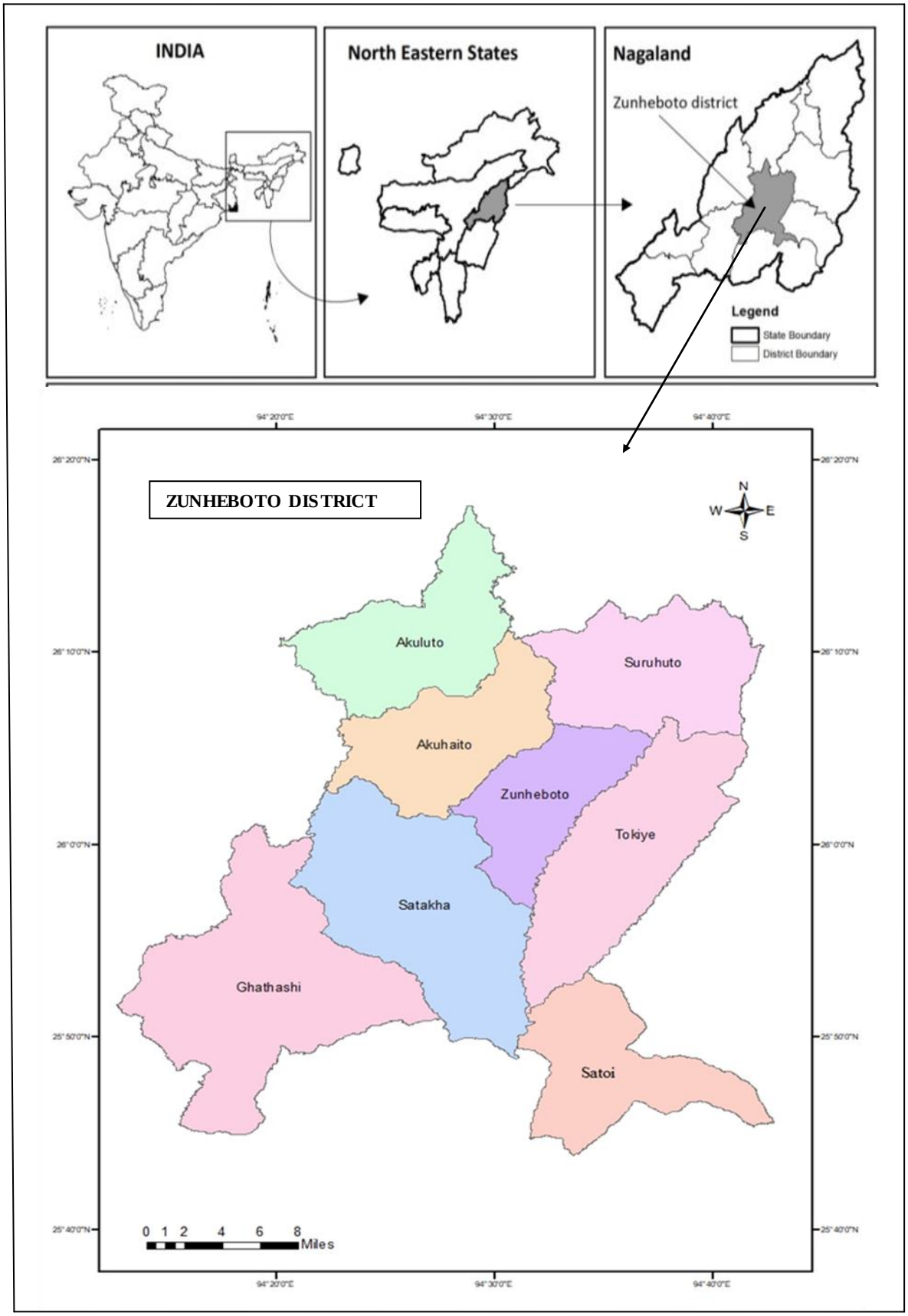
2.1 Introduction

Nagaland is a tribal state which was inaugurated as the sixteenth state of the Indian Union on 1st December 1963 located in the North-east India and lie between 25° 60' to 27° 40' North latitude and 93° 20' to 95° 15' East longitude covering an area of 16,578 Sq.km. The altitude varies from 194 meters to 3048 meters. The State is bounded by Myanmar and Arunachal Pradesh in the East, Assam in the North and West and Manipur in the South. Nagaland is also called as the 'Switzerland of the East'. The State consists of 12 Districts i.e Dimapur, Kiphire, Kohima, Longleng, Mokokchung, Mon, Noklak, Peren, Phek, Tuensang, Wokha and Zunheboto with 16 major tribes namely Angami, Ao, Chang, Chakhesang, Khiamniungan, Kachari, Kuki, Konyak, Lotha, Pochury, Phom, Rengma, Sumi, Sangtam, Yimchunger and Zeliang. The Nagas have rich cultural heritage and each tribe have their own language, dress, customs and practices. The physiography of the State is full of hills and ranges as Nagaland is one of the mountainous State in Northeast. Saramati is the highest peak of the state with 3841 meters located in the district of Kiphire. The main rivers that flow in the state are Dhansiri, Dikhu, Doyang, Milak, Tizu and Zungki with Doyang River as the largest and the longest river in the State. The average rainfall in the state varies from 2000 mm to 2500 mm with the average temperature of 16° C to 31° C maximum during the summer and 4° C to 24° C

maximum during the winter. According to 2011 census, the State has 19.78 lakh populations. It is said that the land mass of the state mostly represent the remnants of Archaen plateau of Indian perimeter shield which is one of the oldest landmasses of Gondwana origin. The entire state is hilly except for a narrow belt of foothills bordering Assam and the small valley in between lower ranges of the Western and North Western flank. Majority of the population live in rural areas having a predominantly agrarian economy as most of the people in the rural areas are involved in agriculture.

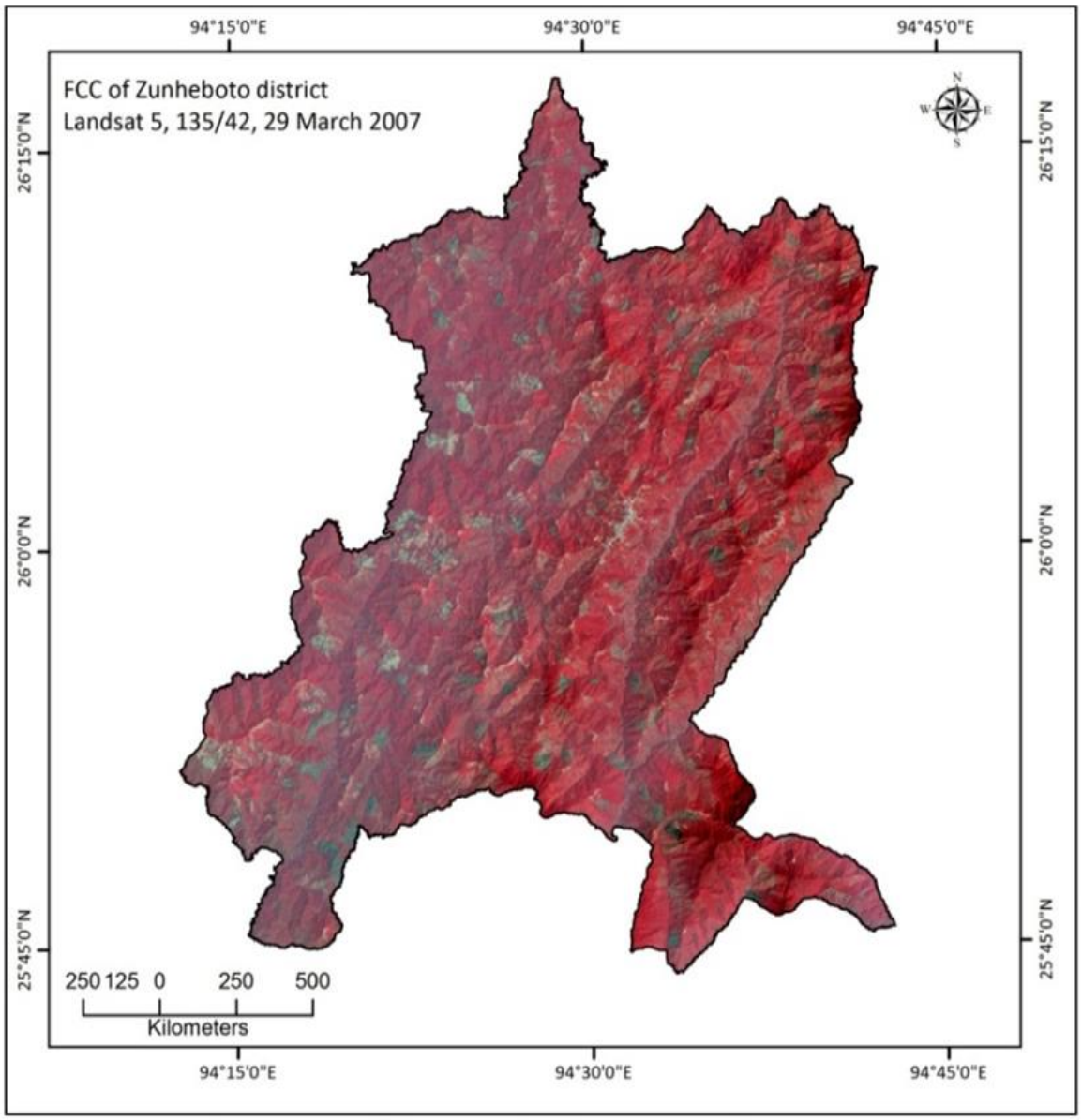
Zunheboto District is situated in the central part of the state of Nagaland between 94.52° East Longitude and 25.97° North Latitude with an area of 1595.88 sq.km (according to GIS data) bounded by the districts of Mokokchung on the North, Tuensang on the East, Phek and Kohima on the South and Wokha on the West. The name Zunheboto is derived from two sets of words of Sumi dialect, 'Zunhebo' and 'To'. 'Zunhebo' is the name of a flower shrub with white leaves and 'To' means the top of a hill. Thus, the district is named after a flower shrub which was found on the top of the hill during the creation of Zunheboto town. Zunheboto is a home of Sumi's and they are considered to be martial tribe among the Nagas. The area was inhabited by the Sumi people and so it was either called Sumi country or Sumi land without any common name. The district is divided into two broad physiographic divisions, i.e, the Eastern Zunheboto and the Western Zunheboto. The area on the Western part is much hotter and usually called 'Ghaboh' implying a hot climate area including Akuluto, V.K, Atoizu, Akuhaito, Saptiqa, Ghathashi and Pughuboto and those on the Eastern part are called 'Ajo' relatively colder area including Suruhuto, Asuto, Zunheboto, Satakha, Aghunato and Satoi.

Fig. 2.1 Location Map of the Study Area



Source: *Lab work*

Fig. 2.2 Satellite Imagery map showing the Study area



Source: *Lab work*

Zunheboto town is the coldest place in the district. There is a variation between the western and the eastern Zunheboto. The way of life and the type of cultivation differ from the east to the western Zunheboto. There are some variations in the language they speak as the people from the western area mainly from Pughuboto area speak other version of Sumi dialect which is difficult for eastern people to understand. The district is hilly and the hill varies from 1000 to 2500 meters altitude. Most of the people practice shifting cultivation as the district is hilly

and also it is the easiest way of cultivation which can be cultivated without irrigation with less capital investments. Zunheboto district is a hilly area with variations in soil types, climatic conditions, vegetation covers etc. The names of each village and town in the district have their own derivative name. There is a reason and meaning behind each village name, some named after the name of a tree, some after nature's name around the village and some after the founder's name of the village while some has a story behind the name of the village.

2.2 The Sumi tribe

The Sumi Naga tribe is said to have its root of existence in Khezakeno village and they relate the story of the Khezakenoma stone as well as many other folk-tales common to the Angami and Lotha particularly the latter. It is said that the Sumi people from Lazami village and the Khezakeno village have confirmed the relation between the two villages, affirming the bygone and beyond 2000. According to the two villages great forefathers, the generation of Naga began with one group of people led by a person named Khephiu who had come to Kezhakeno village from Makhel. It is said that according to the forefather's version, Khephiu had a son named Supu whose son was Koza and Koza had three sons namely Khrieu, Leo, and Seo. Khrieu- present Angami tribe as the eldest, Leo – present Chakhesang tribe is the second son and the youngest is Seo- present Sumi tribe. The word SUMI means the people of SUPU in which 'SU' stands for Supu and 'MI' stands for the people. It is also said that the word Sumi has been derived from the Angami numeration 'Se' meaning 'three' as the Sumi was the third male member of the family and he was known by the name 'Semei' which means 'third person'. Another story tells that the people got their name from the first Sema village named as Swema or Sumi and it is the corrupt form of either Swema or Sumi. Hutton (1921) said that whatever the origin of the Sumi's was, it is quite

clear that the Doyang Valley was the route by which they first entered the present Sumi country and the village of Khezakenoma has been shown as a Sumi settlement. There is a different story regarding the origin of the Sumi tribe where according to Khezakenoma legend, the ancestors of Angamis, Semas and Lothas were brothers who lived with their parents in the Khezakenoma village in the Kheja area. They would spread paddy on a stone inhabited by a spirit who would make the paddy double by nightfall but there was a bitter fight among the brothers about whose turn it was to spread the paddy on the stone so the parents spread eggs on the stone and set it on fire in fear of bloodsheds among them. As a result, the stone burst into pieces and the spirit departed and the brothers also departed in different directions giving rise to the three tribes (Hutton, 1921b). He also said that the Sumis are a composite tribe containing more Mongolian and Bodo blood from the North or North-west than their Angami neighbours. At present, the two tribes i.e Sumi and Chakhesang conclave to keep alive the spirit of brotherhood and engendering greater contact, love and respect between the two communities and they have resolved to strengthen their ties among themselves and celebrate their Brotherhood meet.

2.3 Indigenous Cultural Heritage of Sumi Tribe

Sumi tribe is one of the major tribes of Nagaland with rich cultural heritage. There is a meaningful story and saying behind every different cultural activities and it is a part of the people's life which has many interesting things to know about. Different cultural activities have been observed and practiced in different ways. Festival is one of the most important parts of the cultural heritage which provide an opportunity for the tribal people to share and display their rich cultural heritage. Through festival different cultural activities like colourful war dances, different colourful costumes, ornaments, folksongs, traditional games and sports are performed

and displayed and it gives the opportunities to the tourist to see the different rich cultural activities of the local people. The Sumi tribe also has rich traditional attires which are worn in different occasions and which have a different meaning behind it. Cultural heritage is an important part of tourism, agricultural landscapes, arts and handicrafts, villages, musical traditions. Archeological sites and ancient monuments are also important elements of the cultural heritage.

There are many different activities that are carried out, displayed and performed during different occasions. The different activities of the Sumi tribe which bring out the rich cultures and traditions are as follows:

Men cultural Dances

1. Aphilo kuwo- Men Folk Dance
2. Imu no pi sujo jo- Unity or Oneness
3. Tsutsughu kukusu or Dala Dala- Rain Invocation
4. Apighi lakujo- Snake Shedding Skin

Women Cultural dances

1. Totimi philo kuwo- Women Folk Dance
2. Aye kuzule- Spinning Song
3. Thishole- Sowing Song
4. Thighale- Threshing Song
5. Luxaleh- Weeding Song
6. Alukumlaleh- Field Working Song
7. Ghile qheshoh- Harvest Dance.

Indigenous Games

1. Akhetsu Kuzu- Top Spining

2. Angu Kupusu- Spear Kicking
3. Aphuku kiti- Kick Fighting
4. Ami Kukula- Fire Making
5. Atu vepuwu- Shot-Put
6. Awudu kumgho- Cockfight
7. Asu ilheche- High Jump
8. Kupuka kuxu- Long Jump
9. Puxa Kuxu- Jumping Competition
10. Sholupa Chekuxu- Spear Throwing

Besides the above mentioned cultural activities of the people there are many activities which are no longer performed or followed. Many of the cultural and traditional activities are in a verge of extinction if it is not listened, learnt, practiced and passed on to the next generations. With the change of time and modern life styles, many of the traditional dances, attires, indigenous songs, games and activities have been forgotten and not practiced. Thanmawia (2015) said that "when an elder dies, a library burns". It is therefore important for the present generation to collect, learn and pass the rich cultural heritage and preserve for the future generation.

2.4 District Administration

Nagaland attained statehood with the enactment of the State of Nagaland Act in 1962 by the Parliament and the State of Nagaland was formally inaugurated on 1st December 1963 as the Sixteen State of the Indian Union with Kohima as State capital. Nagaland State had three districts i.e Kohima, Mokokchung and Tuensang during the time of Statehood and later four more districts were created by the State Government namely Phek, Wokha, Zunheboto and Mon in December 1973 where Zunheboto and wokha district were carved out from Mokokchung district, Mon

district from Tuensang district and Phek district from Kohima district. Later Dimapur district was carved out from Kohima district in 1997. Nagaland has 11 administrative Districts and recently, in 2020, Noklak was carved out from Tuensang district which was created as a district making it to 12 administrative districts in Nagaland.

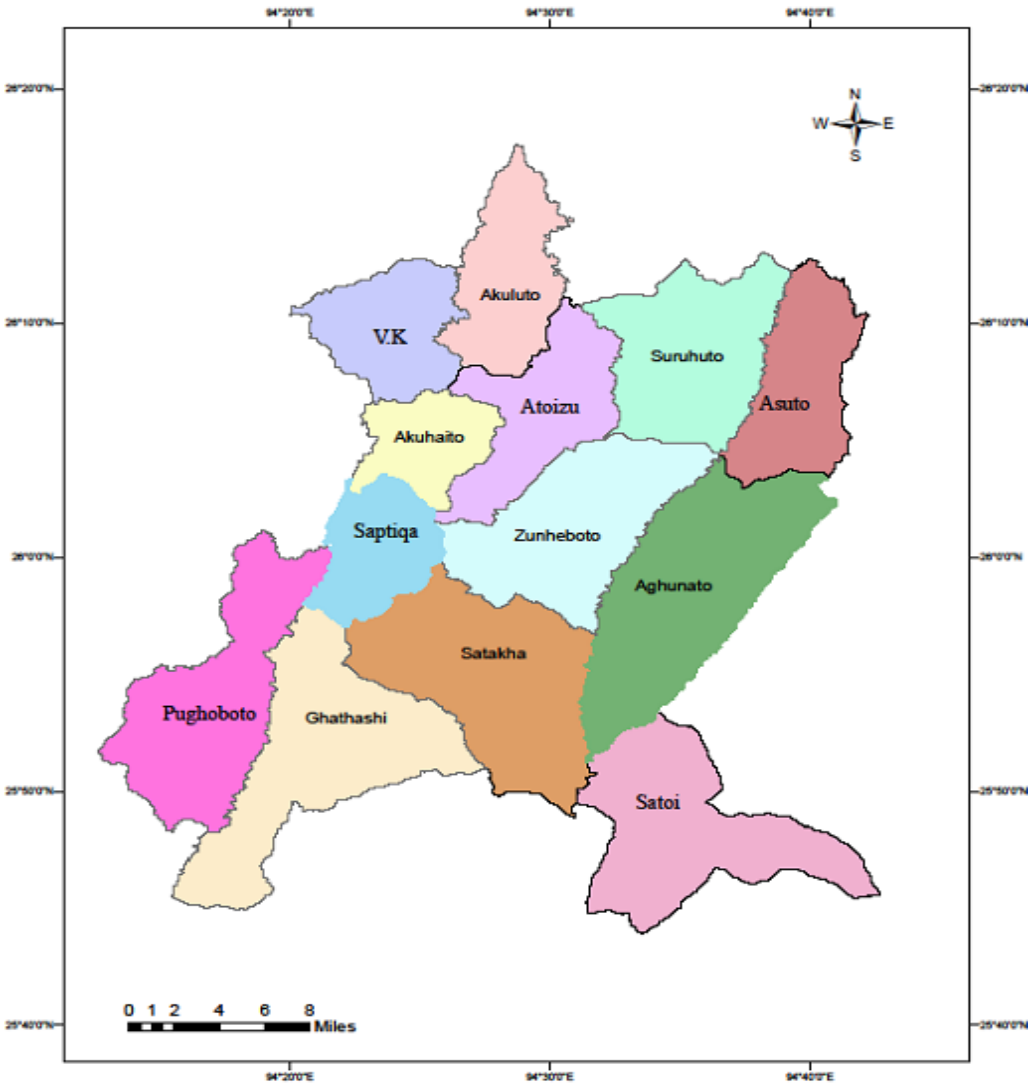
Fig. 2.3 Administration Map of Zunheboto District

Source: *Nagaland GIS and Remote Sensing Centre, Planning & Co-ordination Department, Government of Nagaland*

Zunheboto district was a sub division of Mokokchung district till 1971 and it was declared as a district on 19th December 1973 with 10 circles namely, Akuluto,

Aghunato, Asuto, Atoizu, Satakha, Satoi, Suruhuto, V.K, Zunheboto Town and Zunheboto Sadar. The first census in Zunheboto district as a separate district was taken in 1981. During the first census, the district had 9 administrative circles with 1 town. Later Pughuboto circle with 8 villages and Ghathashi circles with 13 villages were added to Zunheboto district which were transfered from Kohima district. Zunheboto district had 11 circles during the 2nd and 3rd census i.e 1991 and 2001 census. In 2011 census, Akuhaito and Saptiqa circles were carved out from Atoizu and Satakha respectively and making it to 13 circles in Zunheboto District.

Fig. 2.4 Circle map of Zunheboto District, Nagaland



Source: *Lab work*

Zunheboto District has 8 blocks namely, Akuhaito, Akuluto, Ghatashi, Satakha, Satoi, Suruhuto, Tokiye and Zunheboto. Each block consists of two circles except Zunheboto and Satoi blocks which consist of a single block. Akuhaito and Atoizu made up one block, likewise Akuluto and V.K, Ghathashi and Pughuboto, Satakha and Saptiqa, Suruhuto and Asuto, Tokiye and aghunato circle.

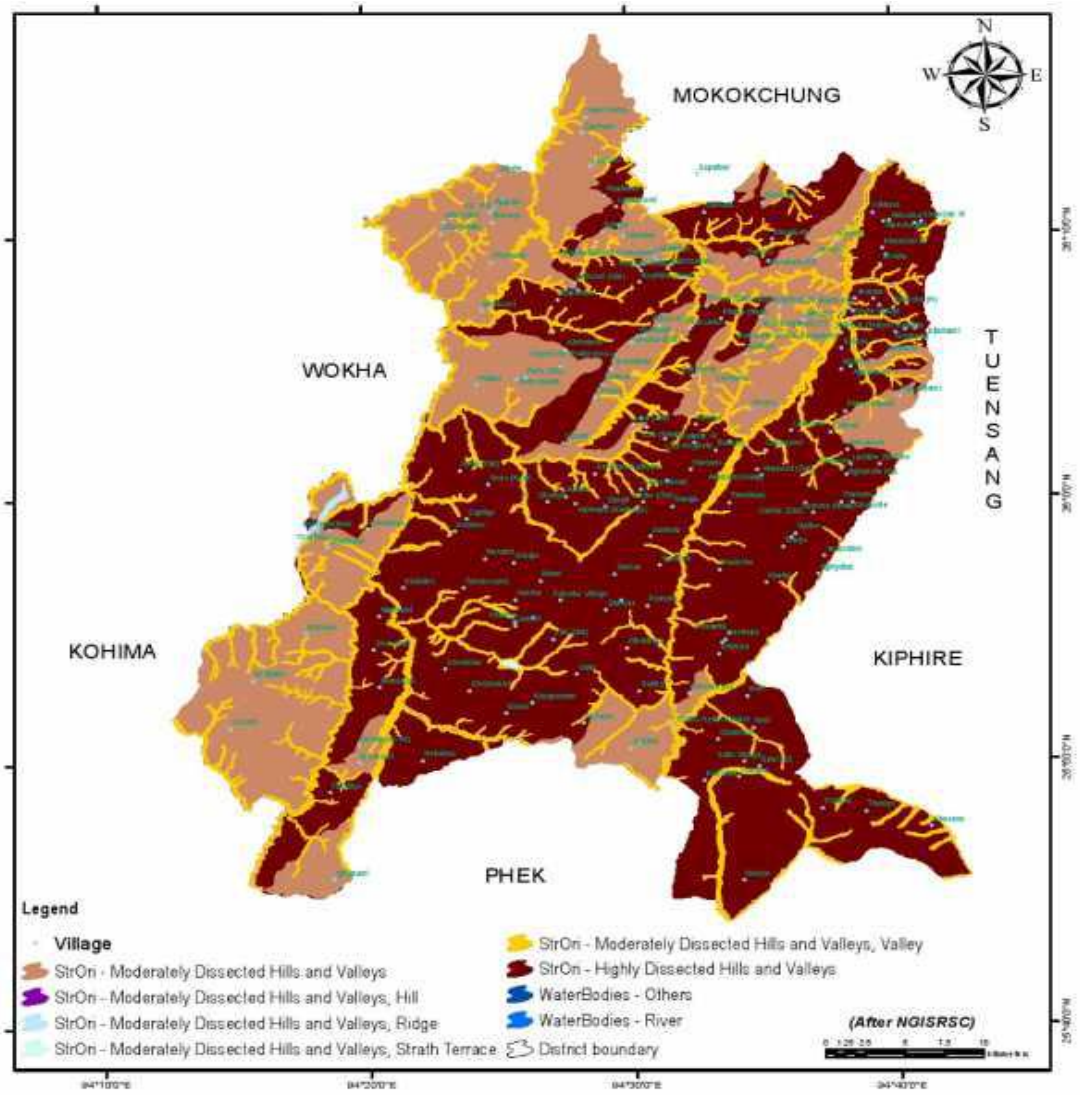
2.5 Geomorphology and soil type

The district is situated in the hills and the hills ranges with steep slopes varying from 1000 to 2500 meters with the average height of 1800 meters. Most of the settlements in the district lie between 1500 and 2000 meters altitude. Major part of the district is dominated by highly dissected hills and valleys and the eastern part of the district has moderately dissected hills and valleys. There are glens and gorges between the ranges in the district where the hill streams flows. The district has a semi-rectangular shape which extends in South North direction.

The soil of Nagaland belongs to Barail and Disang series which is derived from tertiary rocks. The variation in topography and climatic conditions in the state leads to the occurrence of different kinds of soil in the state. Soil of Nagaland belongs to 4 orders, 7 suborders, 10 great groups and 14 subgroups. It is said that 72 soil families are identified from the soil resource mapping of Nagaland State and these soils are mapped into 36 soil units in the entire State. The dominant soil in the state is Inceptisols followed by Ultisols, Entisols and Alfisols. Alfisols or red sandy is one of the common types of soil found in Zunheboto district which are rich in minerals and fine grained loamy types of soil. Other types of soil found in the district which are less common are alluvial soils, forest soil or organic soil pertaining to moolisol, non-laterised soil and spodosals soils which belong to high altitude soils order. Alluvial

soils are more fertile and the formations of the alluvial soils are mostly confined to the low-lying areas and to the banks of the rivers. Soils are fertile and responsive to the application of fertilizers but at the same time it can pollute the soil quality due to excessive use of chemical fertilizers. The soil in Zunheboto district is dominated by very strongly acidic soils with 42.5% of total geographical area. High degree of weathering of acidic parent material under humid climate with intense and heavy rainfall results to the strong acidity of soils in the district.

Fig. 2.5 Geomorphology Map of Zunheboto district

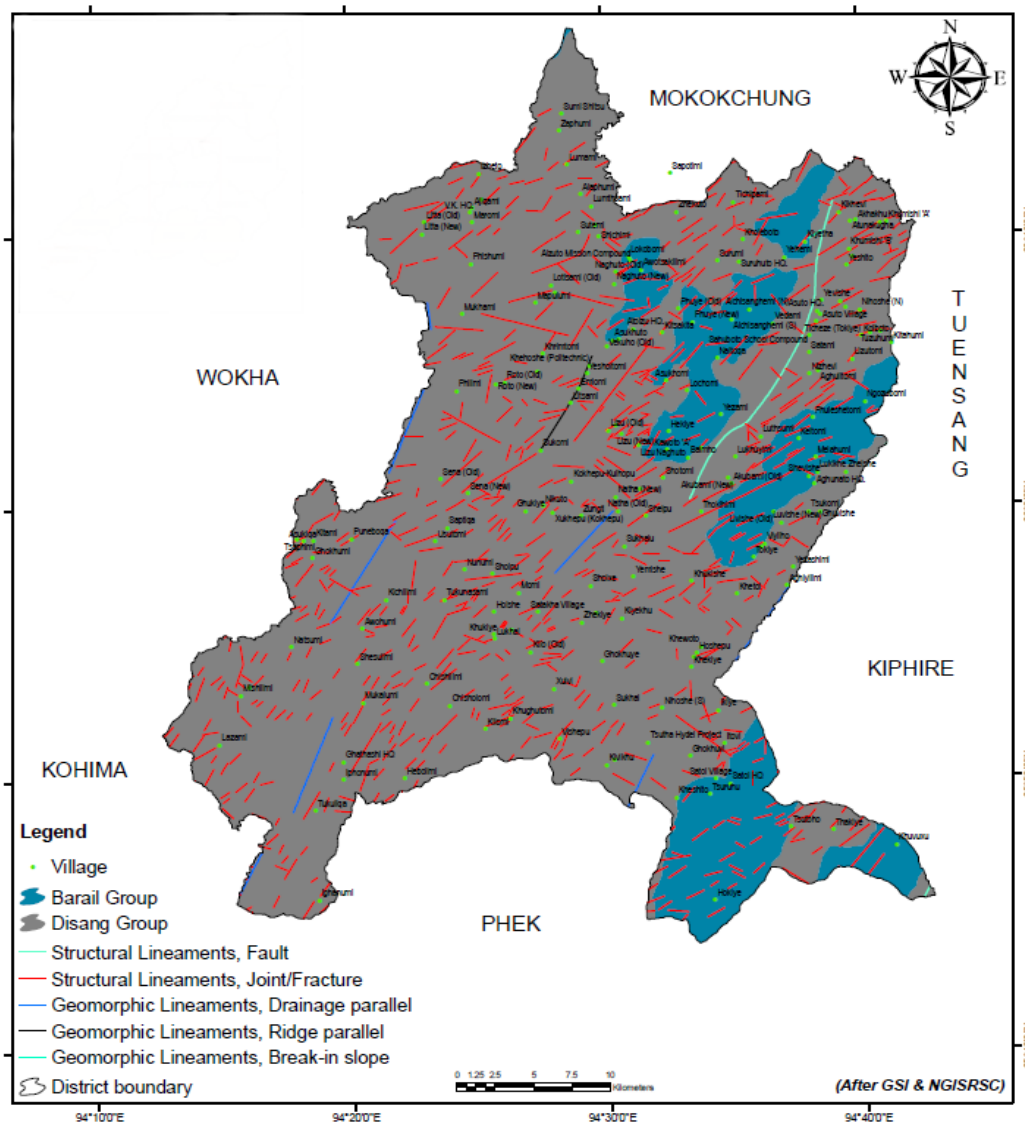


Source: *Nagaland GIS and Remote Sensing Centre, Planning & Co-ordination Department, Government of Nagaland*

2.6 Geology

The geological formation in Nagaland is complex since the state is located in the northern extension of the Arkan Yoma Ranges which are of Tertiary Cretaceous age and which belong to a fairly young mobile belt of the earth. The rock sequence of the state is represented by Disang group, Barail group, Surma group, Tipam group, Nasang beds and Dihing group of formation.

Fig.2.6 Geology Map of Zunheboto District



Source: *Nagaland GIS and Remote Sensing Centre, Planning & Co-ordination Department, Government of Nagaland*

Table 2.1: Age and thickness in meter of geosynclinals sediments of Nagaland

Sl. No	Name	Age	Thickness (in meter)
1	Dihing group unconformity	Pliocane	400
2	Namsang beds Uncomformty	Mio-Pleiocene	800 1800
3	Tipam group (Girujan clay/Tipam sandstone	Miocene	2300
4	Surma group Unconformity	Miocene	900
5	Barail group (Tikak Parbat)	Oligocene	600
6	Barail group (Baragolai)	Oligocene	3300
7	Barail group (Naogaon)	Oligocene	2200
8	Disang group	Eocene	3000

Source: *Gazetteer of Zunheboto district 1979*

Zunheboto District belongs to the rock sequences of the Disang (Eocene) and Barail (Origocene) group as shown in the figure 2.6. Disang group is the oldest group of rocks which consist of sequence of hard splinter shales of dark grey colour with thin sandstone beds where the major part of the district belongs to Disang group and some area in the eastern part of the district belong to Barail group. Parts of the area which belongs to Barail group are Atoizu, Suruhuto, Zuhneboto, Aghunato and Satoi. Naogaon formation at the base of Barail group comprises of mostly well bedded sandstone with shale intercalations. The general geological sequence of the area is Older alluvial which are clay, coarse, sand, gravel and boulder deposit, Tipam group are Tipam sandstone formation, and Girujan clay formation, Surma group - Surma sandstone formation, Barail group - barail sandstone formation, and Disang group are Disang shale formation. The sub-parallel hill ranges in the district runs in the north-

east to south east direction. From the table 2.1 it can be seen that Disang group is the oldest group of rocks which has a thickness of 3000 meters, Barail group of Naogaon has the highest thickness of 3300 meter, and Disang group occurring in the district is approximately 57 million years.

2.7 Climate and Rainfall

The climate of a region is characterized by warm summer and cold winter but the climatic condition differs from one place to another. The State of Nagaland enjoys the south-east monsoon with an average rainfall of 1500mm to 1800mm annually. Zunheboto district enjoys a monsoon climate almost throughout the year owing to the high altitude. The climatic condition varies between the western and the eastern part of the district due to the variation in the latitudinal and longitudinal directions and also influenced by the physiography. The western areas of the district bordering Mokokchung, Wokha and Kohima districts are much hotter than those eastern areas bordering with Tuensang and Kiphire district. The winter is very cold and summer is moderately warm in the district. The average rainfall is about 200 cm where July and August months contribute highest rainfall. During the rainy season, the rainfall is abundant which provide water for cultivation and helps in the growth of vegetation. December and January are the coldest months of the season and the temperature comes down to 10^{o} C and highest summer temperature is 22^{o} C and the average temperature during the year varies by 11.0 ^{o}C / 51.8 ^{o}F. The dry period is from November to April where many of the villages faced the problem of water scarcity. The difference in precipitation between the driest month and the wettest month in the district is 376mm (15 inch). Average rainfall for the preceding 5 years average in the district is 1462.1 mm. The wind in the district generally blows from south-west and the velocity may rise up to 100 km per hour. Sometimes the wind has been accompanied by rainfall.

During the monsoon season, the occasional floods and mild nature affects some parts of plains and foothills which causes damages to agricultural fields, crops, transport and communication and soil degradation etc. The windy season dies out in the month of April. Zunheboto town and Aghunato town are considered as the coldest place in the district. The frost falls in Aghunato town and Zunheboto town and some places in the district but not everywhere. In 2019, several parts of the Northeast India experienced cold waves and even in Nagaland four districts - Zunheboto, Kiphire, Phek and Tuensang received snowfalls for the first time nearly after four decades. Luvishe village under Aghunato circle in Zunheboto district had experienced snowfall after 37 years.

Table 2.2: Season of the year and its Meaning

Sl. No	Season	Local Name	Meaning	Months
1	Spring	Tssulu/Tssuka/Tuqutsuni	Atsutsu kullu/Atsutssu kuka/ Tuqutime	March, April, May
2	Summer	Mutssu	Tsutssughu kichih	June, July, August
3	Autumn	Tixi-ghile	Mutssu tove no ghileh	Sept, Oct, Nov
4	Winter	Susuh	Suthi/Mukomughai	Dec, Jan, Feb

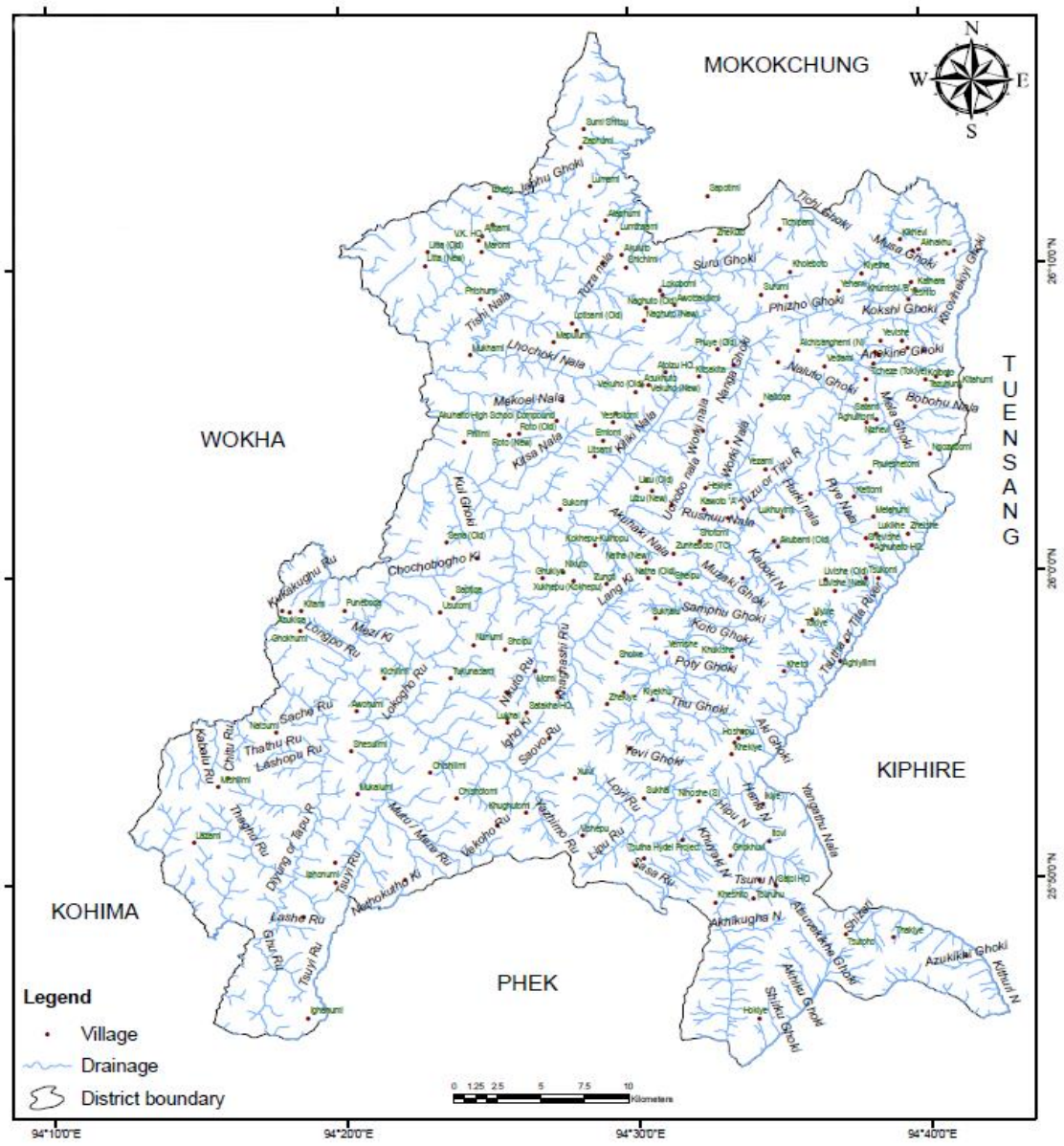
Source: *Atsah eno pimeh ghola (by H.S Rotokha)*

2.8 Rivers

There are many rivers flowing in the district with many tributaries. The main rivers in the district are Tizu, Doyang or Tapu, Tsutha or Tita and Dikhu River etc. Doyang or Tapu is one of the longest rivers in Nagaland which originate in Japfu

mountain in the south and flows from the southwest to the western edge of the district still flowing to the north westward and the river serves as the boundary between the western sides of Zunheboto district and Wokha district. Doyang River enters Zunheboto district from Kohima district which flows northward to Wokha district and finally joins Dhansari in Sibsagar district of Assam. The tributaries of Doyang River in the district are Tulo and Tishi with many other small tributaries. Tizu is one of the main rivers which originated in Tuensang district flowing southward in the eastern part of the district and joined Ti-Ho which joins Chindwin of Burma. The main tributaries of Tizu River are Melaghoki, Piyeghoki, Nalutoghoki, Anekineghoki, Loyighoki, Samphughoki, Nuzakighoki etc. Tizu River also acts as boundaries between Asuto and Suruhuto area, Zunheboto town and Aghunato area, Satakha and Satoi area. Tsutha is another main river flowing in the eastern part of the district originating in the North east of the district where Mini Hydel power project of the district is located in this river. Tsutha River joins Tizu River below Nihoshe village in the south eastern part of the district. Dikhu is another river flowing in the district and it is called Langa which flows towards Mokokchung district. This river also acts as a boundary between east Suruhuto and Akuluto area in the west. Another important river in the district is Tulo river which rise from the northern side of Satakha which joins Doyang river in the west. This river is called Langki ghoki in the south and Tulo ghoki in the north. Kiliki ghoki is one of the main tributaries of Tulo River which starts from the south of Atoizu area. There are many Rivers in the district with many tributaries but all the rivers which flow in the district are not very useful for the irrigational purposes as majority of the rivers which flows in the district are usually narrow and passes through hilly terrain. Tizu, Tsutha and Mela rivers are the main rivers in the district where majority of the Terrace rice fields are located and efforts are also been made to utilize other available rivers in the district.

Fig. 2.7 Drainage Map of Zunheboto District



Source: *Nagaland GIS and Remote Sensing Centre, Planning & Co-ordination Department, Government of Nagaland*

2.9 Flora and Fauna

Nagaland is blessed with rich Natural vegetation where about one-sixth of Nagaland is covered by tropical and sub-tropical evergreen forest. Nagaland lies in the 10th distinct bio-geographic zone under one of the identified 18 mega hot spot in the world with reference to threats to biodiversity. Blyths Tragopan is the state bird of Nagaland and Mithun is the State animal of Nagaland which is found only

in North eastern states of India. The great Indian Hornbill is one of the famous birds found in the State. Favourable climatic condition of the district results in the healthy growth of various species of trees and plants all the year round. Satoi Range is a pristine natural heritage of the district which is located in the western most region of the district. It is a habitat of the Blyth's tragopan which is a rare bird. The Range is covered with thick and green forest and it is the only remaining virgin forest in Zunheboto district. Rhododendrons can be spotted in the month of April and May. Tourists can enjoy sightings of the rare bird species apart from camping and trekking. The Range has been recognized as important bird area for its rich bird diversity. This Range is called Atu kala in Sumi dialect, in which Atu is stone and Akala means ladder. Nagaland has 407 documented community conserved areas (CCAs) out of which Zunheboto district have 31 self initiated CCAs. Ghosu bird sanctuary is a bird sanctuary in the district which is maintained by the village community providing habitats to more than twenty species. This sanctuary is famous for the migratory birds which can be sighted here between the months of June and September. It is located 11 km away from Zunheboto town (District Headquarter). To protect and maintain the bird sanctuary, the village community strictly prohibited hunting and poaching in the area. A natural salty water area lies in this sanctuary where all the species of birds come and drink water. The three villages of Sukhai, Kivikhu and Ghukhuyi under Satakha block in Zunheboto District united under Tizu Biodiversity Conservation and Livelihood Network ban all forms of hunting in the surroundings of the village area and donated lands to create community conserved area (CCA) and started the festival called Chengu festival. Chengu is the local name of the Great Barbet bird. Zunheboto district consists of both deciduous and evergreen forest and most of the trees are deciduous. Evergreen dense forest and evergreen open forest are found

mostly in the eastern part of the district whereas the open scrub land and dense scrub land are more in those areas where shifting cultivation is dominant especially in the western part of the district. Varieties of species of trees and plants are found in the district where the trees and plants also differ from the western to the eastern parts. The plants and trees which are found in the western part of the district are not grown well in the eastern part of the district due to variations in the climatic condition. The district is also rich in fauna where there are plenty of birds, reptiles and animals. Many wild animals are still found in the interior forest of the district but hunting as a part of economic activities and killing of wild birds and animals to protect their agricultural fields from the wild attacks has lead to the loss of many birds and animals life in the district. Different varieties of animal (Table 2.3), Plants (Table 2.4), Trees (Table 2.5), Fruits trees (Table 2.6) in the district are given in the following:

Table 2.3: Varieties of animal species in the district

Sl. No	LOCAL NAME	COMMON NAME	SCIENTIFIC NAME	FAMILY
1	Abongushuu	Lion	*Panthera leo*	Felidae
2	Achequ	Porcupine	*Erethizon Dorsaum*	Erethizontidae
4	Achuwo	Crab	*Brachyura*	Brachyura
5	Achuwo paza	Scorpion	*Scorpiones*	Scorpionoidea
6	Achuyi	Frog	*Rana Temporaria*	Neobatrachian
7	Achuyih	Antelope	*Alcelaphinae*	Bovidae
8	Aji	Rat	*Rattus Rattus*	Muridae
9	Ajighi	Rabbit	*Oryctolagus cuniculus*	Leporidae
10	Akhetsu	Mongoose	*Helogale Parvula*	Herpestidae
11	Akhiwo	Sloth	*Choloepus Hoffmani*	Bradypodidae
12	Akhosa	Cat	*Felis Domesticus*	Felidae
13	Akili	Squirrel	*Sciuridae*	Sciuridae

14	Akuha	Elephant	*Loxodonta Africana*	Elephantidae
15	Amini	wild pig, wild boar	*Sus Scrofa*	Suidae
16	Amishi	Cattle, cow, oxen	*Bos Taurus*	Bovidae
17	Ane	Goat	*Capra Aegagrus Hircus*	Bovidae
18	Anengu	Wild cat	*Felis Silvestris*	Felidae
19	Angushuu	Tiger	*Panthera Tigris*	Felidae
20	Aniza	Lizard	*Lacertilia*	Lacertidae
21	Aniza akumduu	Skink	*Scincidae*	Scincidae
22	Aniza kije	Monitor lizard, chameleon	*Varanus Indicus*	Varanidae
23	Apighi	Snake, Serpents, Asps	*Serpentes*	Over 15 families
24	Apuxulo azaxulo	Harvestmen, harvesters, daddy longlegs	*Opiliones*	Triaenonychidae
25	Aqhu	Sambar	*Rusa Unicolor*	Cervidae
26	Aqufu	Beaver	*Castor Canadensis*	Castoridae
27	Ashe	Deer	*Odocoileus Virginiana*	Cervidae
28	Ashiphi	Armadillo	*Dasypoddidae*	Dasypoddidae
29	Ashuki	Monkey	*Macaca Fascicularis*	Cebidae
30	Ashuqha	Bat, nocturnal mouse	*Chiroptera*	Microchiroptera
31	Asubolo chui	Tree frog	*Hyla*	Hylidae
32	Asuki/ Atulo	Flying squirrel	*Pteromyini*	Sciuridae
33	Asulhache	Carpenter ant	*Camponotus*	Formicidae
34	Asuyi	Golden langur	*Trachypithecus*	Cercopithecidae
35	Athaqhe akijeu	Iquana	*Iguana Iguana*	Iguanidae
36	Athonhe	Tortoise	*Geochelone Elegans*	Testudinidae
37	Athisu	Pharaoh ant	*Formicidae*	Monomorium Pharaonis
38	Athoqhe	Alligator	*Alligator mississippiensis*	Alligatoridae

39	Atine	Jackle	*Canis Aureus*	Canidae
40	Atiyi	Honey bee	*Apis*	Apidae
41	Atsu	Dog	*Canis lupus Familiaris*	Canidae
42	Atsugho	Otter	*Lutra Canadensis*	Mustelidae
43	Atsuko	Prawn, shrimp	*Dendrobranchiata*	Dendrobranchiata
44	Atsuko akijeu	Lobster	*Nephropidae*	Nephropidae
45	Atsupusho	Lady bird	*Coccinellidae*	Coccinellidae
46	Ava	Bear	*Ursidae*	Ursidae
47	Avi	Bison, mithun	*Bison Bison*	Bovidae
48	Awo	Pig	*Sus Scrofa Scrofa*	Suidae
49	Awu	Chicken	*Gallus Gallus*	Phasianidae
50	Ayili	Buffalo	*Syncerus Caffer*	Bovidae
51	Ayithu	Python	*Pythonidae*	Pythonidae
52	Ghau	Hyena	*Crocuta Crocuta*	Hyaenidae
53	Pulau	Cockroach	*Blattaria*	Blattidae
54	Sher	Fox	*Vulpes Vulpes*	Canidae

Source: *Primary Data and Scientific name from the website*

Table 2.4: Name of the plants in the District

Sl. No	LOCAL NAME	COMMON NAME	SCIENTIFIC / BOTANICAL NAME	FAMILY
1	Achhophe	Broom (thysanolaena	*(Genisteae)*	Poaceae
2	Aghane	Mustard leaves	*Brassica sp*	Brassicaceae
3	Aghau lojibo	Molestoma plant	*Melastoma*	Melastomes
4	Aghibo	Paddy	*Oryza sativa*	Poaceae
5	Aghuhapibo	Eupatorium odoratum	*Asteraceae*	Daisy
6	Aghushibo	Loofah	*Luffa*	Cvcurbits
7	Akiphibo	Fodder grass	*Pennisetum*	Poaceae
8	Akuhaxathi	Dillenianunica	*Dillenia indica*	Karmal
9	Alau	Sword beans,entada	*Canavalia gladiata*	Legumes

		scanders		
10	Alhoxipi	Tobacco plant	*Nicotiana talsacum*	Nightahade
11	Aliche subo	Madar, erythrina strica	*Calotropis gigantea*	Dogbanes
12	Alupi	Weed, tares, herbs	*Olea europeaea*	Oleaceae
13	Amghabo	Fern	*Polypodiaceae*	Fern
14	Amlhu	Creeping,fever,plant	*Glechoma hederacea*	Lamiaceae
15	Amsabo	Palm,lectonia jeng	*Arecaceae*	Perennial lianas
16	Amtubo	Marram grass	*Beachgrass*	Grasses
17	Anatsagho	Grass	*Poaceae*	Grasses
18	Apuh	Mushroom	*Agaricus bisporus*	Agaricaceae
19	Aputi	Small fungus	*Fungi*	Agaricaceae
20	Asaqhibo	Khovilota	*Ocaciapiunata*	Acanthaceae juss
21	Auchobo	Banana tree	*Musa acuminata*	Musaceae
22	Ayeghubo	Reed plant	*Phragmitesaustralis*	Grasses
23	Ayichibo	Poison rooted vine plant	*Creeping fig*	Mulberry
24	Ayithobo	Palmyra plam,date palm	*Borassus*	Borassaceae
25	Pulakhu	Mint	*Mentha*	Menthaceae
26	Chena	Gram/chick pea	*Cicer arietinum*	Legumes
27	Chepopu	Mushroom	*Agaricus bisporus*	Agaricaceae
28	Datsuni	Lichen	*Cup lichen*	Cladaniaceae
29	Haldibo	Turmeric plant	*Curcuma longa*	Ginger
30	Isukos	Squash	*Cucurbita*	Cucurbits
31	Japan lupi	Mikania plant	*Asteraceae*	Asteraceae
32	Kanibo	Opium plant	*Papaver somniferum*	Poppies
33	Kitemi qhupu shedu	Stellata, osbekia	*Magnolia stellata*	Magnolia
34	Kofibo	Coffee plant	*Coffea*	Madder
35	Kusalhalupibo	Mimosa plant	*Mimosa pudica*	Legumes
36	Salambo	Touch me not	*Mimosa pudica*	Legumes
37	Yeghithibo,nasathi	Wild cardmom	*Elettaria*	Zmiberaceae

	bo			
38	Yeghuthibo	Cardamom	*Elettaria*	Ginger
39	Yeqhiyebo	Jute plant	*Corchorus olitorius*	Mallouls
40	Yeqiye	Antidosam	*Antidesma*	Phyllanthaceae
41	Zunhebo	Hairy white-wand	*Leucosceptrum canum*	Lamiaceae (Mint family)
42	Zunilobo	Mandrake plant	*Mandragora officinarum*	Nightshade

Source: *Primary Data and Scientific name from the website*

Table 2.5: Name of Trees in the district

SI No	LOCAL NAME	COMMON NAME	SCIENTIFIC / BOTANICAL NAME	FAMILY
1	Aphitsu	Poisoning shrub	*Atropa belladonna*	Cashew
3	Azuyibo	Korami,siris	*Albizzia procera*	Legumes
4	Akusabo	Cinnamom tree	*Cinnamomum verum*	Laurels
5	Angoshebo	Bajorna tree	*Rutaceae*	Rutaceae
6	Angushubo	Amora wallichi lali tree	*Spectabliles*	Meliaceae
7	Aphibo	Oak tree	*Buercus*	Quercaeae
8	Asahubo	Pine tree	*Pinus*	Pine
9	Asalibo	Soap vine tree	*Cardiospermum*	Smilacaceae
10	Asumughutabo	Genus boswellia	*Boswellia*	Burseaceae
11	Asuphabo	Cotton tree	*Bombar ceiba*	Bombacaceae
12	Athithibo	Nettle tree	*Trema orientalis*	Hemp
13	Athumbo	Rhus tree,rhussemialata	*Toxicodendron*	Cashews
14	Atughusubo	Coniferous tree	*Pinophyta*	Plantae
15	Atuthubo	Allergric tree	*Ragweed pollen*	Moraceae
16	Achighisubo	Mechalia,champacca	*Plumeria rubra*	Magnoliaceae
17	Chhochobo	Wild fig tree	*Ficus carical*	Moraceae
18	Chinithi subo	Wild cherry tree	*prunus repalensis*	Rosaceae
19	Chokibo	Acorn tree	*Quercus*	Quercaceae
20	Ghakubo	Walnut tree	*Juglans regia*	Walnut
21	Imlixathibo	Tamarind Tree	*Tamarindus Indica*	Legumes

22	Khaghabo	Sam Tree	*Artocarpus Chaplasha*	Malvaceae
23	Khamabo	Litsaechitrata Tree	*Hevea*	Euphoriaceae
24	Khukhubo	Cotton Tree	*Ceiba Pentandra*	Malvacede
25	Khumusu	Pula,Rydia (Calycina)	*Michelia Champaca*	Mallow
26	Kichhobo	Odal,Sterculiavilosa	*Sterculia(Colorata)*	Malvaceae
27	Kuhubo	Hillock Tree	*Hypericifolia*	Myrtaceae
28	Kululupubo(Pah subo)	Bauhinia Tree	*Variegatia*	Legumes
29	Lutisubo	Alder Tree	*Almes Nepalonsis*	Betulaceae
30	Moousu(Mayiko su)	Mymasa Siris, Albizzia Odoratissima	*Albiza lebbeck*	Fabaceae
31	Michhisu	Gogra,itching tree, Neddel tree, Schima willichi	*Lugunaria*	Mallows
32	Miyisu	Acrocarpus fraxinfolius mundane	*Mezonerum grade*	Fabaceae
33	Mlosu	Willow tree	*Salix*	Willow
34	Mukhokughubo	Hathepaila,pterospermum,acerifolium	*Cassia fistula*	Fabaceae
35	Nakiniyebo	Zanthoxylum tree	*Americanum*	Rutaceae
36	Naltobo	Rhododendron tree	*Arboreum*	Heaths
37	Narkolobo	Coconut tree	*Cocus nucifera*	Palm
38	Nhekobo	Banyan tree	*Ficus benghalensis*	Mulberry
39	Pa-abo/ Puhasubo	Bauhinia tree	*Variegata*	Legumes
40	Pughosu	Cannonball tree	*Coureupita guianensis*	Lecythidaceae
41	Pughusu	Wood of juri	*Diptercarpus*	Dipterocapaceae
42	Kidicho subo	Rubber tree	*Heva brasiliensis*	Spurges
43	Shepughabo	Khokhon tree	*Duabanga sonnerototiodes*	Lythraceae
44	Shekusu	Elaecarpus, Robustus	*Elaeocarpus ganitrus*	Elaeocarpaceae
45	Shevixasu	Hokon	*Amaryllidaceae*	Amaryllidaceae
46	Thumsubo	Rhussemia lata tree,	*Tinospora cordifolia*	Menispermaceae

		Naga tenga kas		
47	Tiksubo	Teak tree	*Tectona grandis*	Lamiaceae
48	Tiqhibo	Cendralatoona	*Cassia fistula*	Fabaceae
49	Tsuithibo	Amura tree	*Albizia*	Fabaceae
50	Yeqeyebo	Diana holosh	*Cassia fistula*	Fabaceae
51	Yepasu	Birch tree, a variety of alder tree	*Betual*	Birch
52	Zutalaghibo	Persimmon, Diospyos	*Diospyros kaki*	Ebenaceae

Source: *Primary Data and Scientific name from the website*

Table 2.6: Name of the Fruit trees in the District

Sl. No	LOCAL NAME	COMMON NAME	SCIENTIFIC / BOTANICAL NAME	FAMILY
1	Atsayithi	Grape	*Vitis vinifera*	Grapes
2	Anaraz/ ngomujothi	Pineapple	*Ananas combus*	Bromiliads
3	Avixathi	Crimson raspberry	*Citrullus ianatus*	Rosaceae
4	Aqhexathi	Cane fruit	*Rubus*	Rosoideal
5	Borbeze	Watermelon	*Citrullus ianatus*	Cucurvits
6	Kathal	Jackfruit, Artocarpus integrifolia	*Artocarpus*	Mulberry
7	Ketli xathi	Tamarindus	*Tamarindus*	Legumes
8	Khaghathi	Fruits of sam tree	*Prunus*	Rosaceae
9	Khaghatu	Pomegranate	*Punica granatum*	Punicaceae
10	Kholithi	Gooseberry, Embelica officinail	*Ribes uva-crispa*	Grossulariaceae
11	Khughuthi	Fig fruit	*Ficus carica*	Mulberry
12	Khungthi	Gum fruit	*Eucalyptus*	Myrtle
13	Kinithi	Cherry fruit	*Prunus*	Rosaceae
14	Kopta	Papaya	*Carica*	Caricaceae
15	Lemon	Lemon	*Citrus*	Rutaceae
16	Mduram	Guava	*Psidium*	Myrtle
17	Mikeithi	Jamun, Black currant	*Syzygium*	Myrtle

18	Mujothi	mango/wild mango	*Mangifera*	Cashews
19	Mushuthi	Orange/wild orange	*Citrus*	Rutaceae
20	Mughuthi	Fruits of Borthe kera	*Borassus*	Rosaceae
21	Pukhoithi	Wild apple	*Domestica*	Rosaceae
22	Shuhathi	Wild grape	*Vitaceae*	Vitales
23	Sulithi	Yellow raspberry	*Rubus*	Rose
24	Tamul	Arecanut, betel -nut	*Areca catech*	Palm
25	Thaithi	Foknak, Hoxonia, Hodgsonia	*Rhamaceae*	Zizipues
26	Tsukoithi	Black fruits, pertaining to tsukoba	*Syzygium*	Myrtaceae
27	Yekuthi	Peach	*Persica*	Rose
28	Yevuthi	Black berry	*Rubus*	Rosaceae
29	Alubekhuna	Plum tree	*Areaceae*	Arecalus
30	Shoxathi	Wild lemon	*Citrus*	Rutaceae
31	Lambu	Ponderosa lemon	*Citrus limon*	Rutaceae
32	Sulithi	Wild berry	*Rubus*	Rosaceae
33	Ghalogi	Blue berry	*Cyanococcus*	Heaths
34	Mighebo	Saurauia	*Napaulensis*	Antindinacea
35	Kiyithibo	Wild mango	*Spondices mangfera*	Anacasdiaceae

Source: *Primary Data and Scientific name from the website*

Zunheboto District is blessed with rich varieties of flora and fauna but many economic activities like hunting, agricultural activities, development activities, cutting down of trees for timbers and firewood etc leads to the degradation of flora and fauna. Many of the wild animals have been disappearing from the district due to different activities and also the decrease of dense forests led to the disappearing of wild animals like tiger, lion and elephant etc in the district. In the year 2019, the footsteps of wild elephants were found in Saptiqa area of Zunheboto district where the elephant destroyed some paddy fields. Varieties of trees, fruits and plants have

been found in the region where many of the plants have the medicinal values which needs to be preserved for the future generation.

2.10 Population

According to 2011 census, Zunheboto district has 13 circles, 1 statutory town (Zunheboto town), 1 census town (Satakha) and 191 (186 inhabited and 5 uninhabited) villages with the total population of 140,757 with 71217 male and 69540 female population. The density of population is 112 persons per square kilometer.

Zunheboto district comprises of 13 circles with Zunheboto town having the highest population with 35977 persons followed by Aghunato Town of 18350 persons. Akuhaito circle has the lowest population of 3876 persons with 4 villages and 1 town under its circle according to 2011 census. Aghunato circle has the highest number of villages with 27 villages and 2 towns followed by Zunheboto circle with 23 villages and Asuto circle with 20 villages. Akuhaito circle with 4 villages and Saptiqa circles with 4 villages have the less number of villages with Akuhaito having the lowest population of 3876 persons in the district.

Sex ratio is defined as a number of females per 1000 males in a population. It is the social indication to measure the social equality between males and females in the society at a given time. Variations in number of sex ratio can be due to different reasons. One reason which lead to the rise of sex ratio is the want of male child in the family where they increase number of female child until a male child is born. Lower sex ratio is due to sex ratio at birth, sex selective of child birth etc. The sex ratio of the district is 976 females per 1000 males with 993 in the rural and 912 in urban areas. Zunheboto district has the highest sex ratio among the entire districts in Nagaland

followed by Wokha with 968. Saptiqa circle with 1069 females per 1000 males has highest sex ratio among the administrative circles in the district with lowest sex ratio in Suruhuto circles of 936.

Table 2.7: Circle wise Population and Sex Ratio of Zunheboto District

Sl. No	Name of circle	Number of Villages/Town	Person	Sex Ratio
1	Aghunato	29	18350	1023
2	Akuhaito	5	3876	950
3	Akuluto	10	6612	940
4	Asuto	21	7598	960
5	Atoizu	16	8740	1023
6	Ghathashi	13	7967	1000
7	Pughuboto	10	8943	1008
8	Saptiqa	5	5163	1069
9	Satakha	19	15103	937
10	Satoi	11	4540	1006
11	Suruhuto	14	13957	936
12	V.K	9	3931	960
13	Zunheboto	24	35977	961
	Total	**186**	**140757**	**976**
	Male		71217	
	Female		69540	

Source: *District census handbook, Zunheboto, Census of India 2011 Nagaland*

2.11 Literacy Rate

Literacy is a key for socio-economic progress and literacy rate is the population of people who can read and write. The table 2.8 shows the percentage of literacy rate in Zunheboto district with 87.85 percent male and 82.62 percent female with the total literacy rate of 85.26 percent. The gap in male and female literacy rate is 5.23

percent. The highest literacy rate in the district among the circles is recorded in Atoizu area with 91 percent followed by Satakha with 90.12 percent.

Table 2.8: Literacy rate in the district

Sl. No	Name of circle	Persons	Male	Female	Gap in Male-Female Literacy rate
1	Aghunato	80.12	84.28	76.13	8.15
2	Akuhaito	79.57	82.49	76.47	6.02
3	Akuluto	88.27	90.35	86.11	4.24
4	Asuto	80.75	83.15	78.28	4.87
5	Atoizu	91	93.22	88.85	4.37
6	Ghathashi	85.54	88.35	82.76	5.59
7	Pughuboto	84.8	88.14	81.53	6.61
8	Saptiqa	84.79	88.63	81.28	7.35
9	Satakha	90.12	92.91	87.15	5.76
10	Satoi	71.09	72.28	69.92	2.36
11	Suruhuto	83.15	85.29	80.84	4.45
12	V.K	87.7	90.42	84.9	5.52
13	Zunheboto	87.82	89.58	85.98	3.6
	Total	**85.26**	**87.85**	**82.62**	**5.23**

Source: *District census handbook, Zunheboto, Census of India 2011 Nagaland*

2.12 Change in population during 2001 and 2011 census

Population composition refers to the physical socio-cultural and economic attributes of the population such as age, sex, place of residence, language, religion, marital status, ethnicity, education and occupation. Change in population determines most of the demographic and socio-economic characteristics of population. The composition between rural and urban differs from each other, the rural folks differ from urban folks in occupation and way of life with mostly engaged in primary

activities. The urban population on the other hand is engaged primarily in secondary and tertiary activities.

Table 2.9: Decadal change in Population of Administrative Circles, 2001-2011

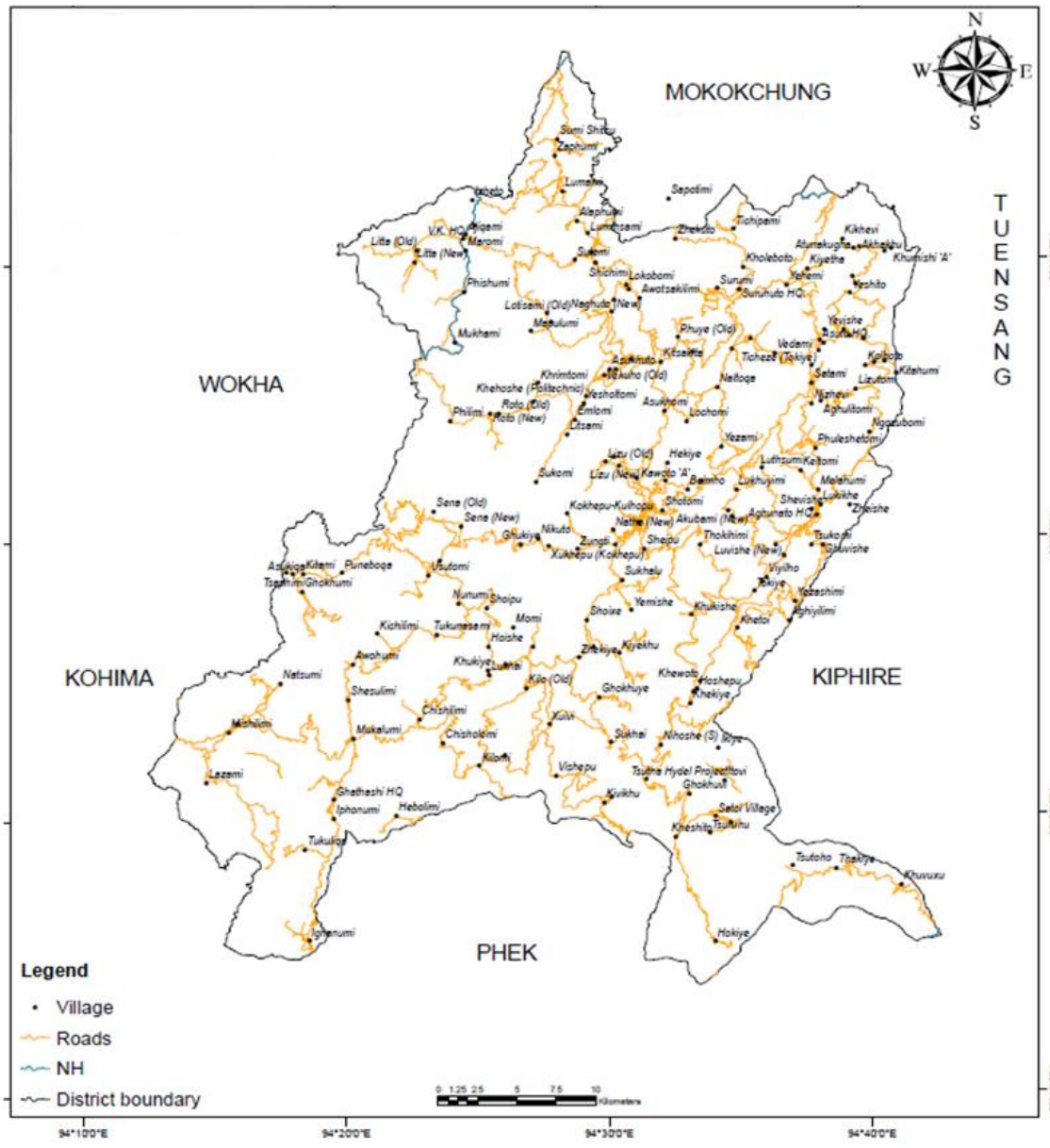
Sl No.	Circle	Total population 2001	Total population 2011	Total percentage decadal variation 2001-2011
1	V.K	5635	3931	-30.24
2	Akuluto	6665	6612	-0.80
3	Suruhuto	14660	13957	-4.80
4	Asuto	7445	7598	2.06
5	Aghunato	16713	18350	-9.79
6	Zunheboto Sadar	38569	35977	-13.84
7	Atoizu	14460	8740	-39.56
8	Akuhaito		3876	0.00
9	Pughoboto	15088	8943	-40.73
10	Ghathashi	9547	7967	-16.55
11	Satakha	19849	15103	-48.92
12	Saptiqa		5163	0.00
13	Satoi	5324	4540	-14.73
	Total	**153955**	**140757**	**-8.57**

Source: *District census handbook, Zunheboto, Census of India 2011 Nagaland*

Table 2.9 shows the decadal change in population of administrative circles in 2001 and 2011. In the district as a whole, the total population has recorded a negative growth rate of (-) 8.57 per cent. As can be observed from the table 2.9, most of the administrative circles have shown negative growth rates during 2001-2011 which can be due to the migration of the denizens to the other districts like Kohima and Dimapur for better livelihoods. It is to be noted that Akuhaito and Saptiqa are new administrative circles to their former/original circles for Satakha and Atoizu will not be as pronounced as given in the table 2.9. Maximum decline in population is seen in Zunheboto circle with (-) 40.73 per cent. Asuto and Aghunato circles, on the other

hand, have recorded positive growth rate during 2001-2011. The shift in population is due to occupation structure of the people profession, trade, and type of work.

Fig. 2.8 Road map of Zunheboto District



Source: *Nagaland GIS and Remote Sensing Centre, Planning & Co-ordination Department, Government of Nagaland*

2.13 Transport network

Road transport is the only way of transportation in the district. The National highway that connects various regions of the State connects the capital of Nagaland

through National Highway 61 (NH 61). The total length of National Highway within the State of Nagaland is 1646.70km. NH 29 runs across the Indian State of Assam, Nagaland and Manipur and NH 129 is a National Highway of India that connects Dimapur in Nagaland to Assam. NH-702(A) connects various districts in the State starting from Mokokchung- Zunheboto- Dzalami- Chozuba- Phek- Kotisu- Tezatse- Meluri. Nagaland has 1095.5 Km of State Highway and connects Zunheboto district via Dimapur- Mokokchung- Chozuba- Zunheboto. The numbers of National Highway crossing and touching Nagaland are given in the following table 2.10.

Table 2.10: Routes of National Highways in Nagaland

Sl No	NH	Routes
1	NH-02	Dibrugarh-Sibsagar-Amguri-mokokchung-Wokha-Kohima-Imphal-Churanchandpure-Seling-Serchip-Lawngtala-Tuipang
2	NH-202	Mokokchung-Tuensang-Shamatore-kiphire-Meluri-Jesami-Ukhrul-Imphal
3	NH-29	Daboka-Dimapur-Kohima-Pfutsero-Jessami
4	NH-129	Dimapur-Bokajan-Golaghat-Numaligarh
5	NH-129(A)	Manipur-Peren-Jalukie-Pimla Junction-Razaphe Junction
6	NH-702	Changtingya-Longleng-Longching-Mon-Tizit-Namtola
7	NH-702(A)	Mokokchung-Zunheboto-Dzalami-Chozuba-Phek-Kotisu-Tezatse-Meluri
8	NH-702(B)	Tuensang-Longleng
9	NH-702(D)	Mokokchung-Tzurang
10	NH-329(A)	Diphu-Pimla Junction
11	NH-229	Jail Junction-Thahekhu-Chumukedima

Source: *Nagaland Economic Survey (2016-2017)*

NH-702(A) is the only National Highway crossing Zunheboto district from Wokha to V.K circle in Zunheboto district to Mokokchung. The State Highway crossing the district is from Kohima – Ghathashi – Satakha - Zunheboto town – Atoizu - Akuluto to Wokha and Mokokchung.

Table 2.11: Important Routes from Zunheboto

Sl.No	**Destination**	**Km**
1	Kohima	150
2	Dimapur	224
3	Mokokchung	64
4	Mon via Dimapur	504
5	Wokha via Kohima	230
6	Longleng Via Mokokchung	150
7	Phek via Chakhabama	421
8	Peren via Kohima	279
9	Kiphire via Chakhabama	350
10	Aghunato	42
11	Atoizu	23
12	Akuluto	38
13	Pughuboto via Kohima	206
14	Satakha	20
15	Suruhuto	39
16	Lumami	42

Source: *Statistical handbook of Zunheboto*

Zunheboto district is situated in the heart of Nagaland which is connected to the entire districts by roads. Table 2.11 gives the details about the important routes connecting by road from Zunheboto town to other destinations. Zunheboto district share the boundaries with Mokokchung, Tuensang, Wokha, Kohima, Phek, Kiphire. The district has road connectivity to every corners of the district either through surfaced roads or unsurfaced roads and to other parts of the state but roads are not

well maintained that all the connected roads are not approachable. Mokokchung is the nearest district to Zunheboto town with 64 km.

Table 2.12: Block wise Road connectivity (2014)

Sl No	Block Name	No of villages	Road	
			Surfaced road	Unsurfaced road
1	Akuhaito	17	17	17
2	Akuluto	18	18	18
3	Ghathashi	22	4	22
4	Satakha	28	5	25
5	Satoi	10	10	10
6	Suruhuto	31	25	31
7	Tokiye	31	27	30
8	Zunheboto	23	23	23
	Total	180	129	176

Source: *Directorate of Economic and statistics Nagaland*

Table 2.12 shows the block wise road connectivity of both the surfaced and unsurfaced roads in each village in the district. Out of 180 villages given in the table 2.12, out of 8 blocks, 129 villages have surfaced roads and 51 villages do not have a surfaced road. Satakha block has the lowest surfaced roads with 5 villages out of 28 villages in the block.

2.14 Tourist Destinations in the district

1. **Sumi Baptist Church Zunheboto:** This Church is located between 26^{o} 01" N latitude and 94^{o}31"E longitude and situated on the hilltop of Zunheboto Town (Zunheboto District Headquarter) in the heart of Nagaland, standing tall and majestic at 1864.9m above the sea level. It can be reached via road transportation which is located 150km away from State capital Kohima and 224 km away from Dimapur. The church is considered to be one of the largest church buildings in Asia which has 9 storeys, 27 rooms including the main hall with seating capacity of

8500. Build on the hilltop of the town, the church can be seen from anywhere in the town and some surrounding villages in the district. The Church was founded in 1942 where the construction of building began on 5th May 2007 which takes 10 years to complete. It was inaugurated on 22 April 2017.

2. **Ghosu Bird Sanctuary:** This is a bird sanctuary which is maintained by the village community providing habitat to more than twenty species. This sanctuary is famous for the migratory birds which can be sighted here between the months of June and September. It is located between Ghukiye village and Nikuto village, 11 km away from Zunheboto Town (District Headquarter). The two villages decided to come together to protect the natural resources and in 2014, Ghosu bird sanctuary was officially announced as CCA. To protect and maintain the bird Sanctuary, the village community strictly prohibited hunting and poaching in the area. A natural place of salty water lies in this sanctuary where all the species come and drink water from that place.
3. **Satoi Range:** Satoi Range is a pristine natural heritage of the district and located in the western most region of the district at Ikiye village which is a small village under Satoi circle. This Range is located between 25° 50' N latitude and 94° 35' E longitude at an elevation of 1677m approximately. It is a habitat of the Blyth's tragopan which is a rare bird. The range is covered with thick and green forest and it is the only remaining virgin forest in Zunheboto District. Rhododendrons can be spotted in the month of April and May. Tourists can enjoy sightings of the rare bird species apart from camping and trekking. The range has been recognized as an important bird area for its richness in bird diversity. This range is called Atu kala in Sumi dialect, in which Atu is stone and Akala means ladder.
4. **Keltomi village:** Keltomi village is under Aghunato circle which is located between 26°02' N latitude and 94°37' E longitude. It was declared as the model

village in the year 1988 for its cleanliness and organic produce of vegetables and fruits. It is located 7km away from Aghunato town and 35km away from district headquarter Zunheboto town.

5. **Rotomi village:** The village is divided into Roto New and Roto Old which is located between 26° 04' N Latitude and 94° 25' E Longitude with an elevation of 995m approximately. This village was approved as Model village on 8 August 2011 and also called as Green village in Zunheboto district. Roof of the houses in the village are all painted with green colour but with the passage of time the colour of the houses are no more uniform. This village has also received the Nirmal Gram Puraskar award for attaining total sanitation and eliminating open defecation in the village. It is located 30 to 35 Km approximately away from the district headquarter Zunheboto town. The first and only village in the district where the mass marriage is compulsory.
6. **Aizuto:** Aizuto is a small town located between 26° 09' N latitude and 94° 31' E latitude with an elevation of 1540m approximately. Sumi Christian Mission Centre which was established by the American Baptist Mission and CBCNEI Guwahati in 1938 is located in this place with a Theological College run by SBAK (Sumi Baptist akukuhou kuqhakulu) located 28.2 km away from the district headquarter and 10 km away from Nagaland University, Lumami. It is a beautiful and a peaceful environment. It is said that the government of Nagaland opened the tourist destination centre to promote the village as a wellness centre apart from showcasing the tribal culture of the region.
7. **Nagaland University:** Nagaland University Lumami Campus is located in Zunheboto District at Lumami village and it is located in the Northern most part of Zunheboto district and lies between 26° 13' N latitude and 94° 28' E longitude. Nagaland University is the only Central University in Nagaland which was

established in 1994 as the 13th Central University of India by the Act of Parliament, Government of India, 1989. Nagaland University campuses are spread across the State at Lumami, Kohima, Medziphema and Dimapur with Lumami Campus as its Headquarter. The foundation stone was laid down by the late Prime Minister of India Rajiv Gandhi on November 1987 at Lumami Campus. Prof. I. Yanger was appointed as the first Vice Chancellor of Nagaland University on 20 September 1994. At present D.N. Buragohain is the chancellor and Prof. Pardeshi Lal is the Vice Chancellor of Nagaland University. Nagaland University has 66 affiliated colleges which offer different courses in 43 disciplines at University and college level with the aim to impart infrastructural and research facilities of learning as deemed fit and provide best knowledge so as to train the students to be able to face the world boldly. It offers courses at UG, PG and PhD levels in the fields of Science, Humanities and Social Sciences, Business and Management studies, Engineering and Mass communication and Media which was approved by UGC. Nagaland University ranked 95th among universities in India by (NIRF) National Institutional Ranking Framework in 2018 and 101-150 bands among all the universities in India by NIRF in 2020 and 151-200 band overall. Nagaland University Lumami campus is spread over 802 acres and it is located at Lumami village which is 42 kilometre away from the district headquarter Zunheboto town and 22 Km away from Mokokchung district.

Besides there are many natural beauty and scenic places that can attract the tourists in the district which needs to be developed, preserved and maintained for the sustainable development. There are many historical places in all the villages which can be preserved and maintained for making the tourist destinations.

2.15 Economy

Agriculture is the primary economic activities of the people in the district. Most of the people living in the rural area depend on agriculture and forest resources. Shifting cultivation is one of the main agricultural activities practiced in the district and most of the cultivation is done for home consumptions and only few surplus are brought to market for sell but not everyone are involved in selling their surplus. In Zunheboto district 90% of the populations in the rural areas are engaged in agricultural activities and the remaining 10% who are not engaged in agriculture sectors are old aged people and those involved in government sectors. The people in the district depend directly or indirectly on agricultural activity, livestock and animal husbandry. Horticulture and handicraft are also some of the economic activities in the district. Many of the people in the district are blessed with good artisans where women are engaged in making different kinds of traditional dresses and ornaments while men are engaged in making different kinds of wooden crafts like furniture, wooden plates, baskets etc. The people in the district are also good in blacksmithing and they made their own agricultural tools and some people get good earnings by making different tools and crafts. The people in the district are also involved in commercial plantation activities like coffee, tea, banana, cardamom, pineapple and orange plantations etc. Cardamom is one of the common plantations of the people in the district as it has good commercial value. Rearing of livestock and animal husbandry is also another economic activity in the district where animals like cow, pig, chicken etc are raised for sale, meat and other products etc. Zunheboto District is still lacking behind in the development of industries. Inspite of its backwardness in the development of industries, the district has 1 industrial training centre located at the district headquarters. Besides they also have apiary farms, lemongrass distillation

plants, and citronella plants. Different governmental plans and programme to improve economic activities have improved the life of the people by helping through loans provided for horticulture, poultry, dairy and fisheries, and supply of improved seeds to the farmers.

References

Achumi Hekhevi (2005), *"Sutsah kuthoh",* S.P. printer, Kohima road, Dimapur. Pp 34-42

Assumi Zhekugha (2009), *The Sumi Ahuna*, Heritage publishing house, Dimapur, Nagaland. Pp 61,-63

Aye Kashito (2012), *Nagaland G.K*, current affairs and lastest who's who, 7th edition, ATICOS, Ltd, Dimapur Nagaland. Pp. 2,3

Data based on village level development indicators as on 31 March 2014, Directorate of economics and statistics Nagaland: Kohima, Government of Nagaland. Pp 76-83

District census handbook, Zunheboto, Census of India 2011 Nagaland, Directorate of census operation Nagaland, Series-14, Part XII- B

Ground water information Booklet Zunheboto District, Nagaland, Central ground water Board, North Eastern Region, Ministry of Water Resource, Guwahati, September 2013. Pp 5-6

Ghosh B.B (1979), *Nagaland District Gazetteers*, Zunheboto, Government of Nagaland, Kohima. B.C Bhattachariee at Labanya art press. Pp 4,11

Hutton J.H (1921), *The Sema Nagas*, Macmillan and co. limited St. Martin's street, london. pp. 375

Muru Y. Vihoshe, Zunhesu, *Zunheboto town Platinium Jubilee magazine,2017*

Nagaland Economic Survey 2016-2017, Government of Nagaland, Directorate of Economics and Statistics, Nagaland, Kohima. Pp 70

Nagaland University, Headquarters, Lumami, Prospectus for academic session 2014-15

https://www.flowersofindia.net/catalog/slides/Hairy%20White-Wand.html

https://a-z-animals.com

https://en.wikipedia.org/wiki/Leucosceptrum

https://en.wikipedia.org/wiki/Sumi_Naga

https://Forest.nagaland.gov.in/biodiversity

https://en.climate-data.org/asia/india/nagaland/zunheboto-101263

https://wikivisually.com/wiki/sumi_Naga

Paul A.K and Paul S.K (2017), *Nagaland G.K and current affairs*, J and C Newspaper group (Regd.). Pp 39, 85

Rotokha H.S (2013), Atsa eno pimhe gholah (Akippi eno akiye), Sumi tsaikoh mippi Zunheboto, Nagaland. Pp74

Sema Lhozhevi (2012), *Sumi tsashe anglo sumi dictionary*, sola printing press, Patkai Ghakhu publishing group, dimapur.

Sumi kiphimi Kuqhakulu (1995), *Mhesho mheghi eno Sulimi sutsa*, Modern publications. Pp 9-12

Sumi Alino and Shohe Kimiyekato (2018), Ethnomedicinal plants of Sumi Nagas in Zunheboto district Nagaland, Northeast India, *Acta scientific pharmaceutical sciences*, Research article, Volume 2 Issue 8 August 2018. Pp 21

State agricultural plan, Under NADP/RKVY programme during 12th Five Year plan (2012-17) activities proposed for the state of Nagaland, Department of agriculture, Government of Nagaland. Pp 7

CHAPTER III

AGRICULTURAL SYSTEM OF ZUNHEBOTO DISTRICT

3.1 Introduction

Agriculture is one of the most important primary economic activities of the people and everyone depend on agricultural products for their survival. It also plays an important role in the process of economic development which makes a significant contribution to the economic prosperity. Agricultural sectors contribute to the income of the economic development as it helps to generate income, provide food-stuffs, provision of surplus, People depend on agriculture for their survival and economic development etc and agricultural activities depend on environment for the growth of plants as environmental factors like climate, rainfall, temperature, soils etc influence the development of agriculture. Climatic and soil conditions varies from one place to another so the types of agricultural activities varies from place to place or from one region to another depending on the climatic conditions. Due to variations in environmental conditions, same types of agricultural activities cannot be adopted in all parts of the world.

The types of agricultural activities practiced around the world are sedentary cultivation, Shifting cultivation, Terrace cultivation, Mixed and Multiple farming, Wet or Irrigated cultivation and Dry cultivation. The characters of agricultural activities also differ depending on the method and products of farming. Another types of agricultural activities in the world as mentioned by D. Whittlessey are

Nomadic Herding, Rudimentary sedentary tillage, Pastoral farming or Livestock ranching, Commercial plantation or Tree crop farming, Subsistence farming, Intensive subsistence farming, Mediterranean agriculture, Commercial grain farming, Arable farming. Besides all the types of agriculture of the world, shifting cultivation is one of the common agricultural activities practiced by majority of the people in the world. Sedentary cultivation is also practiced by many of the people. The type of cultivation is not uniform in all the places and it can vary between the same region depending on the availability of agricultural land and interest of the farmers.

Agriculture is one of the main economic activities of people in Zunheboto district. The district is divided into two physiographic region i.e the Western Zunheboto and the Eastern Zunheboto. Sema (2009), stated that the physiographic conditions are partly responsible for the evolution of different drainage systems, soil types and vegetation covers resulting into specific situations, characterized by soil fragility, inaccessibility, specific development of the area. He also said that these varied aspects of physiographic conditions directly or indirectly control the distribution of natural resources and human concentration. Zunheboto district is a hilly area with variation in soil types, climatic conditions, vegetation cover etc. The type of cultivation and kind of crops grown is different depending on the variation of the climatic condition.

3.2 Type of Agricultural System in Zunheboto District

There are different types of agricultural activities practice in Zunheboto District but the two common cultivations is shifting cultivation and terrace cultivation. The types of agricultural activities in the district are discussed in the following:

1. **Shifting Cultivation**

The Shifting cultivation is a distinct type of agricultural practice generally practiced in the hill slopes after sacrificing the forest cover standing over it (Thakur, 1997). Shifting cultivation is one of the common agricultural activities practiced by the people around the world. Sometimes it is considered as environmentally destructive land use practice. It has very low output and input ratio. Today, our landscape is dotted with farms, from small garden plots to huge corporate giants. Virtually everyone on earth relies on farms or farmers for their daily sustenance, Hancock (2004). Shifting cultivation is the most extensive form of agriculture which is still practice by many people based on their traditional knowledge. Jha (1997) stated that shifting cultivation is an age old prehistoric farming system which is still in vogue as the principal mode of subsistence in various pocket of the mother earth. He also stated that the mode of cultivation is more or less same but nomenclature of the practice varies in different regions.

Shifting cultivation is called by different name in different place or region. It is commonly known as 'Jhum' in North Eastern States of India and the cultivators practicing this cultivation are called Jhumians. It is called Ato-lu kichi in sumi dialect, which means hilly field cultivation as it is mostly cultivated in the hilly areas. Shifting cultivation was the first organised cultivation discovered by the ancestors of the Naga, Nshoga (2009). Shifting cultivation is consider as the destructive form of agriculture as it involves cutting down of trees, clearing of forest, and burnings etc which as a result cause deforestation, soil erosion, loss of biodiversity etc. Das (2001) also said that Swidden cultivation which is also known as slash and burn or shifting cultivation represent a distinct stage in the history of mans exploitation of his environment, which seems to have been well established

during the Neolithic period more than 10,000 years ago. Banerjee and Banerji (2010) said that the traditional form of shifting cultivation is widely practiced across Nagaland which occupies about 90% of the area under agriculture. Shifting cultivation is a traditional farming system adopted by the people and it is the primitive form of soil utilization. Shifting cultivation has been described as economy of which the main characteristics are rotation of fields rather than rotation of crops. Shifting cultivation is also called Jhum cultivation or rotational farming. Though there are some positive impact of shifting cultivation, it contribute more to negative impact with the increase of population because every year thousands of hectares of forest cover are cleared for cultivation and it takes years to restore the loss forest cover and also many plants and species living in that part of forest get destroyed and extinct. Forest can be restored by planting and growing more trees but the species of plants and animals once lost cannot be restored. Shifting cultivation is considered as unsustainable method of farming which leaves the forest area unable to support plants and animals life. Therefore proper planning and improved agricultural system should be introduced in such area/region where the only agricultural system is shifting cultivation.

In the study area, shifting cultivation is one of the most common cultivation practiced by all the people. The areas of cultivation depend on the availability of land/forest for cultivation and also depend on the size of the family members. Shifting cultivation is practiced by everyone as they find this cultivation practice to be one of the easiest ways of cultivation as it does not involve much investment like the other types of cultivations. Shifting cultivation is considered as the first step in transition from food gathering and hunting to domestication of plants yielding human food. This food production system is sustainable as long as a site is slashed,

burnt and cropped at an interval of 20 years or longer, Choudhury and Das (2007). Shifting cultivation is also one of the oldest types of cultivation practiced by all the people from the time since when men learn how to cultivate the crop for the food. Agricultural system of Zunheboto district is dominated by the practice of shifting cultivation. The type of cultivations varies between the western and the eastern. In all the villages, both the shifting cultivation and terrace cultivation are practiced but the western part of the district is mostly dominated by the shifting cultivation. In eastern part of the district, shifting cultivation is done mostly for the cultivation of maize and other vegetables. Mixed cropping is practiced with all kinds of crops planted in the same field, whereas, in the Western part of the district shifting cultivation is done for both paddy and maize cultivation with other crops in the field. Maize and other crops are cultivated side by side along with the paddy cultivation.

Stages of shifting cultivation

i. **Selection of the field:** Shifting cultivation is done in group where the head or chief of the village along with the villagers select the plot of land for cultivation. After the selection of the Jhum plot, each individual select their own plot of land and the clearing and cutting of the forest starts after the demarcation of the Jhum plot. In the study area, cultivation is done in the area allotted for the Jhum cultivation each year. In most of the villages, forest is divided into different Jhum plots and each plot of land has different local name. Division of the Jhum plots depends on the size of the village boundary or forest area in the village. In some villages, there are around 8-10 or more numbers of Jhum plots which is called 'Asuye' in Sumi dialect. Area and size of cultivated field depends on the number of people involved in cultivation

and also depend on the year of cropping. Distribution and allotment of Jhum field to the individual family are done after the selection of the Jhum plot.

ii. **Clearing:** After the selection and allotment of land to individual families for cultivation, slashing and clearing of trees and scrubs in the Jhum plots takes place and all the cultivators actively involved in preparing for the cultivation. Both men and women involve in clearing where men are involved in slashing the trees and scrubs while the women prepare foods for the workers. Clearing of forest usually starts at the beginning of the dry season which starts from the month of December till early January depending on the region or village**.** After the slashing of trees and scrubs, all the woods are taken home for different purpose like firewood, timber etc and the remaining bushes and scrubs are spread evenly over the site and then left to dry for weeks or a month for burning.

iii. **Burning:** The burning takes place after drying up of the felled bushes, shrubs, creepers and grasses for some weeks/month. Setting of fire is mostly done by the men and controlling the fire is done by the women. The day for the burning of the field is fixed where burning of the entire jhum field is done on the same day. It takes hours or a day to calm the fire and all the farmers keep vigil till the field is completely burned down or till the fire dies down completely to avoid the spread of fire to other area. The bough of trees or any debris which is not burned in the first burning are then collected and burnt.

iv. **Leveling:** After burning everything in the field the leveling of field are done by using simple tools like spade, hoe and rack etc. Leveling of field is done mainly for cleaning all the unwanted left over debris and to spread the ashes

all over the field as it provide adequate nutrients for the growth of crops. Leveling of field also makes the sowing of the seeds easier.

v. **Bunding:** After the field is ready for the sowing, bunding of the field takes place. Bunding in the field are done by using long logs, trunk of trees or with bamboos depending on the available materials but most of the bunding are done by the felled log that are put across the field by fixing the peg to avoid soil erosion and runoff of water.

vi. **Construction of farm house/Granary:** A small hut or farm house is constructed in every field as resting shed or to stock the paddy/maize. This granary or farm house is constructed using the available resources. In early days, farm house or granary is constructed using simple available local materials like bamboo and roof of the hut is made with dry leaves, thatch etc but at present farm house is constructed with Plastic or with CGI sheets etc. Farm house is constructed for different purposes. It is used not only for taking shelter and storing crops but it is also used as kitchen for cooking for the farmers.

vii. **Cropping:** After clearing and burning of the field, cropping is done and varieties of crops are sown in the same field. Cropping is done using simple tools like dibbling stick and small hoe for sowing the seeds. Planting of various crops like maize, beans, cucumber, yam, ginger etc are done with rice as the main crop. Varieties of crops are sown in the field depending on the climatic condition and fertility of soil. Rice as the main crop is sown in the month of March/April. Crops are sown in a row and sometimes it act as a boundary between the two field. In some field, intercropping of more than 10 to 30 varieties of crops is grown.

viii. **Weeding:** Clearing and removing of weeds starts from the time of sowing till the time of harvest and it requires day to day clearing till the crops are fully grown. Most weeding is usually carried out by women using simple tools like sickle and hoe etc. Sometimes the weeds are removed by hand. In the paddy field, weeding is done in the month of May/June by spreading of salt water in the field mostly among the paddy to prevent the crops from being smothered by weed and also to prevent the growth of weeds. Some other weedicide like Roundup is used to kill the unwanted weeds on the footpath leading to agricultural field.

ix. **Harvest:** First crops are harvested in the month of May/July, and paddy is harvested in the month of September and October. Different crops are harvested at various stages depending on the varieties of crops sown. During the harvesting of the paddy, reaping is done by the men folks while gathering and thrashing of grains is done by the women folk. Grains are threshed in quiver and then collected and stored in a granary. Winnowing is done by two people where one person hold the basket filled with grain while another person winnows the paddy by separating the empty chaff from the paddy. Some farmer use harvesting machine for harvesting paddy. After harvesting paddy, the field is again cleaned for sowing of some root crops and vegetables for sustaining till the new fields are cleared for the next year.

x. **Fallow:** After cultivation for two years, the fields are left as fallow for some years to allow the soil to restore its lost fertility. The fallow periods varies from village to village depending on the availability of forest or Jhum plot area and also on the population of people depend on agriculture. Some farmers cultivate the field only for the first year and left the field as fallow. Fallow period in Zunheboto district is 9-10 years.

Table 3.1: Local Name of Shifting Cultivation around the World

	Sl. No	**Region/Place**	**Local Name**
World	1	Ardennes	Sartage
	2	Brazil	Roka
	3	Central America	Nutpa
	4	Central Africa	Chitamoni
	5	Congo (Zaire River Valley)	Masole
	6	Equatorial African Countries	Fang
	7	Guadeloupe	Echalin
	8	Indonesia	Ladang
	9	Java and Indonesia	Humah
	10	Japan	Karen
	11	Myanmar	Taungya
	12	Madagascar	Tavi
	13	Mexico	Comile
	14	Philippines	Caingin
	15	Sumatra	Djuma
	16	Sri Lanka	Chena
	17	Thailand	Tamrai
	18	Uganda, Zambia and Zimbabwe	Chetemini
	19	Venezuela	Konuko or Conuco
	20	Vietnam	Ray
	21	West Africa	Logan
	22	Yucanta and Guatemala	Mipla
India	1	Andhra Pradesh	Kondapady , Penda
	2	Bihar	Palamau
	3	Himalayan Range	Khil
	4	Jharkhand	Kuruwa
	5	Madhya Pradesh	Penda, , Bewar, Guharh, Farhha, Marhan
	6	Madhya Pradesh (Bundelkhand Region)	Vevar and Dahiya

	7	Madhya Pradesh (Bastar District)	Deepa
	8	North Eastern part	Jhum
	9	Ranchi	Bewara
	10	Kerala (Hilly Region of Western Ghats)	Kumari
	11	Orissa	Podu, Pama Dabi, Rema, Dahi, , Bringa, Gudia, Dongar Chas
	12	Odisha	Kaman, Vinga and Dhavi
	13	Rajasthan	Valre, Waltre
	14	Santhal Parganas	Kurwa or Khallu
	15	Southern States	Zara and Erka
	16	South-Eastern Rajasthan	Batra
North East	1	Arunachal Pradesh (Adis)	Adimdik
	2	Tripura (Reangs)	Hichusisomoms
	3	Meghalaya (Khasis)	Lyngkhalum or Shyrti
	4	Meghalaya (Gaaros)	Bogma
	5	Assam (Karbis)	Inglong Arit
	6	Manipur	Pamlou
Nagaland	1	Ao	Tekong lu
	2	Angami	Nhalie cie
	3	Chakhesang	Mulu Yi
	4	Chang	Tangsek
	5	Khiamniungams	Tso ko
	6	Konyak	Sheih e kah ham pu
	7	Kukis	Thinglhang lou
	8	Kacharis	Ahu dhan kheti
	9	Lotha	Lishon li / Hapo li
	19	Phom	Kah
	11	Pochuri	Azhuhla
	12	Rengma	Ayishule
	13	Sangtam	Akong lu

	14	Sumi	Ato lu
	15	Yimchunger	Akunglu Tiitak
	16	Zeliang	Heta Lu

Source: *Field survey and website*

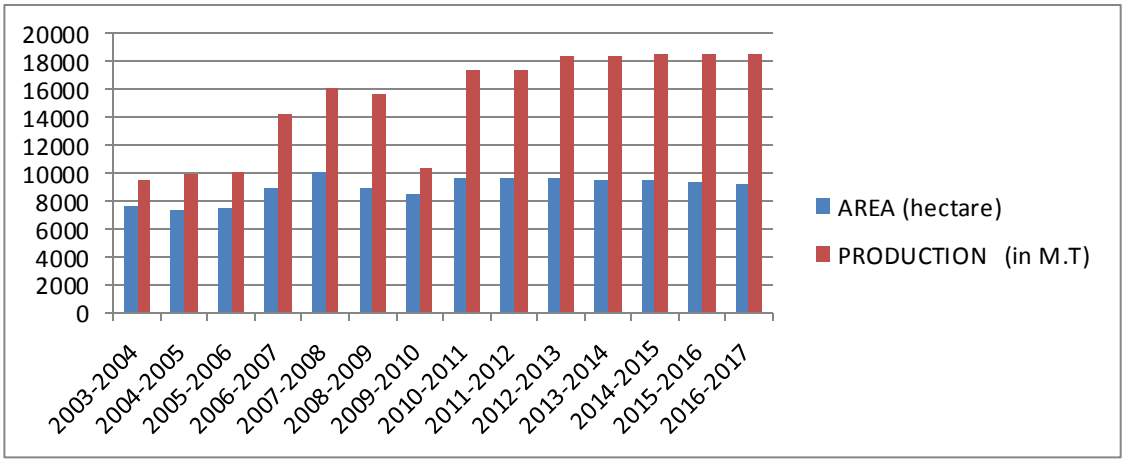
Shifting cultivation is a common type of cultivation practiced across the world and it is called by different names in different regions. Different local names of shifting cultivation across the world are given in Table 3.1. Sometimes it is also called as Swidden agriculture. It is commonly known as Jhum cultivation with different local names around the world.

Table 3.2: Areas and Productions of Jhum Paddy (2003-2017)

Year	Area (hectare)	Percentage	Production (in M.T)	Percentage
2003-2004	7610	6.05	9560	4.49
2004-2005	7380	5.87	9950	4.67
2005-2006	7500	5.97	10050	4.72
2006-2007	8900	7.08	14280	6.70
2007-2008	10140	8.07	16060	7.54
2008-2009	8920	7.10	15710	7.37
2009-2010	8550	6.80	10430	4.89
2010-2011	9720	7.73	17450	8.19
2011-2012	9630	7.66	17340	8.14
2012-2013	9580	7.62	18340	8.61
2013-2014	9560	7.61	18440	8.65
2014-2015	9530	7.58	18470	8.67
2015-2016	9410	7.49	18510	8.69
2016-2017	9260	7.37	18480	8.67
Total	**125690**	**100**	**213070**	**100**

Source: *Statistical Handbook of Nagaland*

Fig 3.1: Area and Production of Jhum paddy in the District (2003 to 2017)



The production of paddy in the district has been increased from 4.49 per cent (2003-2004) to 8.67 per cent in 2016-2017 while the area of cultivation is 6.05 in 2003-2004 and increased to 7.37 in 2016-2017. Comparing to the area of cultivation and production of crops from 2003 to 2017, the production has increased more than the area of cultivation in the district. The increased of production is due to the improved agricultural techniques, usage of different chemicals fertilizers, uses of improved seeds etc. The production of Jhum paddy has increased to 6.70 per cent in 2005-2006 from 4.72 per cent in 2006-2007. There has been a decrease in the production of crops in 2009-2010. The decrease has been dropped to 4.89 per cent from 7.37 per cent._This may be due to the climatic conditions.

Shifting cultivation and Socio Cultural aspect

Shifting cultivation is inseparably linked up with the socio economic and cultural life of the people. Shifting cultivation practice is bounded to cultural practices and beliefs, so to understand the shifting cultivation it is important to know the cultural and social context of the region. The social customs and festivals are also related to the cycle of agricultural activities. Although throughout 12 months of the year, the Sumi's have one or the other ceremony connected with agriculture. Nshoga

(2009) called shifting cultivation as the simplest and busiest method of cultivation as the activities of its operation involves around the year. Luuh (January) is the month when cutting down of trees and clearing of the forest takes place for sowing crops which is done in the next month Suphuh (Feburary). **Tuluni** is a festival celebrated in the month of July when the first produce of crops is collected from their agricultural fields and it is celebrated for five days, the fourth day being the most important where prayers and offerings to the deity for the fruitfulness who grow and protect the crops takes place. **Ahuna** is a traditional post harvest festival celebrated in November (Ghile qhi). Ahuna is celebrated when the paddy is harvested. The new rice is pounded and tested by cooking the rice in bamboo. After the harvest, another plot of land is selected by the villagers along with the village head for next cultivation. Shifting cultivation is done in group to prevent and protect the field from the attack of the wild animals and birds. One common footpath connecting the village to Jhum fields is maintained by the villagers. It is said that in early days people count their age from the cycle of shifting cultivation. Shifting cultivation is deeply rooted in the life of the people which evolved through the years and reflected in their customs, beliefs and folklore etc.

The yearly festivals of Sumi tribe related to shifting cultivation

In early days in all the Sumi villages, people observed and celebrated different festivals in a year. All the rites and rituals for the celebration of the festivals differ from place to place and village to village. But it is said that majority of festivals were common to every villages. Among all the festivals, only two festivals are still followed and celebrated in the present time. The following are the festivals which were celebrated and observed by our forefathers in early days.

1. **Asuyekiphe pine**: This festival is observed for making the purification for the starting of the new field for cultivation. During the festival, people are not allowed to do any works. After this festival, clearing of the forest for the cultivation is done.
2. **Lu-u pine**: This festival is celebrated after the clearing of the forest for cultivation. During this festival, the rites and rituals for the burning of the field are done.
3. **Visavela:** This festival is observed before the sowing of the seeds in the field to ascertain the program for the cultivation. This festival is observed for the protection of the field from the bad climatic condition and insects from destroying the crops.
4. **Litsapa/Kichimi yeh**: Litsapa means a blessing ghost and kichimi yeh means old usages or practices. Some people called this festival as litsapa festival while some called it as kichimiyeh. It is celebrated twice in a year. One before the sowing of seeds and another before the starting of the harvesting. This festival is observed for the litsapa to bless the crops in the field.
5. **Asukuchu pine**: This festival is also observed twice a year. One before the sowing of seeds and another before the harvesting of crops. This festival means killing a pig and having feast on the foot path of the field before the sowing and also before the harvesting.
6. **Amutukusa or Alu chike keu pine**: This festival is observed when the crops in the field started to grow up and when the time for the cleaning of the field started. Weeds in the field are clean during this time.
7. **Tuluni or Anni**: One of the most important festivals for the sumi people. Tuluni is celebrated in the month of July. Tuluni is a celebration for the plentiful growth of crops in the field. Tuluni is the month of joy and making peace not only with the relatives but with others as well.

8. **Ashi aghu phikimthe**: This festival is observed in the beginning of the year just before the clearing of the new field for cultivation. It is a festival for the purification or cleaning of their body, machete, spears and clothes etc.
9. **Saghi**: This festival is celebrated after Tuluni when all the harvested crops were brought home. It is a celebration of plentiful or abundance of crops after Tuluni festival.
10. **Ahuna kuchu**: Ahuna is celebrated after all the harvested crops and paddy is brought and kept inside the granary or barn. The new rice is pounded and tested by cooking the rice in bamboo.
11. **Ana phikimthe**: This festival isobserved once after every three years. All the man in the village goes to the resting place away from village and prepares a camp to sleep overnight and have a feast. And the next morning they will clean their machete, spears, wash their clothes and went home. The next day they burn a new fire in a new grill and cooked with fresh water.

All the above festivals are related to the agricultural activities. All the rites and rituals are performed and observed before and after the cultivation of crops. The blessing for the growth of crops and harvesting of the crops is one of the most important for the people. Therefore all the festivals throughout the year were all related to the agricultural activities. But with the advancement and development in the present generation and with the coming of Christianity, many of the rites and rituals of the past are not followed and people depend more on the advancement of technology and knowledge for the better cultivation of crops without performing the rites and rituals of the past. But as a Christian, the prayer before the sowing of crops in the field is done in the church for the blessing known as Ghixu kighini tsala (Sowing prayer day) in the month of March, Ghile kighini tsala (Prayer day for harvest) invoking God's help to

start the harvest is done in the month of August and thanksgiving prayer and offering to God is done after the harvesting of crops.

Two main festivals which is celebrated at present

The Naga festivals are generally aimed to increase fertility and correspond to different agricultural operations and the festivals are intertwined with a spiritual sentiment and the predominant theme of all such festival is offering prayers to the supreme one who is referred by different name in different groups (Rizvi and Roy, 2006). At present, only two festivals are celebrated by the people of Sumi tribe. They are as follows:

Tuluni Festival

Tuluni or anih is one of the most important festivals for the Sumi tribe. In early days during our forefather time, Tuluni festival are celebrated by the Sumi people in different time according to the villages as there are differences in the western dwellers and eastern dwellers. But in 1966 the Sumi tribal council decided to celebrate this festival on the same day and declared 8 July as restricted holiday in Nagaland state. Tuluni festival is celebrated in the month of July or anih qhi. In early days it was believed that the paddy and other crops in the fields do not grow well if this festival is not celebrated. It is celebrated for one week, the fourth day being the most important where prayers and offerings to the deity for the fruitfulness who grow and protect the crops takes place. Tuluni is also a festival for a peace making, forgiveness and day for happiness. Following are the seven days celebration of Tuluni Festival:

1. **Asuzani (Monday):** The word 'Asu' refer to millet. Millet is the first among all the crops to be sown in the field so it is observed on the first day. On this day, the

first harvested millet is cooked and tasted as millet is the first harvested crops among all the planted crops.

2. **Aghizani (Tuesday):** Aghi means paddy. Paddy is the second crop to be sown in the field and it is one of the most important crops among all the crops. So Aghizani is observed in the second day. On this day, a kind of rice beer called as aqqhicho is prepared and drinks. After that, all the tools used in agricultural activities are kept in a safe place away from rain and water so that the paddy and millet will grow well.
3. **Ashighini (Wednesday):** Ashi means meat. It is the day where animals are killed for the Tuluni feast. This day is considered as one of the important days among all the days. It is said that if the meat is not cooked on this day then the crops does not grow well. So for the crops to grow well, they have to cook meat by any means.
4. **Annighini (Thursday):** This day is also a very important day of Tuluni festival. This is the day to share happiness and joy to others. It is a day to make peace with others. On this day they do not do any work as they believe that cyclone may come and destroy their fields, they do not touch the plants thinking that the crops may cling among themselves and also the people do not comb their hairs thinking that the flood may destroy their fields.
5. **Mucholani (Friday):** This is the day when all the men clean the footpath to the field, surroundings of the village and paddy barn or granary. All these clearings and cleanings of the barns and footpaths are done so that there will not be any problems during the harvesting season. First they eat food and clean the barn because if they clean the barn with the empty stomach then the barn spirit may bring quick exhaustion of the foodstuff. It is also a day of making peace and forgiving each other.

6. **Tupulani (Saturday):** Tupu means young. On this day all competitions for games and sports are played. Tuluni is a festival for making peace and making compromise among people if they have any conflicts before the festival. During the Tuluni festival, people make peace among themselves as during this festival God make peace with people. It is the day for giving meals to other for making peace by inviting poors, orphans, baby sitters etc. In some village, women folk go to field for collecting vegetables. Some call this day as Laghe pine as the footpaths connecting their village to other villages, agricultural fields and resting places are cleaned on this day.
7. **Tugha khani/Tugha lakha (Sunday):** The celebration of Tuluni festival ends on the 6^{th} day and the 7^{th} day is prohibited for going on a journey or to do any work. This day is considered as the wicked day and it is the sacred day for everyone. In early days, Tughakhani day was spend carefully and the Tuluni festival was concluded on this day.

Ahuna Festival

Ahuna is a traditional post harvest festival celebrated in November (Ahuna qhi). 'Ahu' is the act of taking out the rice at the top on the granary and 'Na' is rice. Ahuna is celebrated after all the harvested crops and paddy are brought and kept inside the granary or barn. The new rice is pounded and tested by cooking the rice in bamboo. To take out the first rice from the barn, it is done very carefully by saying 'Chumpa shompamo no chupuh shopuh peniu' meaning "Let there be no early exhaustion of foodstuff but let there be abundant in consumption of this food" and they take out the rice. The next morning the rice will be cooked in the bamboo and in the evening they will take that empty bamboo to the field and will toss for the next year cultivation. They slice that burnt bamboo into two pieces and it will be thrown into the air and say

'In this time of cultivation, let there be no sickness, death and let there be no misfortunes in the family'. If both the bamboo falls on the same position, it was considered as a sign of ill omen. If both the bamboo pieces look downwards then it is considered as a sign of death or short life, and if both the pieces look upward then it is the sign of quick exhaustion of foodstuffs. But if one piece of bamboo look upward and the other one face downward then it shows the sign of good fortune for the next cultivation. After that they throw away both the bamboo piece, one on the wet area side and other on the dry side of the area.

2. Terrace Rice cultivation

Terrace cultivation is the methods of farming where the terraces are build on the slopes of hills for cultivation and this type of farming made the cultivation of crops possible in the hilly and mountainous region or area. Terrace cultivation is a grading steep land on hillside where a series of level benches are built for growing different crops and it was started thousands of years ago. China, Japan, Phillippines, Southeast Asia, Africa and Andes of South America are some countries which practice terrace cultivation. Terrace agriculture and irrigation in general are also important facts in Naga engineering (Nuh, 2016).

Terrace cultivation is the type of farming which is mostly used for the rice cultivation. The types of cultivation differ from one region to another where some practice this type of farming for cultivating varieties of crops but in the North eastern region, terrace cultivation is practiced mostly for rice cultivation. Cultivation is done by using traditional tools as the use of modern machineries is not possible in the hilly area.

It is said that Terrace Farming is invented by the Inca people who lived in the South American mountains. This type of farming prevents the soil nutrient from washing away by the rains which helps in the reduction of soil erosion and water loss. In the study area, there are two types of terrace field. One is called Ato kulu which means Terrace field in the hilly area and Akulu are those fields near the river. Terrace rice cultivation is found in all the areas of the study area but terrace rice cultivation is practiced mostly by the people in the eastern part of the district. Majority of the terrace rice cultivation is practiced by the people living near the river. Terrace cultivation is done for the cultivation of the paddy and some people cultivate for the second cropping where peas and mustard leaves are grown. After the harvest of the paddy, the terrace field is burned and some crops are sown for second cropping.

Many of the Terrace rice cultivation are found near the River bank. All the other Terrace rice cultivation found in the hilly areas is those areas where the drainage system is available. Majority of terrace field is found in Tizu river, Tsutha river, Mela and some in Langki river of the district and people involved in terrace cultivation are mostly from the villages located near the river. Doyang river pass through the western side of the district but no terrace field is located in the river bank and villages located around the river mostly practice shifting cultivation as the water level increase with season which can destroy the field in the river bank.

In the study area, terrace rice cultivation is done mostly using traditional tools and ploughing of the field is done by cow/bull, man force etc. Following are the steps involve in Terrace Rice cultivation:

1. **Clearing and cleaning:** Cleaning and clearing of the terrace field starts in the months of March/April where the weeds are removed using traditional

tools or by hand. After cleaning of the terrace field, they start preparation for the ploughing of the field.

2. **Sowing of seeds**: Preparation of seedbed is done near the terrace rice field and seeds are sown in the seedbed where the seeds are allowed to grow before transplanting in the terrace field.
3. **Ploughing**: After cleaning and clearing of the field, ploughing is done by the bull with the help of men. After the ploughing is done by the bull, another round of ploughing is done by using hoe and other tools to prevent the growth of weeds. Ploughing is done frequently to make the soil softer. For ploughing of the field the farmers rent a bull where they had to pay 600 rupees for a day.
4. **Irrigation**: Water is connected to the terrace rice field from the available water source by constructing irrigation. Water is poured in the field to soften the soil before planting of paddy plant. Soil is soaked for few days till the soil become soft for the planting of paddy in the terrace field.
5. **Second cleaning and clearing**: Another round for clearing and cleaning is done after pouring of water in the field to check if all the soil is completely soften and leveling of the soil is done before the planting of the seedling.
6. **Planting**: Seedling is transplanted in the field after 20-30 days in the month of June/July. Some areas like in Mela river area, seedling is planted in the month of May.
7. **Weeding**: Weeding is done from time to time to prevent the growth of weeds in the paddy field. Removing of weeds starts when the plant is fully grown and second weeding is done when the paddy starts to bear seeds.
8. **Draining of water:** Irrigation is done only during the growing period of paddy from June to October and pond water is drained out from the field

when the paddy starts to bear the seeds. Water is also drained from the field for the plant to bear more seeds.

9. **Bunching**: Bunching of the paddy starts in the month of September/October. Paddy in the field is bunched together to protect the plants from the damage by the wind or to hold the plants from the weight of the grain and also it makes the harvesting easier.
10. **Harvest:** Harvesting of the paddy is done in the month of November. Harvesting is done in group where men cut down the paddy and women involve in collecting and threshing.

Transplantation method in terrace cultivation

Nursery area is prepared for the seed to grow before being transplanted to terrace field. The seedling sprout after 3 to 4 days and were transplanted to the wet field between 20-30 days. In some regions these seedlings are transplanted in the Terrace rice field in the month of May and some regions transplant between June and July depending on the preparation and cleaning of the field.

In Zunheboto district, many villages practice terrace rice cultivation but majority of the terrace field is found in eastern part of the district where majority of the terrace field is located in Tizu, Mela and Tsutha river. In the western area hilly terrace field is found with few terrace field in each villages. Some villages like Lumami, Khrimitomi, Awotsakili villages have abandoned the terrace field and prefer more on the shifting cultivation.

Terrace cultivation is one of the eco friendly agricultural systems but there are many factors which force people to choose other types of agriculture system. For terrace cultivation there should be enough land, construction of terrace field is also

not possible in the loose soil. In the study area, it is found out that some people abandoned terrace rice cultivation field for many reasons specially those terrace fields which are located in the hilly area. Some of the reasons which lead to the decrease of Terrace Rice Cultivation in the district are given below:

1. Distance between the field and village: Most of the Terrace field are located near the river or streams for the water supply and it become difficult for the individual family to cultivate the field located far away from the settlement due to many reasons like maintaining of the footpath, transportation problem, fear from the wild animals etc.
2. High capital investment: Cultivation of terrace fields involves capital investment for maintaining the field and most of the farmers cannot afford for the maintenance of the field, they go for the less capital investment and they found shifting cultivation as the easiest way of cultivation.
3. Irrigation problem: Many of the terrace field located in the high hills face the irrigation problem and if water channel connecting to terrace field is not maintained properly, it cause landslide, shortage of water etc.
4. Lack of interest: With many facilities provided by the government to the villagers and farmers, people focus more on the other economies like plantation activities and depends more on the market products than on cultivation. Shifting to the economy activities leads to the abandonment of the terrace field.
5. Ploughing is done by the bull and not all the farmers own a bull for ploughing the field so they hire a bull from the people who owned a bull. The ploughing by the bull is done twice a day i.e morning and evening where they had to pay 300 rupees for the morning 5 hours and 300 rupees for the evening

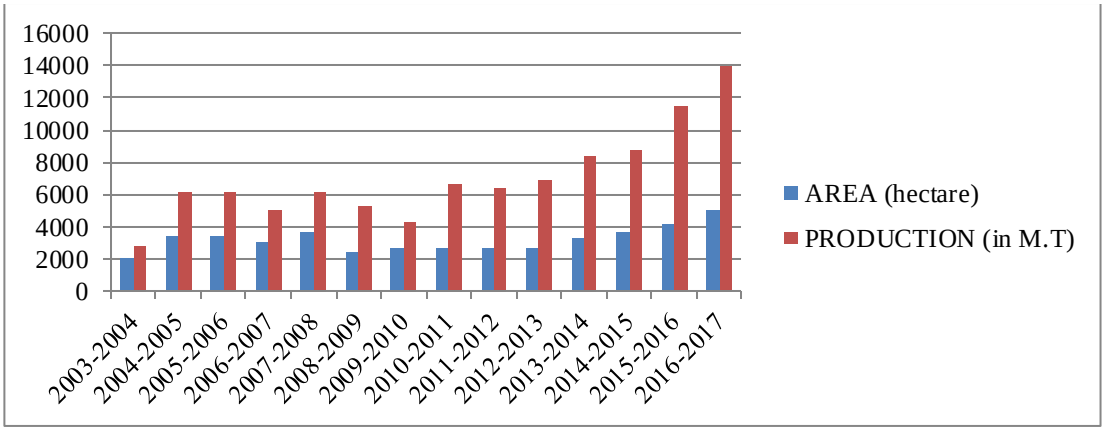
4 hours of ploughing, all together it cost 600 rupees for one day. Therefore it becomes a problem for some people to afford the hire of the bull.

Table 3.3: Area and Production of Terrace Paddy (2003-2017)

Sl. No	Year	Area (hectare)	%	Production(in M.T)	%
1	2003-2004	2050	4.59	2790	2.84
2	2004-2005	3400	7.61	6100	6.20
3	2005-2006	3450	7.72	6170	6.27
4	2006-2007	3000	6.71	4990	5.07
5	2007-2008	3630	8.12	6120	6.22
6	2008-2009	2450	5.48	5290	5.38
7	2009-2010	2620	5.86	4350	4.42
8	2010-2011	2680	5.99	6710	6.82
9	2011-2012	2630	5.88	6400	6.51
10	2012-2013	2740	6.13	6860	6..97
11	2013-2014	3240	7.25	8420	8.56
12	2014-2015	3620	8.10	8740	8.89
13	2015-2016	4210	9.42	11500	11.69
14	2016-2017	4980	11.14	13920	14.15
	Total	**44700**	**100**	**98360**	**100**

Source: *Statistical Handbook of Nagaland*

Fig 3.2: Area and production of Terrace paddy from 2003 to 2017



The area of cultivation and the production of terrace paddy in the district have been increased. The area of cultivation has increased from 4.59 per cent in 2003-2004 to 11.14 per cent in 2016-2017. The production of paddy has also increased

from 2.84 per cent in 2003-2004 to 14.15 per cent in 2016-2017 out of total 98360 M.T production of Terrace paddy from 2003 to 2017.

3. Plantation Activities

Commercial plantation is commonly known as the plantation farming and also called as tree crop farming or Industrializing agriculture. This has a high commercial value and covers a large or small area for cultivation depending on the availability of land for cultivation. The practice of Commercial plantation requires a high capital investment and requires the land for cultivation. Cultivation of commercial crops like tea, coffee, cardamom etc has been encouraged by the Government and supports the farmers in different way by providing loan, supply seeds and seedlings etc. Many of the people in the district are involved in plantation activities for the commercial purpose as well as for the individual benefits maintained either with the help of government or by individual.

Table 3.4: Plantation activities in the surveyed villages

Sl No	**Circle**	**Sl No**	**Village**	**Plantation/ Commercial**	**Common crops**
1	Aghunato	1	Khewoto	Tea, Cardamom, ginsing	Potato, beans, maize, cabbage, watermelon
		2	Nihoshe	Ginger, Banana, Orange	Grams
		3	Ghuvishe	Banana	Beans, Maize
		4	Lukikhe	No	Potato, beans, chilly, Pumpkin
		5	Shevishe	No	Potato, beans, chilly, pumpkin
		6	Hoshepu	Cardamom (few)	Soyabean, maize, beans (all crops)

2	Asuto	1	Khumishi	Cardamom (highest)	Maize, chilly, Pumkin
		2	Satami	Cardamom	All crops suitable
3	Zunheboto sardar	1	Baimho	No	Potato and peas
		2	Lizu aviqhato	No	Beans, potato, ginger, pumpkin
		3	Natha old	No	Potato, beans, soyabean
		4	New land	No	All crops
		5	Shotomi	Cardamom, coffee, pine	All crops
		6	Asukhomi	Banana and Cardamom (every household)	Colocassia, potato, beans
4	Satakha	1	Hoishe	Banana plantation by all the villgers	Colocassia ,Chilly, beans, ginger
		2	Tukunasami	Pineapple	Colocassia, king chilly
5	Atoizu	1	Vekuho old	No	Pumpkin, Yam, Ginger
		2	Naghuto old	Cardamom, Banana, Orange, Kiwi	Colocassia, Pumpkin
		3	Naghuto New	Banana, Orange, Cardamom	Colocassia, Pumpkin
6	Suruhuto	1	Tichipami village	Cardamon (Majority), Kiwi, Mechinga(majority)	All crops
		2	Surumi	Cardamom, Banana	Beans, chilly, ginger, millet, cucumber (All crops)
7	Ghathashi	1	Kughutomi	Cardamom, Orange, Rubber	Ginger, chilly
		2	Kichilimi	Cardamom, pineapple, Rubber, orange, banana	Colocassia, chilly, ginger

8	Satoi	1	Ikiye	Banana (Majority), Gauva, orange, Cardamom	All crops
		2	Itovi	Cardamom	Beans and soyabeans
9	Akuluto	1	Lumami	Yongchak (Petai), coffee, Tea	Colocassia, ginger, chilly
		2	Zaphumi	Litchi, Orange, Lemon, Tea, coffee	Colocassia, ginger, chilly
10	Pughuboto	1	Kitami	Orange, pineapple, banana, Cardamom	Ginger
		2	Lazami	Dry Beans (Akixi)	Maize, Colocassia, Pumpkin, beans, chilly, millet, barley, brinja, bitter gourd, soyabean
		3	Puneboqa	Pineapple, Banana, Orange	Soyabean and colocassia
11	VK	1	Litta new	Coffee, Ginger, Turmeric, Tea plantation	Pumpkin, Ginger, Colocassia
		2	Litta old	Coffee, Ginger	Pumpkin, Yam ,Ginger
12	Saptiqa	1	Shena old	Coffee, orange	King chilly, pumpkin, colocassia
		2	Shena new	Cardamom, orange	Ginger, Colocassia, pumpkin
		3	Usutomi	Orange, Yongchak (Petai), Cardamom,	Ginger, king chilly, Perilla, soyabean,
		4	Zhevishe	Yongchak (Petai), orange, cardamom	Ginger, Colocassia,king chilly
		5	Saptiqa	Ginger, orange, Yongchak (Petai)	Ginger, Colocassia, Tapoica

13	Akuhaito	1	Khirimitomi	Ginger	Ginger, Pumpkin, chilly, bitter ball, Colocassia
		2	Akuhaito Town	Sugarcane, coffee, cardamom, Orange	Maize, cucumber, Pumpkin
		3	Roto old	Coffee, Ginger	Pumpkin, Ginger
		4	Roto New	Ginger, coffee	Pumpkin, Ginger, Colocassia

Source: *Field survey (2016-2019)*

There are many plantation activities taken up in the district and it is cultivated by those who owned agricultural land. Among all the different kinds of plantation activities in the district, Cardamom is one of the common plantation activities taken up by the majority of people in the district as cardamom has more commercial value comparing to other plantation.

Table 3.5: Area under coffee plantation in Zunheboto District

Sl. No	Year	Physical Target (in Ha.)	%
1	2015-16	15	3
2	2016-17	75	17
3	2017-18	110	25
4	2018-19	150	34
5	2019-20	95	21
Total Physical Target (Ha)		445	100
No. of Household identified (2015-2020)			900

Source: *Nagaland Economic Survey 2016-2017*

Coffee plantation has been introduced in the State in collaboration with the coffee Board of India. A five year comprehensive plan has been setup in the State in the entire district with target coverage of 5000 hectares across the district to promote coffee plant. The above table shows the details coverage of coffee plantation in

Zunheboto district. Total number of Household identified during 2015 to 2020 physical target for coffee plantation in the district is 900 household. Physical target for coffee plantation is highest in 2018-2019 with 150 hectares (34%) and lowest in 2015-2016 with 15Hectares (3%) of the total target area.

4. Home garden

This is the type of cultivation where the crops are grown near the household and is used for growing different kinds of vegetables, fruits, medicinal plants and other food crops for the family. The sizes of the cultivation depend on the availability of the land. The larger the areas of cultivation, it become more like a permanent cultivation. Different kinds of crops are grown in this type of cultivation where one or the other crops is always available in the garden. This type of cultivation is done adding organic manure which is healthier than the other types of cultivation. In the district, almost all the surroundings of the house are occupied with home gardens except those areas which are occupied by the compact settlements and lands occupied by the people in the rented house. Varieties of crops are grown throughout the year with season. Beginning of the year starts by growing of mixed crops like potato, chilly, bean, yam, garlic, onion, ginger, cabbage, tree tomato etc with maize as the main crop. In colder area, mustard leaves and other vegetables occupied the garden whereas in the warmer area tapioca is more dominant. Varieties of crops are grown in the home garden depending on availability of land and the needs of the family. Many of the people managed to maintain their home garden in different ways. The size and type of garden depend on the availability of land and also depend on the proper utilization of available land and area by the people. Some people even managed to cultivate varieties of crops from the house terrace by putting the soil in some basket or whatever possible way they could manage. Home garden is

cultivated by applying manure from time to time and one of the common manures apply in the garden by the people is pig manure and some even apply chicken and cow manure if available. In colder area, one of the most common vegetables grown in every house is the Chayote which is commonly known as iskos in Sumi dialect. It is grown for both the home consumption and also to feed the domestic animals. Some vegetables are grown in the home garden for sale like the leafy vegetables. One of the common vegetables that are grown for sale is the mustard leaves. According to the survey conducted by NEPED in 185 villages across Nagaland showed that about 4 percent of village land is used as home garden. Home garden act as a trial place for growing new crops before it is cultivated in the field. It also provides food to the family during the lean period and act as security food provider to the family at all time. Varieties of medicinal plants are also grown in the home garden where the plants are used as pain reliever and for different purpose. Some of the people prefer to settle in the outskirts of the village or town so as to cultivate a larger home garden so that the crops cultivated can be use for home consumption as well as for the commercial purpose.

5. Livestock and animal husbandry

Ever since man started farming in organized form, the need for draft animals for cultivation was increasingly felt and the domestication of animals started (Lekhi and Singh, 2016). Rearing of livestock and animal husbandry is another economic activity which acts as supplements of farmer's income. It also provides self employment opportunities and foods to the people and helps in the economy of people in the district. Rearing of Livestock is done for both home consumptions as well as for commercial. Chicken and pig are commonly reared by majority of the people for meat.

Table 3.6: Comparative statement of 17th, 18th and 19th Livestock census of Nagaland

Sl. No	Species	17th census, 2003	%	18th census, 2007	%	19th census, 2012	%	Growth rate of per cent 19th census over 18th census (Per cent)
1	Cattle	451017	10.44	469818	9.35	234974	7.36	-49.99
2	Buffalo	33757	0.78	33920	0.68	32648	1.02	-3.75
3	Mithun	40452	0.94	33355	0.66	35258	1.10	5.71
4	Pig	644214	14.92	697790	13.89	503688	15.79	-27.82
5	Goat	174929	4.05	178072	3.54	99350	3.11	-44.21
6	Rabbit	38408	0.89	41922	0.83	44227	1.39	5.50
7	Dog	141373	3.27	161617	3.22	113021	3.54	-30.07
8	Poultry birds	2672554	61.89	3282196	65.34	1995485	62.53	-39.20
9	Duck	116576	2.70	120131	2.39	125961	3.95	4.85
10	Sheep	4187	0.10	3649	0.07	3815	0.12	4.55
11	Horse & Pony	893	0.02	799	0.02	473	0.01	-40.80
12	Turkey					1592	0.05	
13	Quail					657	0.02	
Total		**4318360**		**5023269**		**3191149**		**-36.47**

Source: *Nagaland Economic survey 2016-2017, Economic and Statistic Department*

Table 3.6 shows the comparative statement of Livestock census of Nagaland during 17th, 18th and 19th livestock census. There is a decrease in the numbers of livestock in 19th livestock census comparing to 17th and 18th livestock reports. It is said that the negative growth is reportedly attributed to errors in the technique of conducting the census. Turkey and Quails are included in the census during 19th livestock census.

Table 3.7: Number of Livestock and Poultry as per 19th Livestock 2012 of Zunheboto district

Sl. No	Species	Livestock census	%
1	Cattle	27292	8.28
2	Buffalo	14	0.004
3	Mithun	7318	2.22
4	Pig	59691	18.10
5	Goat	9678	2.93
6	Rabbit	917	0.28
7	Dog	14305	4.34
8	Fowl	205112	62.19
9	Duck	5476	1.66
Total		**329803**	**100**

Source: *Statistical handbook of Nagaland 2016*

Livestock and poultry have been reared by many people in the district. Total livestock of the district during 19th livestock census 2012 is 329803 numbers. Rearing of Fowls is highest in the district with 62.19% followed by Pig with 18.10% and rearing of buffalo shows the lowest number with 14 (0.004 %) of the total livestock in the district. Zunheboto district contribute 10.33% of total livestock in Nagaland during 19th livestock census 2012. In the study area, chicken is found in almost all the household for own consumption and some for the commercial purpose. Pig is another important livestock commonly reared by many people for meat as consumption of pork is common in all the occasion and festivals. Rearing of Mithun, Buffalo and Cattle are mostly done by the people living in the villages. It is said that there are about 250 Mithuns in Saptiqa area alone.

Table 3.8: Total Number of Towns and Villages with total population and agricultural activities in Zunheboto District, Nagaland

SL. No	NAME OF CIRCLE		Agriculture		Population (2011 census)
	No. of villages	VILLAGE NAME	Shifting	Terrace	
1	Aghunato circle with 27 villages And 2 towns	**Aghunato Town**	Yes	Yes	2883
2		Aghiyilimi	Yes	Yes	373
3		Aquabami new	Yes	Yes	427
4		Aquabami old	Yes	Yes	131
5		Ghokishe	Yes	Yes (less)	321
6		Hoshepu	Yes	Yes	1091
7		Keltomi	Yes	No	616
8		Khekiye	Yes	Yes	846
9		Khetoi	Yes	Yes	1077
10		Khewoto	Yes	Yes	694
11		Khukishe	Yes	Yes	1056
12		Lukhuyimi	Yes	Yes	507
13		Lukikhe	Yes	No	860
14		Luthusumi	Yes	Yes	897
15		Luvishe New	Yes	No	121
16		Luvishe old	Yes	Yes (less)	364
17		Melahumi	Yes	No	402
18		Nihoshe	Yes	Yes (less)	585
19		Phuleshetomi	Yes	Yes	424
20		Shevishe	Yes	No	1017
21		Thokihimi	Yes	Yes	618
22		Tokiye Town	Yes	Yes (less)	459
23		Tsukomi	Yes	Yes	635
24		Tsutha Hydel project	Yes	Yes (less)	9
25		Guvishe	Yes	Yes	635
26		Viyilho	Yes	Yes (less)	540

27		Viyixe	Yes	Yes	492
28		Yezashimi	Yes	Yes	713
29		Zheishe	Yes	Yes	286
1	Asuto circle with 20 villages and 1 town	**Asuto Town**	Yes	Yes	423
2		Achikuchu	Yes	Yes	718
3		Aghulitomi	Yes	Yes	227
4		Akhakhu	Yes	No	250
5		Asuto village	Yes	Yes	234
6		Atunakugha	Yes	No	248
7		Kathara	Yes	No	291
8		Khumishi A	Yes	Yes (less)	194
9		Khumishi B	Yes	Yes (less)	376
10		Koiboto	Yes	Yes (less)	287
11		Kikhevi	Yes	No	203
12		Kitahumi	Yes	No	150
13		Lizutomi	Yes	Yes	759
14		Nogzubomi	Yes	Yes (less)	487
15		Nizhevi	Yes	Yes	161
16		Satami	Yes	Yes	1282
17		Tuzuhumi	Yes	No	100
18		T. Island S/comp	Yes	Yes (less)	111
19		Tazuhumi	Yes	No	135
20		Yeshito	Yes	No	120
21		Yevishe	Yes	No	136
1		**Zunheboto Town**	Yes	Yes	22633
2		Asukhomi	Yes	Yes	1406
3		Baimho	Yes	Yes	529
4		Ghukiye	Yes	Yes	891
5		Hekiye	Yes	Yes	130
6		Kawoto	Yes	Yes	381
7		Kheshepu	Yes	Yes	91

8	Zunheboto circle with 23 villages and 1 town	Kulhopu	Yes	Yes	497
9		Lizu new	Yes	Yes	513
10		Lizu old	Yes	Yes	770
11		Lizu Aviqato	Yes	Yes	512
12		Lizu Naghuto	Yes	Yes	631
13		Lochomi	Yes	Yes	921
14		Natha old	Yes	Yes	466
15		Natha new	Yes	Yes	546
16		Newland	Yes	Yes	291
17		Nikuto	Yes	Yes (less)	265
18		Sheipu	Yes	Yes	980
19		Shotomi	Yes	Yes	407
20		Sukhalu	Yes	Yes	523
21		Xukhepu	Yes	Yes	506
22		Yemishe	Yes	Yes	702
23		Yezami	Yes	Yes	773
24		Zungti	Yes	Yes	593
1	Satakaha circle with 18 villages and 1 town	**Satakha Town**	Yes	Yes	4964
2		Aghuito S/comp	Yes	Yes	171
3		Ghukhuyi	Yes	Yes	230
4		Hoishe	Yes	Yes	327
5		Khukiye	Yes	Yes	614
6		Kilo old	Yes	Yes	377
7		Kivikhu	Yes	Yes	481
8		Kiyekhu	Yes	Yes	611
9		Lukhai	Yes	Yes	540
10		Momi	Yes	No	381
11		Nunumi	Yes	No	879
12		Satakha village	Yes	Yes	552
13		Shoipu	Yes	No	982
14		Shoixe	Yes	Yes	684
15		Sukhai	Yes	Yes	474

16		Tukunasami	Yes	Yes	458
17		Vishepu	Yes	Yes	847
18		Xuivi	Yes	Yes	1180
19		Zhekiye	Yes	Yes	351
1	Atoizu circle with 15 villages and 1 towns	**Atoizu Town**	Yes	Yes	998
2		Apukito	Yes	Yes (less)	54
3		Asukhuto Town	Yes	Yes	1165
4		Awotsakilimi	Yes	Yes (less)	621
5		Emlomi	Yes	Yes	306
6		Kitsakita	Yes	Yes	97
7		Litsami	Yes	Yes	1251
8		Lokobomi	Yes	No	497
9		Mapulumi	Yes	Yes	609
10		Naghuto new	Yes	Yes	372
11		Naghuto old	Yes	Yes	428
12		Sukomi	Yes	Yes	419
13		Vekhuho old	Yes	Yes	784
14		Vekhuho new	Yes	Yes	451
15		Yesholutomi	Yes	Yes	407
16		Aizuto	Yes	No	278
1	Suruhuto circle with 13 villages and 1 town	**Suruhuto Town**	Yes	Yes	1922
2		Aichi saghami	Yes	Yes	1751
3		Kholeboto	Yes	Yes (less)	179
4		Kiyetha	Yes	Yes	233
5		Lithsami	Yes	Yes	574
6		Naltoqa	Yes	Yes (less)	1938
7		Phuye new	Yes	Yes	485
8		Phuye old	Yes	Yes	639
9		Sapotimi	Yes	Yes (less)	694
10		Surumi	Yes	Yes	2859
11		Tichipami	Yes	Yes (less)	1181

12		Vedami	Yes	Yes	227
13		Yehemi	Yes	Yes	1092
14		Zhekuto	Yes	No	183
1	Ghathashi circle with 12 villages and 1 town	**Ghathashi Town**	Yes	Yes (less)	686
2		Awohumi	Yes	No	269
3		Chishilimi	Yes	Yes	762
4		Chisholomi	Yes	Yes	564
5		Hebolimi	Yes	Yes	822
6		Ighanumi	Yes	Yes	1331
7		Iphonumi	Yes	Yes	464
8		Khughutomi	Yes	Yes	274
9		Kichilimi	Yes	Yes (less)	691
10		Kilomi	Yes	Yes	649
11		Mukalimi	Yes	No	486
12		Shesulumi	Yes	No	776
13		Tukuliqa	Yes	Yes (less)	193
1	Satoi circle with 10 villages and 1 town	**Satoi Town**	Yes	Yes	527
2		Ghokhuvi	Yes	Yes	634
3		Hokiye	Yes	Yes	289
4		Ikiye	Yes	Yes(less)	309
5		Itovi	Yes	Yes (less)	343
6		Khuvuxu	Yes	Yes	476
7		Kheshito	Yes	Yes	187
8		Satoi village	Yes	Yes	525
9		Thakiye	Yes	Yes	562
10		Tsuruhu	Yes	No	265
11		Tsutoho	Yes	Yes	423
1		**Akuluto Town**	Yes	Yes (less)	2524
2		Alaphumi	Yes	No	640
3		Lotisami new	Yes	No	191

4	Akuluto circle with 9 villages and 1 town	Lotisami old	Yes	No	301
5		Lumami	Yes	Yes(one) not regular	820
6		Lumthsami	Yes	Yes (less)	609
7		Shichimi	Yes	Yes (less)	215
8		Sumi Settsu	Yes	No	523
9		Sutemi	Yes	Yes(less)	544
10		Zaphumi	Yes	No	245
1	Pughoboto circle with 9 villages and 1 town	**Pughoboto Town**	Yes	Yes (less)	1356
2		Asukiqa	Yes	No	74
3		Ghokimi	Yes	Yes (less)	1029
4		Kitami	Yes	No	430
5		Lazami	Yes	No	2936
6		Mishilimi	Yes	Yes (less)	1446
7		Natsumi	Yes	No	1108
8		Phuyeqa	Yes	No	44
9		Puneboqa	Yes	Yes (one)	139
10		Tsaphimi	Yes	No	381
1	V.K circle with 8 villages and 1 town	**V.K Town**	Yes	No	1023
2		Ajiqami	Yes	No	250
3		Izheto	Yes	No	196
4		Litta old	Yes	Yes (less)	448
5		Litta new	Yes	Yes (less)	322
6		Maromi	Yes	No	525
7		Mukhami	Yes	No	304
8		Phushumi	Yes	No	610
9		Sastami	Yes	No	253
1	Saptiqa circle with 4 villages and 1 town	**Saptiqa Town**	Yes	No	205
2		Shena old	Yes	No	2059
3		Shena new	Yes	No	816

4		Usutomi	Yes	No	1713
5		Zhevishe	Yes	No	370
1	Akuhaito circle with 4 villages and 1 town	**Akuhaito Town**	Yes	Yes (less)	507
2		Khrimito	Yes	Yes (Two) Not regular	581
3		Philimi	Yes	No	652
4		Roto new	Yes	Yes (less)	697
5		Roto old	Yes	Yes(less)	1439
	Total	14 Towns	186 Yes	101 (Yes)	140757
	186	172 Villages		48 (No)	
				37 (less)	

Source: *Field Survey and Census of India 2011*

Table 3.9: Total Number of Towns and Villages involved in different kind of agricultural activities in Zunheboto District, Nagaland

Sl. No	**Name of the circle**	**Total Number of Town**	**Total Number of villages**	**Total Population**	**No. of Town & villages in Shifting cultivation**	**No. of Town & villages in TRC**	**Shifting cultivation**
1	Aghunato	2	27	18350	29	24	5
2	Asuto	1	21	7598	21	12	9
3	Akuhaito	1	4	3876	5	4	1
4	Akuluto	1	9	6612	10	5	5
5	Atoizu	1	15	8740	16	14	2
6	Ghathashi	1	12	7967	13	10	3
7	Pughuboto	1	9	8943	10	4	6
8	Saptiqa	1	4	5163	5	Nill	5
9	Satakha	1	18	15103	19	16	3
10	Satoi	1	10	4540	11	10	1

11	Suruhuto	1	13	13957	14	13	1
12	V.K	1	8	3931	9	2	7
13	Zunheboto	1	23	35977	24	24	Both
	Total	**14**	**172**	**140757**	**186**	**138**	**48**
	Percentage					**74.2%**	**25.8%**

Source: *Field Survey and Census of India 2011*

From the table 3.9 it is clearly stated that the District has 13 circles with 186 villages and towns consisting of 172 villages and 14 towns respectively. Aghunato circle has the highest number of villages with 27 villages and 2 towns. Saptiqa and Akuhaito circle has the lowest number of villages with 4 villages each under its circle. According to 2011 census, it has 140757 total populations with Lazami village having highest population of 2936 followed by Surumi village having 2859 population. The lowest population is Tsutha Hydel project with 9 population followed by Phuyeqa village with 44 population. The district has total number of 186 towns and villages with 14 Towns and 172 villages. The district is dominated with shifting cultivation. All the town and villages practice shifting cultivation. Terrace rice cultivation is also practiced by many towns and villages but out of 186 towns and villages, 138(74.2%) towns and villages in the district has terrace rice cultivation field where 48 (25.8%) towns and villages depend only on shifting cultivation. 27 towns and villages has less terrace field and they are the villages which has less than five terrace fields or those villages who have abandoned their terrace fields. Some of the villages like Lumami, Khrimito villages have one or two terrace field in the villages and cultivated by one or two family members or not cultivated regularly. In the study area many of the terrace fields have been abandoned and people prefer more on the shifting cultivation as it is one of the easiest ways of cultivation which

can be cultivated without irrigation and with less capital investments. Majority of the terrace fields are located in the river banks and those in the hilly areas face the problem of irrigation.

3.3 Traditional tools

Cultivation of agriculture is mostly done using the Primitive tools. Traditional tools that are commonly used in agricultural activities are machete, bamboo sticks, sickles, spade, rake, cane and wooden tools for different purposes. They buy their implements from local blacksmiths of the neighbouring villages or towns or they have their own blacksmiths. Many villagers are skilled with making of traditional tools. Many of the tools they used for agriculture are all locally made tools. To carry agricultural crops, baskets are also made by the local people.

Table 3.10: Different implements used by the people in agricultural activity (Plate 9)

Sl. No	Local Name	Common Name	Usage
1	Aboshu (apikhi)	Pounding table	Mostly Used for pounding rice and maize, and occasionally used for pounding rice flour chili powder etc.
2	Achegha	Harrow	Used in agriculture for breaking up and smoothing out the surface of the soil.
3	Aghakighe zuta	Bill hook	Cutting tool, used widely in agriculture for cutting woody material such as shrubs, herbs and trees used as weapon.
4	Aghalu	Mallet	Used in carpenter to knock wooden pieces together or to drive dowels or chisels.
5	Aghiheyi	Hammer	Used in carpenter to strike another object used to drive and pull nails.
6	Aghikugho potigha	Reaping machine	Machine used for harvesting crops.
7	Akhoje	Sieve	Used for separating wanted and unwanted material or for

			characterizing the particle size.
8	Akhuwo	Rake	Mostly used in agriculture to collect leaves, hay grass etc.
9	Akihesu	Flail	Agriculture tool used for thrashing the process of separating grain from their husks.
10	Akukulushu	Moulded timbers	Used to mask any transition between surface such as the use for skirting between the wall and the floor.
11	Akuphu	Hoe, spade	Spade is a hand tool primarily use for digging, removing soil or trash etc.
12	Akuwo	Scuffle hoe	With the shape of somewhat arrow head, used for rooting out weeds and stirring the soil.
13	Akho	Quiver	Verities of shapes size of quiver are used by Naga's, quiver are mostly used to carry vegetables crops and food grains.
14	Akutsughu potigha	Grinding machine	An abrasive wheel in the form of a cutting tool which is used for grinding work.
15	Amghu	Axe	Used to shape, split and cut wood, cutting branches of trees etc.
16	Aghushi mughu (Amghu chhothalei)	Tomahawk	Weapon used for hunting, chopping and cutting
17	Angu	Spear	Used in hunting and fishing tool and as a weapon.
18	Asukumtsu	Dibble	A pointed gardening implement used to make holes in soil especially for planting blobs or seeding.
19	Ayephu	Mat	Mostly used for drying crops, such as paddy, maize, millet etc.
20	Ayevu	Sickle	It is a curved blade typically used for harvesting grain crops or cutting succulent forage chiefly for feeding livestock etc
21	Ayi ghakuthau	Hacksaw	Originally and principally made for cutting metals but can also cut various other materials such as plastic and wood.
22	Azuta	Machete	It is a universal tool with different size used for cutting, chopping and clearing forest etc

23	Beltsa/ Sholepu	Shovel	Used for digging, mixing the soil as well as to move loose granular material like dirt, gravel grain or snow.
24	Kotari	Knife	It is a cutting tool used for different purpose.
25	Aphighi	Winnowing Fan	Used for separating chaff
26	Asupe	Small Basket	Carried by women to a field
27	Aqhupu	Slender basket	Used for containing foodstuff, meat, dry crops etc
28	Amto	Sift Basket	Used for carrying crops, firewood etc
29	Ashoghi	Bushel	Used for storing things

Source: *Field survey*

3.4 Cropping Pattern

The cropping pattern varies in all the regions and it is largely influenced by different factors like terrain, climatic variation, soil type, irrigation, social and economic interest of the people etc. Cropping pattern means the proportion of various crops in an area of land at a specific time period. It indicates the yearly sequence and spatial arrangements of crops and fallows in an area. Crop rotation is also the process of growing different crops in succession, on a piece of land, in a specific period of time. Change in cropping pattern from one year to the next can occur by changing the relative acreage of existing crops and by introducing new crops and by cropping existing crops (Bindumathi and Sannashiddannanavar, 2016). Cropping pattern refers to the distribution of cultivated land among different crops grown in a country. Cropping pattern reveals the nature of agricultural operations and is influenced by a host of factors which can be broadly classified into two categories i.e physical factors and economic factors (Prasad, 2009). The cropping pattern depicts the area of land devoted to different crops which gives a picture of relative position of different crops (Agrawal and Lal, 1996).

In the study of cropping pattern, it is necessary to know the areas where different crops dominate (Gomathi and Kumaraswamy, 2016). In the study area, cropping pattern differ from one region to another. Cropping pattern differs from Shifting cultivation and terrace rice cultivation where shifting cultivation is practiced for the cultivation of all the varieties of crops but terrace rice cultivation is done mainly for the paddy cultivation and after the harvest of the paddy, some farmers cultivate pulses in the terrace field. Mixed cropping and intercropping is practiced in the area where shifting cultivation is the only agricultural system. The first year of cropping is usually dominated by cereals with a mixture of legumes and vegetables. After harvesting the cereals such as rice and maize, root crops are then planted. The main crop is rice and various crops like maize, chillies, yam, beans, soyabeans, cucumber, pumpkin, ginger, bitter gourd etc are grown in the same field with the rice. Maize is the second important crop after rice. King chillies, pumpkins and gingers are also grown in large. The other crops such as colocasia, tapioca, leafy vegetables are also commonly grown on the ridge of the field or near the homestead. In some area farmers use different kind of fertilizer or manure for the cultivation but majority of farmers used salt water for killing the weeds from the paddy fields. The most important element of the farming in the study area is the production of grains that dominate the food chain.

Different crops grown in Zunheboto District

Zunheboto District is divided into two parts as western and the eastern area. Western dwellers are called Ghabomi and Eastern dwellers are called Ajomi. Ghabomi are those areas which are warm/hot areas and Ajomi are cold areas. All kinds of crops and vegetables are available in the eastern parts of the district than those in the western areas. The type of cultivation and the crops they grow differ

from western dwellers and eastern dwellers. The crops that are grown in the west is not cultivable in the eastern area due to differences in the climatic conditions and also due to the changes in the climatic conditions, the crops or plants that are grown in early days does not grow well at present. Cultivation system and the time of sowing crops and harvesting of crops also differ and the kinds of crops they cultivate also differ from one another. In the eastern part of the district, all the varieties of crops are grown whereas in the western part of the district, not all the crops are grown due to climatic condition as the western part is hotter than the eastern part. Some of the crops grown in the district are giving below with the local name:

Table 3.11: Crops grown in the District

Sl No	**Local name**	**Common name**	**Scientific name**
1	Athikishi	Rice	*Oryza sativa*
	Asuchuchu	Tapioca	*Manihot esculenta*
2	Akithi	Jobtears	*Coix lacryma-jobi*
3	Akini	Beefsteak plant/Perilla	*Perilla frutescens*
4	Ahengu	Pumpkin	*Cucurbita*
5	Ajoxa akughukhou	Kidney bean	*Phaseolus Vulgaris*
6	Akhoi	Sugarcane	*Saccarum officinarum*
7	Akhughi akughukhou	Aubergine	*Solanum melongea*
8	Akuka	Cucumber	*Cucumis sativus*
9	Akuu	Ginger	*Zingiber offcinale*
10	Akhoghi	Brinjal	*Solanum melongens*
11	Akuhaghanhe	Lettuce	*Lactuca sativa*
12	Alu	Potato	*Solanum tuberosum*
13	Apoxi	Gourd	*Lagenaria spp; Cycurbita*
14	Ashothi/Athisho	Wheat	*Triticum aestivum, Triticum durum*
15	Asu	Millet	*Pennisetum glaucum*
16	Asupa	Jowar	*Sorghum Vulgare*

17	Asu beghunabo	Tomato tree	*Cyphomandra betacea*
18	Atsuna	Onion	*Allium cepa*
19	Atsunaqhi	Oat	*Avena Sativa*
20	Atsu	Sesame	*Sesamum indicum*
21	Ayikhu	Soya bean	*Glycine max*
22	Ayi	Colocasia	*Colocasia esculenta*
	Axa/ khetsuthi	Beans	*Phaseolus Vulgaris*
22	Beghuna	Tomato	*Lycopersicon esculentus*
23	Bobotsuna	Leek	*Allium ampeloprasum*
24	Badam	Peanut	*Arachis hypogaea*
25	Loshun	Garlic	*Allium sativum*
26	Kholakiti	Maize	*Zea Mays*
27	Migishi	Chilly	*Capsicum annuum*
28	Motor	Peas	*Pisum Sativum*
29	Mula	Radish	*Raphanus Sativus*
30	Mula akuhu akushuu	Carrot	*Daucus carota ssp, Sativa*
31	Pendi	Ladyfinger/Okra	*Abelmoschus Esculentus*
32	Shepishe	Sweet potato	*Lopmoea batatas*
33	Iskos	Chow chow/Chayote	*Sechium edule*

Source: *Field survey and scientific name from the website*

Varieties of crops grown in the region depend on the terrains, soil types and climatic condition but it also depend on the needs and interests of the people cultivating it. Some crops like millet which are cultivated at large in the early days are not much cultivated at present. Following are some of the common crops grown in the District.

1. **Rice:** Rice is the main crop which is sown in the month of March/April and harvest in the month of late September and October/November. The sowing areas are determined by the slope of the field and by the soil fertility. The yields of the production depend on the suitability of the soil and climate.

Sometimes the yield increase or decrease because of the climatic variations. Dry climate with adequate water supply is suitable for the growth of rice. High humidity effects the growth of rice. A variety of rice is grown in the study area depending on the choice of the seeds used by the farmers. The types of rice grown by the people differ from the western to the eastern. The names of some varieties of rice grown by the people in different areas are: Atsaghi (ajothi), Tushoghi(ajoghi), Atuku (sayikeu ghi), Kumunupu (sticky rice), Lazau(kind of small grain), Matsaku, Sulighi (paddy plants grown in a loamy field), Aghu, Amaghi (variety of paddy which is said to have been found from 'amabo'), Tsungughi, Aghigi, Inagho, Lukhama, Mujoghi, Kishe kebelighi, Khulu ghi, Wuchoghi etc

2. **Maize:** Maize is the second important crop. It is grown in every field. It is sown in the month of March along with the sowing of rice and other crops. There are varieties of maize in which the smaller size of maize is commonly grown in the western part of the study area and the bigger size is grown by the people in the eastern area. Maize is grown mostly for the use as food for the domestic animals like pig, chicken etc. Sometimes the surplus produce is sold among the villagers or to the neighbouring villages.
3. **Ginger:** Ginger is also one of the common crops which are grown in all the areas in the district and which is sometimes cultivated for the subsidies, supplies or for home consumptions. Ginger is grown in the field with other crops but in some areas, it is grown separately for the commercial purpose.
4. **Chilies:** Chilies are also grown in large. The farmers grow a variety of chilies in which king chilly is at large but it also depend on the climatic conditions for the increase and decrease of the yield. The surplus produce is dried up in the sun or fire to use it in the off season. King chilly is largely grown in

western part of the district especially in Saptiqa area where the farmers grow king chilly in large area for commercial purpose. King chilly which is also called as Naga chilly or Raja mircha is known to be an indigenous crop of the State. It is said that Naga chilly is believed to be originated from the Zeliangrong area of Nagaland. The king chilly or Naga chilly was the first crop from the State to be given the GI (Geographical Indication) tag which is known as the world hottest chilly. It is said that during the winter, the dew drops in the morning makes the king chilly tasteless whereas making the other types of chilly more hot.

5. **Pumpkin:** Pumpkin is also grown in every field and every year it is grown to use as food for the domestic animals mostly for the pigs. The seeds of the pumpkin are also dried up and used for different purposes. Different kinds of pumpkin are also grown by the people. Pumpkin is grown both in the cold and warm areas.
6. **Soya beans:** One of the most important crop grown in every field as it is used for making of the traditional food called axone in Sumi dialect. It is sown in the month of June/July and harvested in the month of November. Cultivation of soybean is not suitable in all the areas as the climatic condition and soil differ from western and the eastern region.
7. **Millet:** It is grown in the eastern areas. It is also one of the crops which had decreased in the production as many of the people did not cultivate it. In the early days, it was used as the main crop after rice.
8. **Colocasia:** It is grown more in the western areas. It is used for both the root and the leaves. The leaves of colocasia are used for feeding domestic animals specially for the pig and they are also sliced into pieces and dried up from the sun. Different local names are Ayiba, Kantsuyi, Lomiyi, Atsuthu yi etc.

9. **Beans:** Different kinds of beans are grown in the district. It is called Axa or Khetsuthi in Sumi dialect and it has varieties which some are called Khuwuthi, Ajoxa etc. Beans are grown by all the people but the most common beans in the district are Ajoxa which is grown mostly in the eastern region of the district. Ajoxa which means beans of colder place in which ajo mean colder area and xa mean beans.
10. **Mustard:** It is grown mostly in the eastern part of the district. Due to climatic condition it does not grow well in the western part of the district. It is not only cultivated in the field but it is grown in home garden and in the farm by applying cow dung or other manure to the soil.
11. **Pirilla:** It is not grown in all the areas. It is cultivated mostly in the warmer areas.
12. **Naga Tree Tomato**: It is the second crop of the State to be given GI (Geographical Indication) tag after Naga King chilly. It is grown in all the parts of the district. It is said that the Department of Horticulture has secured Geographical indication Registry for the Naga Tree Tomato.
13. **Potato**: It is cultivated mostly in the eastern part of the district. It is one of the important crops where the villagers are able to earn by selling it. Majority of the potato supplies comes from Aghunato area from the villages like Ghokishe, Phulesheto and Khetoi village.
14. **Mechinga:** It is grown in the colder area and most of the supply is from Suruhuto area especially from the Tichipami village in which they are famous for this mechinga as it is said that the taste of their mechinga is different from the other area. It is supplied mostly to Mokokchung district as the village is more accessible to Mokokchung district.

15. **Bitter bean or Petai:** It is grown in the warmer area in the western Zunheboto district.

The farmers in the eastern region cultivate more than the western region and the type of crops grown is also different from those of the western dwellers. In a year the eastern dwellers cultivate crops two times a year. After the harvest of the rice and maize they cultivate beans, mustards, peas, onions, garlics etc. With all the varieties of crops grown throughout the year, it is not able to sustain the population throughout the year and the people depend more on the outside market. The cultivation is done mainly for the home consumption and only few surpluses are sold in the market in the harvesting season. Only few crops which lasted till the next harvest are dried crops like dry chilly, dry beans, maize and rice etc.

The crops harvested from the field are not able to sustain till the next harvest, the harvested crops (specilally Rice) lasted only for a few months and only some few people are able to sustain it till the next harvest but it also depend on the size and number of the family members. The size of the field or areas of the cultivation depend on the size of the family and also on the interest of the farmers. Majority of the people cultivate only for the home consumption and they depend on the market. During the harvest season of different crops, some of the villagers sold their crops from the marketing sheds near the village or in the highway. The crops are sold or transported to the town markets by those who are accessible to the markets or those who have better connectivity to nearby towns.

Villages from Aghunato circle transport their products to Aghunato town and Zunheboto Town, Villages from Suruhuto circle transport their products to Mokokchung Town, Villages from Pughuboto circle sale their products to Kohima town. Villages around Zunheboto town brought their crops and sell it directly from

the markets in the town. The villages which are connected to the roads or located near the highways or roads leading to other places have better chance of selling their crops and vegetables from the highway marketing sheds or the road sides. Villages like Asukho, Awotsakili, Zaphumi village's sale their surplus crops on the roadsides connecting to Mokokchung district. Chishilimi village road connects Kohima district.

All kinds of wild eatable fruits are available in eastern region and only few in the western region. The wild fruits and vegetables found in the region also differ from place to place. The fruit found in the western is not available in the eastern like wild apple which is found only in the eastern part of the district.

Year of cropping in shifting cultivation

In Zunheboto District, agricultural system and the pattern of cultivation differ from village to village. Cropping pattern and the year of cropping depend on the area of cultivation and also fertility of soil. In some areas, it is cultivated till the third to fourth year if the fertility of soil is good for the crops. But in most of the areas, cropping is done till the first and second year.

1. **First year cropping**: It is called aphu-lu in Sumi dialect. First year cropping is done mainly for the Rice and Maize cultivation. In most of the areas, cultivation is done only for the first year and abandoned the field after the harvesting of the first cropping. In the first year field, Paddy and maize are the two main crops which occupied the field along with other crops. One time cultivation is practiced by most of the villagers in the western area as the main activity of agriculture is for cultivating paddy and maize. In some areas

the fertility of the soil or distance of the fields does not allow them to cultivate the field for the second time.

2. **Second year cropping**: Second year cropping is known as Ali-lu and it is done mainly for the maize cultivation. Some other crops like ginger, arum, cucumber, pumpkin, chilly etc are grown in ali-lu. After the abandonment of the field it is called Aligha meaning uncultivated place. Second time cultivation is done in the areas where the soil fertility is good for the continuous cultivation.
3. **Third year cropping**: Third year cropping is called as Akuthuku lu meaning the cultivation of a field for third times. Cultivation for the third time is done only by few people and it is cultivated only in some fertile soil areas. But in the third cropping year only few crops like chilly, tapioca and arum etc are cultivated. Third year cultivation is found only in few areas with small area of cultivation.
4. **Fourth year cropping**: Fourth year cropping is done only in few areas and most of the fourth cultivation is near the settlements. It is cultivated for some few crops which are planted during the second or third year cropping as some crops like tapioca and chilly etc which lasted for years and can be harvested anytime.

Cropping pattern is greatly affected by natural factors like location of field, quality of soil, climate etc. It is found in that the villages like Vekuho and Naghuto villages which are located in the middle of the area between Ajo (cold area) and Ghabo (warm area). They said that the cultivation of the crops and yield of the crops depend on the location of cultivation. Growth and yield of the crops differ and depend on which side of the area they cultivate. If they cultivate

in the eastern side of the villages, varieties of crops are grown and the yield of the crops increased but in the western side, the varieties of crops grown in the field is limited as it does not grow well like in the eastern side (ajo).

The production and yield of the crops depend on the fertility of the soil and climatic condition of a particular region and also the way the farmers maintain their fields. Many of the farmers do not take the importance of conserving and improving the soil fertility. They depend only on the natural fertility of the soil available. Lack of improved seeds and used of the traditional seeds also affects the yield of the crops. Although government is making many efforts and plans to improve agricultural activity or improve the production of crops by distributing the quality seeds to the farmers but majority of the farmers do not get accessed to the government helps.

Table 3.12: Area of principal crops in the district (area in Hectare)

Sl. No	Year	Cereal	%	Pulses	%	Oil Seeds	%	Commercial crops	%
1	2003-2004	18800	5.88	3800	9.80	7810	5.41	1230	5.78
2	2004-2005	19800	6.19	2810	7.25	8160	5.66	1980	9.30
3	2005-2006	20030	6.27	3070	7.92	9000	6.24	1940	9.11
4	2006-2007	22220	6.95	3720	9.60	9170	6.36	1140	5.35
5	2007-2008	22860	7.15	2780	7.17	12280	8.51	1250	5.87
6	2008-2009	22610	7.07	2370	6.11	10480	7.26	1490	7.00
7	2009-2010	22370	7.00	1590	4.10	13810	9.57	1380	6.49
8	2010-2011	23810	7.45	2460	6.35	10370	7.19	1160	5.45
9	2011-2012	23660	7.40	2510	6.48	10400	7.21	1300	6.11
10	2012-2013	23750	7.43	2680	6.91	10450	7.24	1650	7.75
11	2013-2014	24250	7.59	2710	6.99	10540	7.31	1420	6.67
12	2014-2015	24630	7.71	2720	7.02	10560	7.32	1740	8.17
13	2015-2016	25140	7.87	2730	7.04	10600	7.35	1770	8.31
14	2016-2017	25700	8.04	2810	7.25	10630	7.37	1840	8.64

	Total	**319630**	**100**	**38760**	**100**	**144260**	**100**	**21290**	**100**

Source: *Statistical handbook of Nagaland (2003-2017)*

Fig 3.3: Area of principal crops in the district (2003-2017)

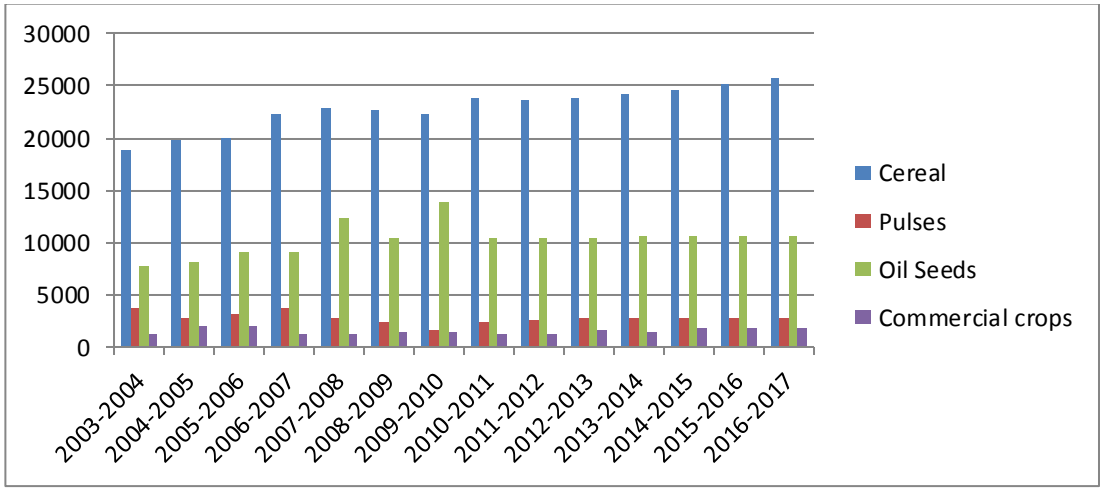
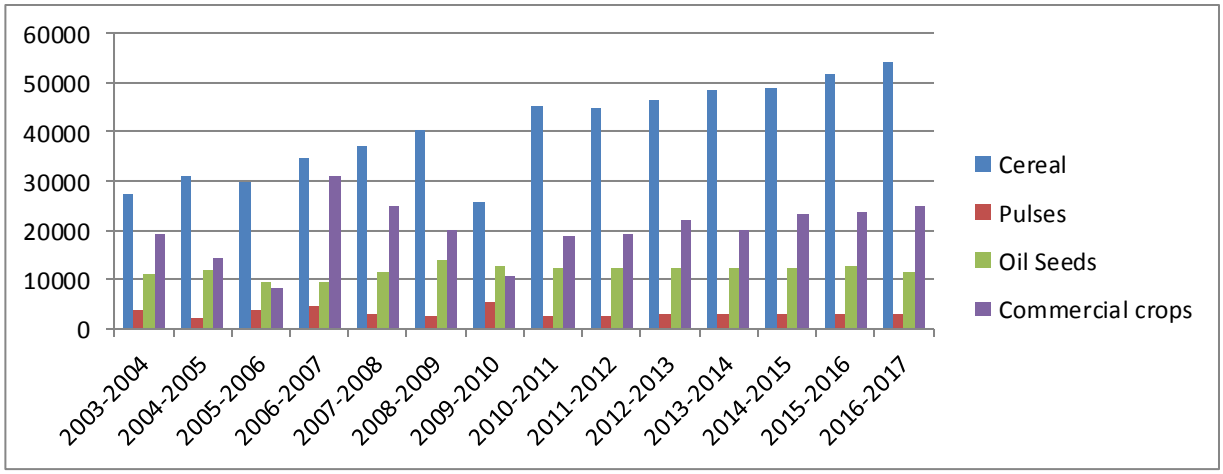


Table 3.13: Production of principal crops in the district (Production in M.T)

Sl. No	Year	Cereal	%	Pulses	%	Oil Seeds	%	Commercial crops	%
1	2003-2004	27360	4.83	3620	8.03	11210	6.73	19250	6.84
2	2004-2005	31180	5.50	2120	4.70	11950	7.17	14500	5.15
3	2005-2006	29990	5.29	3810	8.45	9640	5.79	8330	2.96
4	2006-2007	34580	6.10	4490	9.96	9410	5.65	31130	11.06
5	2007-2008	37020	6.53	3100	6.88	11570	6.95	25060	8.91
6	2008-2009	40540	7.15	2480	5.50	14030	8.42	20040	7.12
7	2009-2010	25890	4.57	5460	12.11	12600	7.56	10770	3.83
8	2010-2011	45240	7.98	2470	5.48	12310	7.39	18850	6.70
9	2011-2012	44980	7.94	2550	5.66	12280	7.37	19360	6.88
10	2012-2013	46670	8.24	2880	6.39	12370	7.43	22140	7.87
11	2013-2014	48410	8.54	2950	6.54	12470	7.49	20040	7.12
12	2014-2015	48890	8.63	3000	6.65	12520	7.52	23280	8.27
13	2015-2016	51770	9.14	3020	6.70	12550	7.53	23840	8.47
14	2016-2017	54200	9.56	3130	6.94	11660	7.00	24750	8.80
	Total	**566720**	**100**	**45080**	**100**	**166570**	**100**	**281340**	**100**

Source: *Statistical handbook of Nagaland (2003-2017)*

Fig. 3.4: Production of principal crops in the district (2003-2017)



The production of crops in the district has increased with the increase of area of cultivation in hectors from 2003 to 2017. Cereal production is more dominant in the district followed by oil seeds whereas the pulses and commercial crops has less production. Cereals crops include Rice, Maize, Jowar, Millet, Jobstear, Bajra, Wheat, Barley, oats. Pulses are Tur/Arhar, Mong, Naga dal, Beans, Rajma, Kholar, Gram, Pea, Lentil, Gram etc. Under the oil seeds the crops are Ground nut, Soyabean, Perilla, Castor, Sesamun, Sunflower, Mustard, Linseed etc. and under the commercial crops its includes Sugarcane, Tapioca, Colocossia, Yam, Ginger, Potato, cardamom etc. Cardamom and ginger are two main commercial crops grown by majority of people in the district.

3.5 Marketing

In Zunheboto District, most of the people cultivate crops for their own consumption and only few people cultivate for sale. Cultivation is done for the home consumption and surpluses are sold on the market or supplied to the neighbouring towns or villages. All the fresh agricultural crops are available in the market only in the harvesting season. During the off season only few dried products are available. Varieties of crops are sold in the market by local vendors and majority are sold by

the women. They either sell their own crops or sell the crops that are bought at wholesale rate from the villagers. The products are either sold in the highway marketing sheds or taken to the market places for sale. Different crops are sold or supplied to the town markets. To the local markets at Zunheboto Town, many of the crops are supplied from the eastern part of the district. All the varieties of wild vegetables and wild fruits are also brought for sale. Majority of the beans and potatoes are supplied from Aghunato area especially from khetoi village. Among all the crops, beans and potato are the two crops which are more profitable than the other crops as they can be sold during the off season of the crops. The supply of crops and vegetables depend on the yield and availability of agricultural products. Agricultural products are sold in various ways where the farmers sold their crops directly in the market or supply to the neighbouring town or village/town. Some of the farmers sold their crops directly from the fields, roadsides or marketing sheds in the village or sometimes they organised a sales day where all the crops are collected and put up on sale. Crops brought for sale in the market cannot be kept for longer period as agricultural products are perishable and if it is not sold on time, it will result in wastage of crops. Most of the vegetables that are sold in markets by the vendors are harvested crops from the Jhum fields and home gardens.

Discussing with the vendors in Zunheboto Town, it is found that majority of the crops and vegetables are brought from Aghunato area where all kinds of crops are cultivated and all the wild vegetables and crops are available. Vegetables are brought through contact with the farmers. The supply and price of the different crops depend on the availability of crops yield and accessibility of the transport system to market. Many of the villagers could not sale their products due to poor road connection to the town area where they can sale their products. One of the main

problems faced by the vendors are that they do not have proper storage place and preservation place for the season crops which sometimes result in loss of their capital invested for sale. The only way to preserve the crops is drying it from the sun or fire but not all the crops are suitable for drying. Drying beans, chilly, ginger and varieties of rice, millets etc are some few agricultural products which are available in the market throughout the year if the yields of the products are good.

Table 3.14: Block wise marketing shed development (2014)

Sl No	Block Name	No of villages	No of Marketing shed
1	Akuhaito	17	8
2	Akuluto	18	14
3	Ghathashi	22	3
4	Satakha	28	12
5	Satoi	10	10
6	Suruhuto	31	7
7	Tokiye	31	1
8	Zunheboto	23	23
	Total	180	72

Source: *Directorate of Economic and statistics Nagaland*

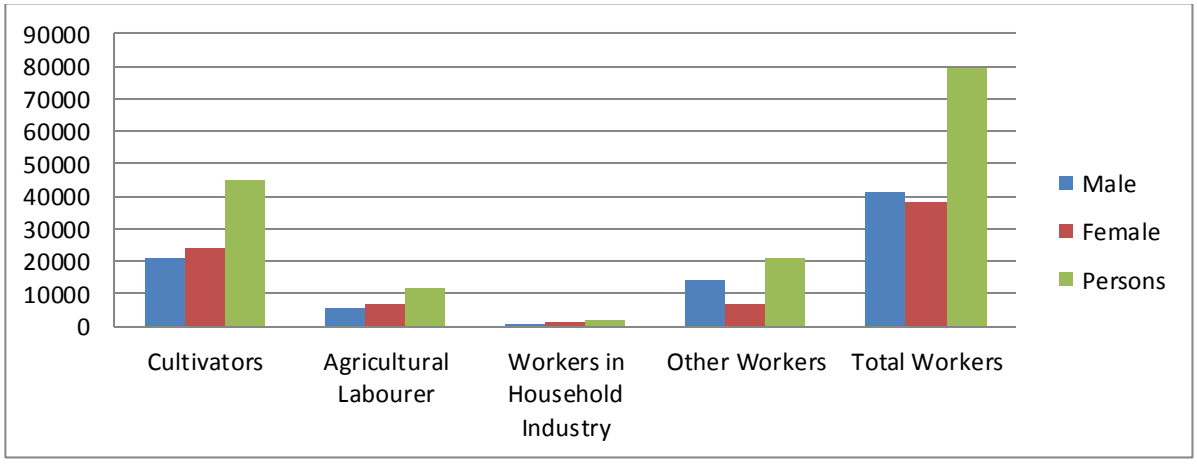
Marketing sheds have been constructed at highways and roadsides in many villages with the aim to facilitate the farmers to dispose off their surplus produces for remunerative returns to enhance their rural economy. The table 3.14 gives the number of marketing shed available in each block of the district. 72 villages have marketing sheds and the rest 108 does not have a marketing shed in their villages. Tokiye block has the lowest number with one village having marketing shed in Luthsumi village followed by the second lowest is Ghathashi block with only three marketing sheds.

Table 3.15: Numbers of workers (Main and Marginal)

Sl. No	Category		Number	Percentage
1	Cultivators	Persons	44723	56.28
		Male	20835	50.60
		Female	23888	62.39
2	Agricultural Labourer	Persons	11955	15.04
		Male	5443	13.22
		Female	6512	17.01
3	Workers in Household Industry	Persons	2025	2.55
		Male	825	2.00
		Female	1200	3.13
4	Other Workers	Persons	20763	26.13
		Male	14075	34.18
		Female	6688	17.47
5	Total Workers	Persons	79466	56.46
		Male	41178	57.82
		Female	38288	55.06

Source: District census handbook Zunheboto 2011

Fig. 3.5: Total number of workers in the district



About 70% (seventy) percent of the population still depend on agrarian economy, and cultivation plays an important role in booming the economy of the region because of the absence of industry and technology. Although majority of its population is engaged in agricultural activities, it still depends on the import of food grain from other states. Other sectors such as weaving and handicraft are important source of income for the people apart from government employs/services.

The table 3.15 shows the number and percentage of the workers divided in various sectors namely cultivators, agriculture laborers', workers in household industries, and other workers, the main economic activity of the workers in the district is agriculture and its allied activities. It is shown in the table that the workers engaged in the cultivation (44,723person) and agriculture labor (11,955person) account for 71.32 percent of the total workforce. Workers in household industries (2025 person) represent only 2.55 percent of the total. Other workers (20,763 person) constitute 26.13 percent of the total workers. The proportion of male and female distribution of work among different sectors female outnumber male in cultivation. 62.39 percent of the total female workers are engaged in cultivation while 50.60 percent of the total male workers are cultivator. But in other workers category male outnumber the females. There are 14075 male workers representing 34.18 percent of the total male worker against 6688 female other worker representing 17.47 percent to the total female workers. Apart from few exceptions, almost the same pattern is observed in the administrative circles as well.

Table 3.16: Numbers of Workers and Non Workers in Zunheboto district

Sl. No	Category		Number	Percentage
1	Main Workers	Persons	49382	35.08
		Male	27876	39.14
		Female	21505	30.93
2	Marginal Workers	Persons	30084	21.37
		Male	13302	18.68
		Female	16782	24.13
3	Non Workers	Persons	61291	43.54
		Male	30039	42.18
		Female	31252	44.94
	Total Workers	Persons	79466	56.46
		Male	41178	57.82
		Female	38288	55.06

Source: District census handbook Zunheboto 2011

Fig. 3.6: Number of workers and Non-workers in Zunheboto District

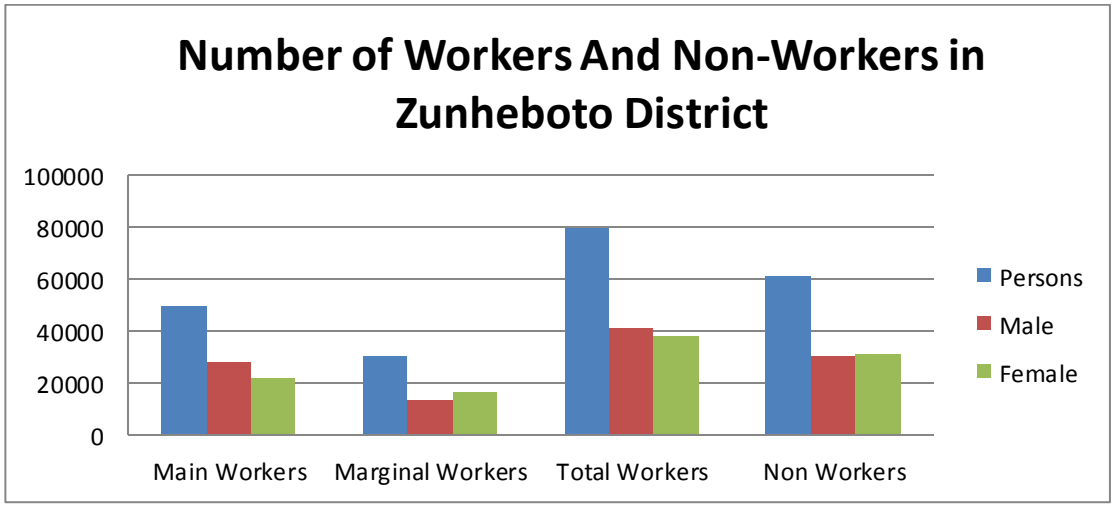


Table 3.16 present the number and percentage of the main workers, marginal workers and non workers by gender as per 2011 census of Zunheboto district. Total workers consist of main and marginal workers. It can be seen that the percentage of

the total worker to the total population which is also known as work participation rate for the district is 56.46 percent. This means that roughly 565 person for every 1000 population are workers while the remaining 435 are non-workers. In absolute terms there are 79466 workers and 61291 non-workers who have worked for the major part of the year are 49382 person or 35.08 percent of the population. Among the main worker 39.14 percent are males while 30.93 percent are females. Marginal workers are those who have worked for less than six months in the preceding years, accounts for 30084 person or 21.37 percent of the total population. In marginal work category female workers outnumber male counterpart.

3.6 Belief and tradition of the people in the early days

There are many beliefs and traditions in the past which are believed to have come true according to their saying and beliefs. The following are some saying, omen and belief which were followed by the people in the past relating to agriculture.

i. Luffa plant is planted near the tree in the field to protect the field from the lightning because they believed that the blessing for the growth of crops will flee away if the lightning strikes the tree in the field.
ii. The trees burned by lightning are not supposed to be use as they believed that they may get sick if they use the tree burned by lightning.
iii. It is believed to be bad omen if the clothes are burned during harvesting.
iv. During the harvesting time, the harvesting of crops is first done by rich people to let that year be a plentiful harvest of crops.
v. The strangers are not allowed to cross the threshing floor during the harvesting as they believed that the blessing may flee away.

vi. During the sowing season, they do not make the head bald as they thought that the flood will destroy the field.

vii. They believed that if there is a plentiful harvest of grapes in that year then there will be plentiful harvest of others crops like beans and soyabean.

viii. Coming of Shefu bird (hornbill family bird) indicates rainfall, there is a good harvest on which side the bird fly. If the bird flies low then it is said that there will be rainfall suitable for the crop growth.

ix. Harvesting time starts after the arrival of Kashopapu (cuckoo) birds.

x. Neddlewood tree is not use in the construction of house because the lightning will strike the house.

xi. The sowing of the seed of millet start after the full blooming of the neddlewood tree.

xii. They do not go to the field if anyone died in the village as they believe that the crop will not grow well.

xiii. Youth are not allowed to eat tortoise meat as they will not be able to cope with other people.

xiv. The singing bird meats are given to the child on his/her first food after their birth for the child to be smart in talking and singing.

xv. At the time of any misfortune in the family they are not allowed to eat walnut, orange, maize, beans and cucumber as the crops in the field may die soon.

xvi. If any good rulers in the village died then there would be a famine in the village.

xvii. No one should talk about dividing the property among the relatives or while dividing the property they should not rush to be the first one to choose their share. If they do they were they may die soon.

xviii. Fruits are not eaten on the tree as they believe that the insects will affect the fruits.

xix. During the harvesting season, flute is not played because the wind may destroy their field.

xx. Millet is sown during the blooming of the peach tree and harvest of millet start when the peach fruit is ripped.

xxi. The first harvested crop and first animal from the house are given to the parents as parents are considered to be next to God and that shows the sign of respect to the parents.

xxii. The remnants of rice from the barn are given to the parents.

xxiii. When the strangers are at home, they do not collect the piglet even if the pig is farrowing and does not collect the chicken if it hatched as those piglet and chickens may die.

xxiv. Stealing of bamboo and bamboo shoot of other people may defect their eye and teeth soon.

xxv. Youth are not allowed to put the stone in land demarcation, as they may die soon.

xxvi. If the rainbow surrounds the sun then it is said that it will be a scorching hot day.

xxvii. If the hunting dogs cry in the village then it is the sign of misfortune in the village.

There are many points which are hard to believe and also which are not applicable in the present generation but there are many things which can be learned from the past beliefs and traditions like planting of luffa plant in the field to protect from lightening, indication of rainfall, good harvest and time of harvest from the coming of different

birds around the field, knowing the right time for sowing and harvesting of crops by looking at the blooming of trees, sharing of first harvest crops and animals to the parents etc.

Table 3.17: Name of the villages surveyed and their agricultural activities

Sl No	Circle	Sl No	Village	Modern Tools	Seeds	Agri expense	Sale
1	Aghunato	1	Khewoto	No	Traditional	High	Direct
		2	Nihoshe	No	Traditional	Less	Through other
		3	Ghuvishe	No	Traditional	Moderate	Direct (Aghunato town)
		4	Lukikhe	No	Traditional	Moderate	Through other
		5	Shevishe	No	Traditional	Moderate	Through other
		6	Hoshepu	No	Traditional	High	Direct
2	Asuto	1	Khumishe	No	Both	Moderate	Through other
		2	Satami	No	Both	High	Through other
3	Zunheboto sardar	1	Baimho	No	Both	Moderate	Direct
		2	Lizu aviqhato	No	Traditional	Moderate	Through other
		3	Natha old	No	Traditional	High	Direct
		4	New land	No	Both	High	Through other
		5	Shotomi				
		6	Asukhomi	One machine for harvesting Two machine for ploughing	Both	Moderate	Direct from village

4	Satakha	1	Hoishe	No	Traditional	High	Direct (Satakha town)
		2	Tukunasami	one machine for ploughing terrace field	Both	High	Direct
5	Atoizu	1	Vekuho old	No	Traditional	Moderate	Direct
		2	Naghuto old	No	Traditional	Moderate	Direct
		3	Naghuto New	No	Traditional	Moderate	Direct
6	Suruhuto	1	Tichipami	No	Both	Moderate	Direct
		2	Surumi	No	Both	Moderate	Direct
7	Ghathashi	1	Kughutomi	No	Both	High	Direct
		2	Kichilimi	No	Traditional	High	Transport problem
8	Satoi	1	Ikiye	No	Both	High	Through other
		2	Itovi	No	Both	Moderate	Through other
9	Akuluto	1	Lumami	No	Both	Moderate	Direct (less)
		2	Zaphumi	No	Both	Moderate	Direct
10	Pughuboto	1	Kitami	No	Traditional	High	Through other
		2	Lazami	No	Traditional	Moderate	Through other
		3	Puneboqa	No	Both	Moderate	Directly from the highway
11	VK	1	Litta new	No	Both	Moderate	Through other
		2	Litta old	No	Both	Moderate	Through other
12	Saptiqa	1	Shena old	No	Traditional	moderate	Through other
		2	Shena new	No	Traditional	Moderate	Direct and

							through other
		3	Usutomi	No	Traditional	Moderate	Both
		4	Zhevishe	No	Traditional	Moderate	Both
		5	Saptiqa	No	Traditional	Moderate	Both
13	Akuhaito	1	Khirimitomi	No	Both	Moderate	Through other
		2	Akuhaito Town	No	Traditional	Moderate	Direct
		3	Roto old	No	Both	Moderate	Direct
		4	Roto New	No	Both	Moderate	Direct

Table: *Field survey (2014-2018)*

For the study of agricultural activities in the district, 41 villages have been randomly selected from 13 circles in the district. It is found out that many of the villages share the land for the cultivation among the villages. The type of cultivation and varieties of crop seeds used by the farmers are same among the neighbouring villages. Among the surveyed villages, only two villages use modern machines i.e Machine for ploughing terrace field (Tukunasami vilage) and Harvesting machine (Asukhomi village) and the rest of the surveyed villages cultivate using traditional tools available to them.

Shifting cultivation and terrace cultivation are the two main agricultural systems practiced by the people in the district. Shifting cultivation is done for both Paddy and maize as the main crops whereas Terrace rice cultivation is done mainly for Paddy cultivation. Home Garden is done for mixed cropping by those people who own a land near the house. Different plantations activities are also done by the majority of people in the district. Different types of agricultural activities are practiced by the people depending on the availability of agricultural land.

References

Agrawal A.N and Lal Kundan (1996), *Agricultural problems of India*, Vikas publishing house pvt Ltd. Pp. 63

Bindumathi. S and Sannashiddannanavar. S. Subash (2016), *The Deccan geographer*, Vol 54, No 1, June 2016 (peer review refreed journal), the Deccan geographical society, India. Pp 87-88

Choudhury Jayanta and Das Manoshi (2007), Rehabilatation of shifting cultivators in the State of Tripura, India. In: Saxena, K.G. Liang Luohui. and Rerkasen Kanok. (eds.). *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood*, Bishen Singh mahendra Singh. Pp 33

Data based on village level development indicators as on 31 March 2014, Directorate of economics and statistics Nagaland: Kohima, Government of Nagaland. Pp 76-83

Gomathi and Kumaraswamy (2016), Patterns of crop concentration and diversification in Aiyar Basin, central Tamil Nadu, *Punjab geographer- A Journal of the APG*, India and Isper India, Panchkula. Vol. 12, Oct 2016. Pp 100

http://www.inspection.gc.ca/plants/grains-and-field-crops/list-of-grains-and-field crops/eng/1323244558875/1323244642996

http://www.plantauthority.gov.in/pdf/CropSpeciesnotified.pdf

http://www.fao.org/fileadmin/templates/ess/documents/world_census_of_agriculture/appendix4_r7.pdf

https://a-z-animals.com

http://fieldguide.mt.gov/displaySpecies.aspx?family=Triaenonychidae

Lekhi R.K and Singh Joginder (2016), *Agricultural economics an Indian perspective*, Kalyan publishers, Pp 480

Prasad Chandra Shekhar (2009), *Agriculture and rural development in India since 1947*, New century publication. Pp. 12

Nagaland Economic Survey 2016-2017, Economic and Statistic Government to Nagaland. Pp 39

Nuh V.K (2016), *The Naga Chronicle 2nd edition*, (eds.) Wetshokhrolo Lasuh, Regency publications- A division of Astral international (P) Ltd, New delhi. Pp 11

Rizvi S.H.M and Roy Shibani (2006), *Naga Tribes of North East India*, B.R Publishing Corporation (A Division of BRPC India Ltd). Pp. 54

Sema Lhozhevi (1992), *Sumi Tsashe anglo sumi dictionary*, Patkai Ghakhu Publishing group. Pp 4-204, 234-235, 284-305

Sema toiho P (2009), Slope analysis of Zunheboto District: a geographical analysis, *Hill Geographer*, Vol. XXV 1 & 2, The geographical society of North- Eastern Hill Region (India) Shillong. Pp 71

Thakur B.N (1997) Impact of shifitng cultivation on forest eco-system, (eds.) Mohapatra P.M and Mohapatro P.C, *Forest management in Tribal areas- forest policy and peoples participation* (Procedding of the seminar, forest policy and tribal development during 15-16 february 1994 at koraput), Concept publishing company. Pp.99

CHAPTER IV

AGRICULTURAL ACTIVITIES AND ITS IMPACT ON ENVIRONMENT

4.1 Introduction

Environment play a crucial role as the most important asset on earth for living beings to survive and support life, as environment connects us to our surroundings with plants, animals, forests, water ,air and sunlight on living and non living habitats. Disturbance on any natural habitat can lead to an effect on environment, as ecological balance is very important for nature to replenish and maintain sustainability on earth. Environment has been affected in different ways and environmental problems occur depending on the level of economic activities, economic developments of the region, life styles of the people, availabilities of natural resources, and mostly dependent on the population. Many scholars and experts have different opinions about the practice of shifting cultivation. Majority of the people viewed shifting cultivation as destructive system of agriculture.

The impact of human activities on environment can be seen from the type of soil, vegetation, forest type, climatic condition and geographical areas etc. Saxena (2010) stated that human impact on natural environment is an important component in the management and optimization of the man-society-nature system. He mentions that the way human beings have changed and are changing the face of the earth has drawn the attention of not only natural scientists but also social scientist as well as

planners and policy makers. The impact of human activity on natural environment has affected the balance of atmospheric phenomena etc.

Many factors have contributed to the pollution of environment but among all, in the study area agricultural activity is one of the major factors contributing to environment deterioration. Environmental problem starts with decreasing of forest and disrupting natural habitat, as forest play an important role in determining the quality of environment. Through agricultural activities, Environment has been effected in various ways. Some of the effects on environment problems caused by agricultural practices are as follow:

1. **Changes in forest cover**: Forest habitat have been exploited a lot due to extensive human activities for cultivation, exploitation on different species (hunting) and for fire-wood, these activities leads to degradation of flora and fauna. As flora and fauna are two most important roles in maintaining balance in forest ecosystem. Forest covered area degenerated as with the increase population demands their essential needs for lively-hood increases. Among all of those factors agricultural activities remains one of the main factors in contributing towards a change in forest covered areas.
2. **Soil degradation**: Agricultural activities disrupt the soils ability to regenerate nutrition naturally , where during this process the top soil which are very essential in providing nutrient to the forest are washed away making the soil loss its capacity to hold and provide nutrients , which makes more susceptible to erosion.
3. **Deforestation:** It can be ensured that agriculture is the main cause of deforestation, as it overtook small scale farming by replacing the natural forests for plantations. Although other factors like logging, firewood and

human establishment caused deforestation too but agricultural activities remains a major effect on deforestation.

4. **Climate change**: Climatic change have become one of the most important issues in the present scenario. As living beings are interrelated with the environment, if our environment are not maintained or balanced, our natural ecosystem will not be able to support life on earth which living beings are dependent on it. Agriculture that sustains us in providing our essential need also threatens our continued existence of a species, as climate changes occurs due to unbalanced cycle of nature. Agricultural activities are affecting the climate as it almost produces 23 percent of global greenhouse gas emission.
5. **Land Degradation**: Land is one of the important natural resources where all the activities on earth depend on land. All the different kinds of development depend on the availability and quality of land. With many developmental activities and population pressure on land, it affected the land beyond the limits where the land suffers from various kinds of problem like soil erosion, soil degradation and pollution. Land, a non-renewable resource is central to all primary production systems. Over the years, Indian landmass has suffered from different types of degradations. Floods and droughts are recurrent phenomena in India, severely constraining agriculture. The problem of land degradation gets exacerbated due to large scale land erosion in which fertile top soil is lost (Prasad, 2009). Different activities causing land degradation are agricultural activities, deforestation, Developmental activities, Quarrying etc.
6. **Loss of flora and fauna**: Agricultural activities such as intercropping, grazing, crop rotation, extensive usage of pesticides and especially with the practice of shifting cultivation causes loss of flora and fauna, as the

agricultural activities involves the clearing and cleaning of the forest area for cultivation while on the other hand natural fertility of the soil is lost which are caused due to cutting down of trees, clearing of forest and burning down of plants for cultivation. All these agricultural activities causes destruction to the natural vegetations as well as it causes the loss of flora and fauna.

Agriculture is the main economic activities of the people in the district as the population is totally dependent on agricultural products for their livelihood. Agricultural activities such as shifting cultivation are one of the main methods practised in the district. There are many factors which effects environment in varieties of way but agricultural activities is one of the major factors effecting environment.

4.2 Uses of chemicals on agricultural enhancement and its weakness

Technological developments in the field of agriculture have improved and increased the agricultural outputs but it also led to the widespread destruction of the environment leading to ecological imbalances. Uses of chemicals do not improve the structure of soils and when it is used for prolonged duration it damages the soil which leads to the loss of the ability of the soil to replenish. Soil is one of the most important natural resources for agriculture and original source of nutrients for plants and crops. Soil has been polluted and exploited by agricultural activities and usage of different chemical fertilizers. Continuous utilization of land for cultivation also plays a major role that affects the ability of the soil to support the growth of plants, as soil is mostly regarded a non-renewable resource because its rate of soil formation is a very slow process.

For improvement of soil and as well as to increase the growth of crops, sustainable soil management with sustainable agriculture steps are initiated, where its efforts are to maintain and increase food and crop productions on the other hand it efforts to prevent soil degradation. Initiation of sustainable agriculture is an approach to farming that focuses on production of foods and crops in a manner that can be maintained with minimal degradation of soil and natural resources. Sustainable approach to agriculture strives to protect environment's natural resources and provide economic profitability while maintaining social equity. The concept of sustainable agriculture is often misinterpreted to mean that chemical fertilizers and pesticides should never be used, this notion is incorrect as sustainable practices should not only consider its stress on crops production but it must include land management strategies that reduce soil erosion and protect natural resources .

In the study area, many of the villages practice organic farming without using chemical fertilizers and pesticides. Some of the villages use pesticides and fertilizers in the field for increasing the growth of plants and to kill unwanted weeds in the field. Among those one of the most common used methods in the area is the practice of spreading the salt water in the paddy field for killing the weeds. Salt is commonly used by almost all the farmers as it is one of the easiest ways for killing the weeds among the paddy plants and it is one of the cheapest products available in the markets. Jha (1997), stated that the management practice for weed control is identification of varieties of crops which have very fast early growth rate and he suggested that peasants can use weedicides but should always use recommended dose of weedicides for different crops. He said that the extension worker should know the weeds habitat, growth behaviour and crop association and accordingly to suggest methodology to suppress the weed growth. Different fertilizers and

pesticides are also used in the field by the farmers to kill unwanted plants and species in the field. Some of the fertilizers and pesticides used by the farmers are;

1. **Round up**: It is the brand name of a systemic broad-spectrum glyphosate – based herbicide originally produced by Monsanto which hit the market in 1970s and an American chemical company first sold the herbicide commercially in 1974. Its main ingredient is isopropylamine salt of glyphosate and another ingredient as surfactant. It is a herbicide which is recommended to control axonopus compressus, cynodon dactylon, imperata cylindrical, polygonum perfolliatum, paspalum scrobiculatum, arundinella, Bengalensis and kalm grass of tea crop and in non cropped areas for monocot and dicot and in general weed control. This chemical composition is used by the people in the district for killing the weeds around the fields and footpaths. But it is not used by all the farmers. Some of the risks on the uses of roundup are human health risk on exposure, effects on water habitats etc
2. **Salt:** It is commonly used by the villagers for killing the weeds in the paddy field. It is used in the Jhum fields to get rid of the weeds in the paddy fields. It is said that the spreading of salt water in the paddy field increases the yields of the paddy but disadvantages of using salt water in the field is that it pollute the soil and it prevent the growth of trees in the salt used area. Some farmers even mixed petrol with the salt water to prevent the salt water from washing away by rain. They mixed it so as the petrol is sticky which helps to hold the salt water in the soil. Villagers have recently realised the negative impact of using salt water in the paddy fields and recently many villages have banned the use of salt water in the fields. The use of salt for killing weeds in the field is common for all the farmers as they find it as one of the easiest and

cheapest way of killing the weeds in the field. The spraying of the salt water in the field depends on the size of the field. Depending on the sizes of the field, around 3-5 bags of salt is used in the field and some farmers use even more than 5 bags in the field.

Table 4.1: Number of sample Towns and villages in Zunheboto District using Salt water in the paddy field

Sl. No	Name of Circle	Total Number of sample villages	No. of village using Salt	No. of villages in organic farming	Restricted use of salt/ Chemicals
1	Aghunato	6	3	3	
2	Asuto	2	2	0	
3	Zunheboto	6	2	4	
4	Satakha	2	1	1	
5	Atoizu	3	1	2	2
6	Suruhuto	2	2	0	
7	Ghathashi	2	0	2	
8	Satoi	2	2	0	
9	Akuluto	2	0	2	2
10	Pughuboto	3	1	2	2
11	V.K	2	0	2	
12	Saptiqa	5	2	3	3
13	Akuhaito	4	2	2	
	Total	41	18	23	9

Source*: Field survey (2017-2019)*

Using of salt and weedicides makes the works easier but the people also realize the negative impacts of its usages. It is said that the presence of salts affects the plant uptake of nutrients and the microbiological activity in the soil. Salinity also affects other soils to lesser extent and may lead to recognition of saline phases which also deserve attention when present under salt-sensitive crops. To prevent the excessive accumulation of salt in the root zone, irrigation water or rainfall is applied in excess for the evaporation of the crop. Saline water also decrease the phosphorus,

potassium, calcium and magnesium contents and increase the nitrogen and sodium contents. Nutrient uptake is decreased by water salinity and increased by nitrogen application (Kumar et al. 2012).

Recently it has been found out that the farmers started using soap (lifebuoy) to kill the fall army worm (FAW) in the crop plants. It is found that the spread of soap water in the plants kill the worm immediately.

3. **Lime**: It is also used by some farmers in the field. It is mixed in the seeds to prevent and protect the seeds from the worms and ants inside the soil. As liming can also improve the soil quality of acid soils to adjust pH to the levels needed by the crops to be grown, it benefits in increased nutrient availability and improve soil structure. Agricultural lime is also commonly known as Aglime, garden lime or liming. Calcium carbonate is the active component in agricultural lime. It is used in agriculture as a calcium supplement or as an antacid. Its effect on soil is that it reduces soil acidity and increases its alkalinity, provides a source of calcium and magnesium for plants, and it improves the uptake of major plant nutrients like nitrogen, phosphorus, and potassium for growing on acidic soils.

   Lime is the oldest traditional stabilizer used for soil stabilization however lime treatment has a number of inherent disadvantages such as carbonation (a chemical reaction of carbon dioxide to give carbonates, bicarbonates and carbonic acid), sulfate attack and environment impact.

   A harmful effect of the uses of lime on environment is that lime is a component of calcium carbonate which involves the calcinations (heating to high temperature in air or oxygen), the production of any calcium based material such as lime involves the calcinations of calcium carbonate. This

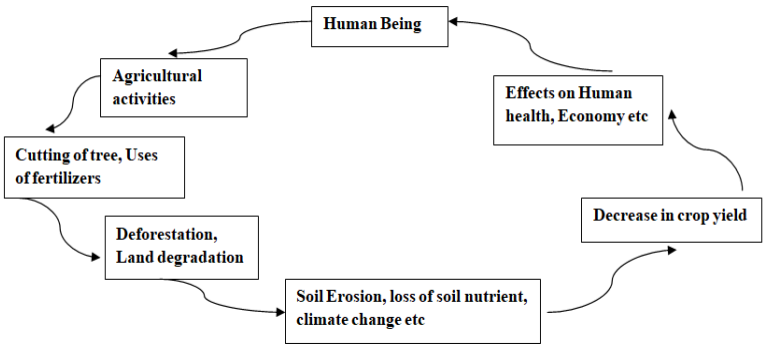
calcinations process occurs at very high temperature, therefore the process is responsible for a considerable percentage of carbon dioxide emission in addition to high energy consumption (Birchal et al, 2000; Shand, 2006). Hence the production of calcium based additives has a negative impact on environment.

4. **Use of Pesticide**: Without use of pesticides more than half of the crops would be lost to insects, weeds etc. uses of pesticides help farmers grow and yield more crops on less land by protecting from the invading pests ,weeds etc from the field. Some common method used in some villages is that farmers used the pesticide while sowing seeds, as they put pesticide and maize in the water and mixed it well before sowing the seed, to protect seeds in the early stage from the insects before the seeds sprout out.

4.3 Effects of extensive Agriculture

Human being cannot survive without food and they depend on the agricultural activities for the food and economy. But agricultural activities practiced by the people have impact on the life of the people. The following fig.4.1 show the cycle of human activities on agriculture:

Fig. 4.1: Cycle of effects of extensive Agriculture



Source: *Primary data*

1. **Human:** The basic needs of life for man, like food, shelter, clothing etc all comes from the environment. Even the food chain itself is a part of environment and human being cannot survive without food, so humans depend on their surroundings for food and for the survival. Hence agricultural activities become the most important role for the needs of food, thus their practice of agriculture depend on the place or region or the availability of forest and land for the cultivation.
2. **Agricultural activities**: For the survival and economic development, man practice agriculture. Agricultural activities involves cutting of tree and clearing of the forest for cultivation. With the increase of population, demand for food crops increased and with the increased demand for food agricultural activities increased which as a result has great impact on the forest and land in the environment.
3. **Use of Fertilizers**: For increasing the growth of different plants and also to increase the supply of demand for food crops, fertilizers and pesticides are used in the field which as a result caused land degradation, loss of soil nutrient etc.
4. **Deforestation**: Demand of food supply leads to the increase of agricultural activities and with the increase of agricultural activities, the pressure on the forest increased. Due to the increasing agricultural activities, many of the forest have been converted to agricultural land especially in the populated areas or regions with less forest cover. Cutting of trees for different purposes and increasing agricultural activities especially the practice of shifting cultivation in the hilly regions leads to deforestation.
5. **Soil Erosion:** Many factors leads to soil erosion but agricultural activity is one of the major factors contributing to soil erosion where all the soils on the

surface are washed away by rain , wind or running water which effects soil fertility.

6. **Loss of soil nutrient:** Washing away of surface soil leads to the loss of soil fertility and also the use of different chemicals in the fields effects the soil nutrients which as a result effects the growth of plants and decrease the yield of crops in the field.
7. **Land Degradation:** Pressure on land for different activities effect land and agricultural activity is also one factor which pollutes and degrades the quality of land and soil. Land degradation affects food production, livelihoods etc.
8. **Climate Change:** Agricultural activity also contribute towards climate changes by decreasing forest cover and causing ecological imbalances.
9. **Decrease in crop production:** Soil and climate play an important role in the production of the crops. When the soil fertility and climate of a particular area is effected the yield and productivity of a particular area decreased.
10. **Effect on economy:** Contribution of agricultural products plays an important role in the economy of a particular area or region. Decreased in agricultural output will automatically affects the economy of the region.
11. **Effect on Human Health:** Different fertilizers and pesticides are used in the agricultural field for increasing the production of the crops and also for removing and killing of different species and weeds in the field which increased the yield of crops but the use of different chemicals in the field pollute the soil and crops which ultimately effects the health of man.
12. **Effect on Human Being:** Human being is the only living being who alters the environment for their survival and for their own benefit. All their activities effect the environment and that effect on environment has great impact on the life of human being. They alter the environment for their own

uses but when the activities reach beyond certain limits for the environment, its result reflects back to the human. The activities they start to satisfy their needs will be reflected in their life which can lead to the cost of their own life.

Human being plays an active role in utilizing all the available resources on the earth. Environment is polluted by different activities done by the people all over the world and it is affected in such a way that the result has started effecting human life in return. Human has great impact in changing the face of the earth and has power to utilize all the available resources but at the same time they must realized that the result of their activities can be harmful to them in return. Agriculture is one of the main activities which has been practicing since thousands of years ago and since the beginning of the cultivation it is effecting the environment as it involves the burning, clearing of forest, use of chemical fertilizers etc. Everything on the earth is related in one way or the other way. Therefore destroying or affecting one will ultimately affects the other as well. Activities for the survival cannot be stop but it should be practiced in such a way that the activities of one will not be a result of destructions for the other.

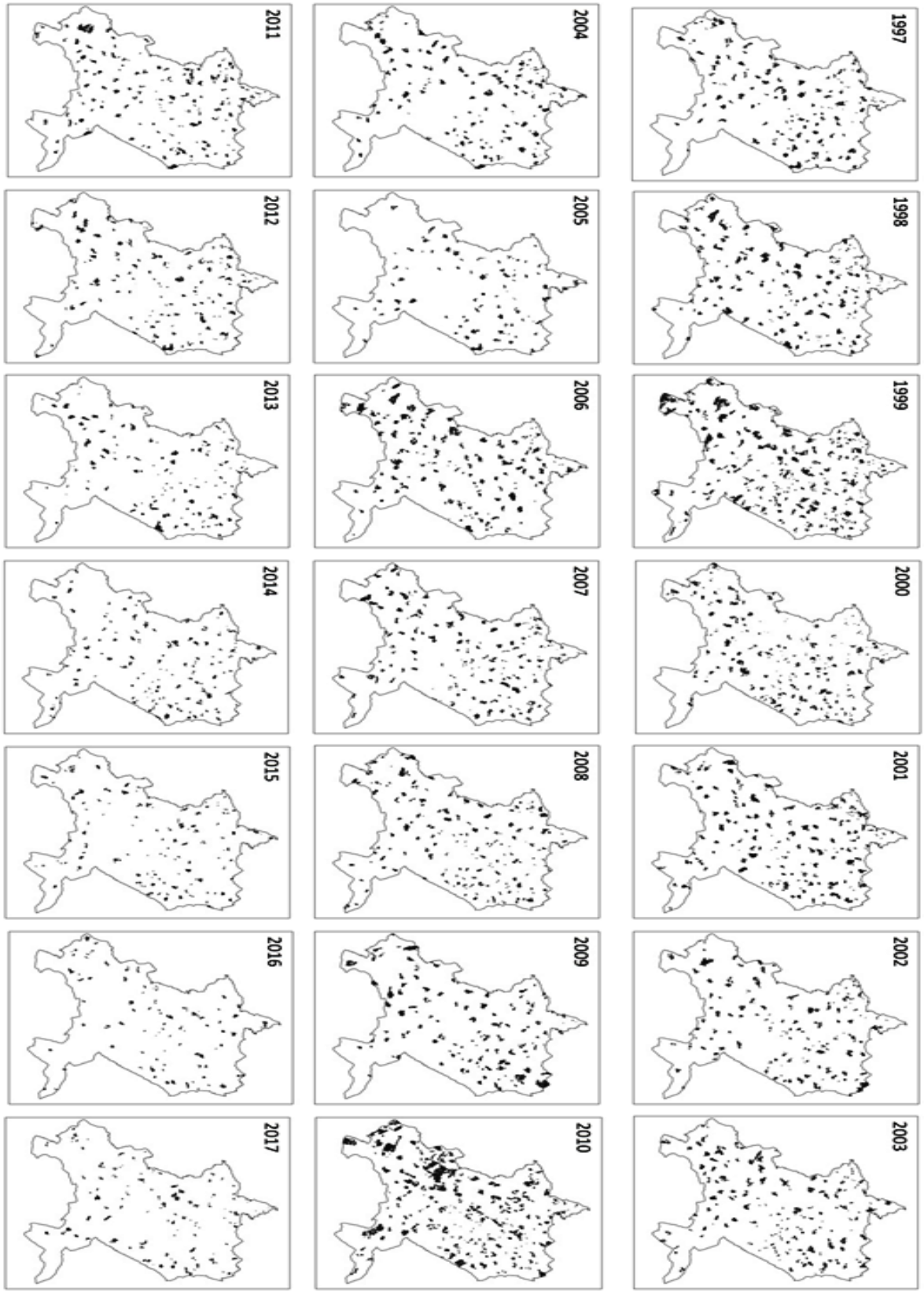
4.4 Dynamic of shifting cultivation during the last two decades (1997-2017) of Zunheboto District

Shifting cultivation is one of the most important agriculture activities in the district. Every year thousands of hectares of forest are cleared for shifting cultivation. Shifting cultivation is done mostly for the paddy cultivation and along with it some of the crops are also grown for domestic consumptions. In early days most of the people depend only on the agricultural products and agricultural

activities is the oldest economic activities of the people, but with the introduction of many different schemes and developmental plans by the government, depending on the agriculture decrease as people depend more on the products and goods from the markets which are imported from the neighboring states and areas. Mostly cultivation is done for home consumptions and only few surplus goods are sold in the local markets by the villagers and some sell it through the middle persons. There was a change in the practice of shifting cultivation in the district during the last two decades, where increase and decrease in shifting cultivation were experienced depending on the area of Jhum plots they cultivated, and it also depend on the years of cropping because in some areas they cultivate the fields for 3 to 4 years. The first year cropping is done mainly for the paddy and maize cultivation and the 2^{nd} ,3^{rd} and 4^{th} cropping is done mainly for the cultivation of crops like maize, potato, chilly, pumpkin, gingers, beans etc.

There is a drastic change in the total area of Jhum cultivation in Zunheboto District from 1997 till 2017. There is a decrease in the Jhum cultivation with the increase in population. There has been a decreasing trend in the annual area under Jhum field and the decrease has been more prominent from the year 2010. The total area of cultivation is highest in the year 2010 with 16.34 % and the lowest is in the year 2005 with 3.38%. For the year 1997 to 2001, not much change is found in the total area of cultivation but there is a decrease in 2005 and increase to 8.49 % in 2006. The increase and decrease in the total area of cultivation are found in between 2006 to 2009. The whole area of the district has been affected by shifting cultivation except the virgin forest in Satoi range.

Fig. 4.2: Maps showing area under annual current Jhum in Zunheboto District (*dot in the map indicate the current Jhum field)



Source: *Primary data*

4.5 Changes in shifting cultivation during the last 21 years

The practice of shifting cultivation is the main livelihood of the people in Zunheboto district except the people living near the river banks who practices terrace cultivation. There has been a drastic change in the practice of shifting cultivation in the district, where the practice of shifting cultivation seems to be decreasing despite the increase in the total population. During the last 21 years, total area of 886.29sq.km is affected by shifting cultivation in the district which is 55.54% of the total area of the district. Almost all the forests in the district has been cleared for shifting cultivation since 1997 till 2017, except in the south eastern part of the district where there are some forests area which has not been affected by the shifting cultivation. Satoi range is one of the only remaining virgin forests in the district which is surrounded by lush green trees and vegetations. This range offers only facility for camping and trekking. The change in the practice of shifting cultivation is due to the social economic conditions of the people. With the increase in the educational facilities and many developmental programs initiated by the government to improve the life of the farmers and to improve the agricultural activities show a positive result by decreasing in shifting cultivation. Different activities like providing drinking water facilities, educational facilities, supply of rice, construction of Agri link roads in every villages, providing subsidies to the farmers and many different schemes helps in improving the life of the villagers. With all these facilities and developmental programs involvement, cultivation activities reduced as people depend more on other facilities and helps from the government and began to engage more on the other economic activities.

Fig. 4.3: Map showing the total area affected by shifting cultivation during the last 21 years i.e 1997 to 2017.

Source: *Primary data*

Table 4.2: Annual area under Jhum fields during the 1997-2017 in Zunheboto District

Sl. No	Year	Current	%	2nd yr	%	3rd yr	%	4th yr	%	Total	%
1	1997	8227.88	5.16	5574.48	3.49					13802.35	8.65
2	1998	9589.47	6.01	7384.77	4.63	3508.01	2.20		0.00	20482.25	12.83
3	1999	14315.56	8.97	6901.31	4.32	1417.60	0.89	898.68	0.56	23533.15	14.75
4	2000	8031.82	5.03	8486.40	5.32	64.17	0.04		0.00	16582.38	10.39
5	2001	10217.73	6.40	8031.82	5.03	1151.28	0.72	64.17	0.04	19464.99	12.20
6	2002	7725.50	4.84	5994.98	3.76	101.33	0.06	37.67	0.02	13859.49	8.68
7	2003	8863.54	5.55	4802.67	3.01	1401.38	0.88	10.83	0.01	15078.42	9.45
8	2004	7450.68	4.67	6152.95	3.86	356.78	0.22	182.46	0.11	14142.87	8.86
9	2005	4396.48	2.75	985.18	0.62	19.38	0.01		0.00	5401.04	3.38
10	2006	10350.57	6.49	2991.18	1.87	199.45	0.12		0.00	13541.20	8.49
11	2007	8133.44	5.10	7030.43	4.41	1188.40	0.74	0.12	0.00	16352.39	10.25
12	2008	7539.44	4.72	3954.98	2.48	621.36	0.39		0.00	12115.78	7.59
13	2009	8812.88	5.52	5059.89	3.17	678.39	0.43	62.62	0.04	14613.78	9.16
14	2010	16461.60	10.32	6917.91	4.33	2520.29	1.58	182.71	0.11	26082.51	16.34
15	2011	7307.94	4.58	9990.91	6.26	2896.62	1.82	1452.20	0.91	21647.67	13.56
16	2012	5942.17	3.72	3334.17	2.09	2618.56	1.64	469.50	0.29	12364.41	7.75
17	2013	5099.87	3.20	3312.71	2.08	404.02	0.25	832.48	0.52	9649.08	6.05
18	2014	4842.20	3.03	3163.92	1.98	619.80	0.39	233.90	0.15	8859.82	5.55
19	2015	4054.49	2.54	4391.20	2.75	995.72	0.62	347.00	0.22	9788.42	6.13
20	2016	3287.53	2.06	3240.49	2.03	64.61	0.04		0.00	6592.63	4.13
21	2017	3753.40	2.35	2510.35	1.57	978.58	0.61	64.61	0.04	7306.94	4.58
	Total	**159588.5**		**159588.46**		**159588.5**		**159588.5**		**159588.5**	

Source: *Primary data*

Fig. 4.4: Annual area under Jhum cultivation in Zunheboto District

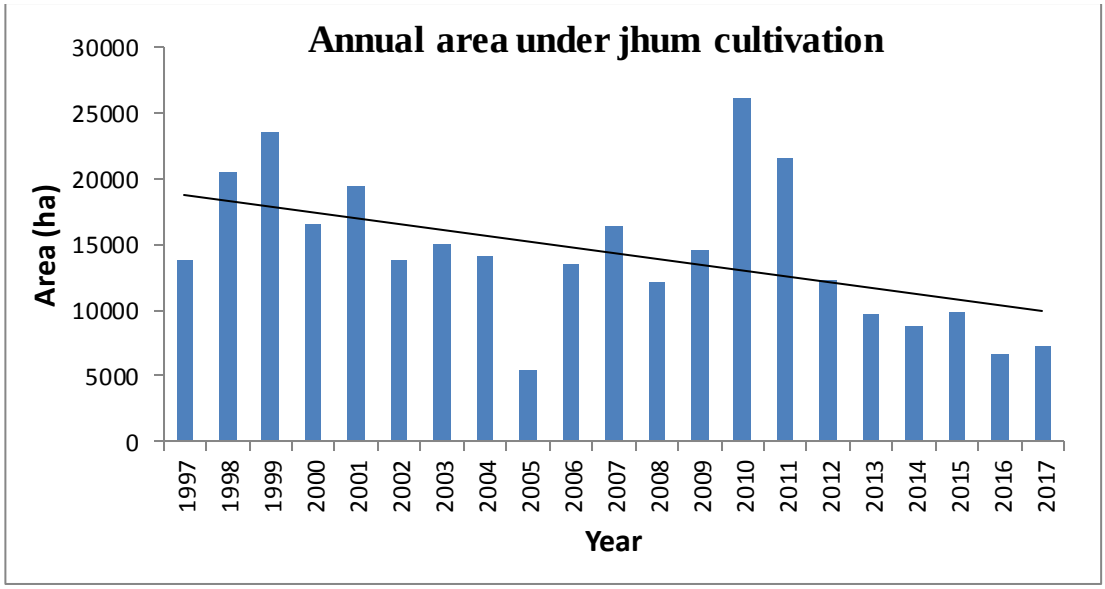
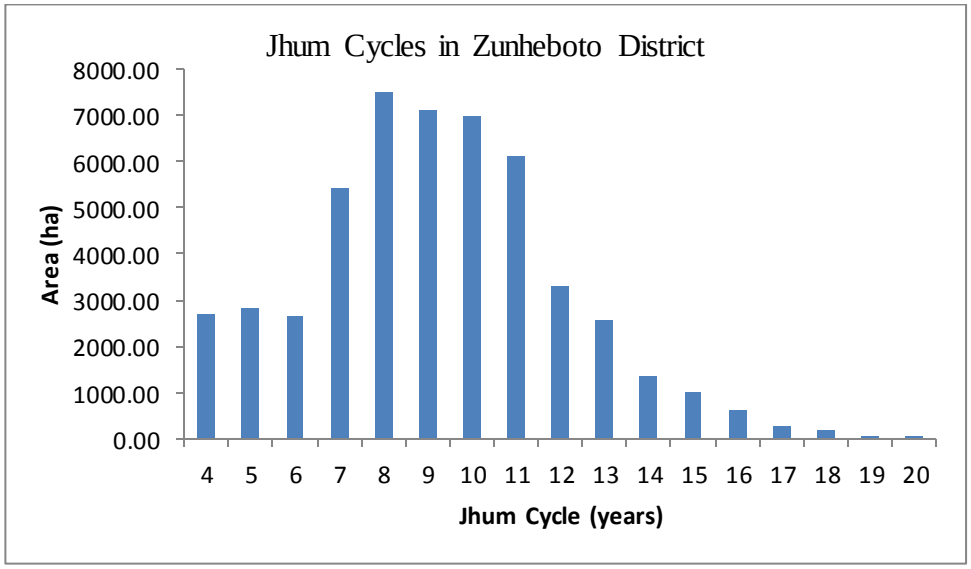


Table 4.3: Area under different Jhum cycles in Zunheboto district

Sl.No	Jhum cycle (years)	Area (sq.km)	% of total	
1	4	26.988	5.32	
2	5	28.082	5.53	16.07
3	6	26.487	5.22	
4	7	54.416	**10.73**	
5	8	75.170	**14.82**	
6	9	71.337	**14.06**	**65.47**
7	10	69.956	**13.79**	
8	11	61.271	**12.08**	
9	12	33.008	6.51	
10	13	25.624	5.05	
11	14	13.474	2.66	17.40
12	15	10.043	1.98	
13	16	6.139	1.21	
14	17	2.518	0.50	
15	18	1.782	0.35	1.06
16	19	0.770	0.15	
17	20	0.298	0.06	
18	Total	507.362		

Source: *Primary data*

Fig. 4.5: Jhum cycle in Zunheboto District, Nagaland



4.6 Cycle of shifting cultivation and changes in soil reaction/ condition

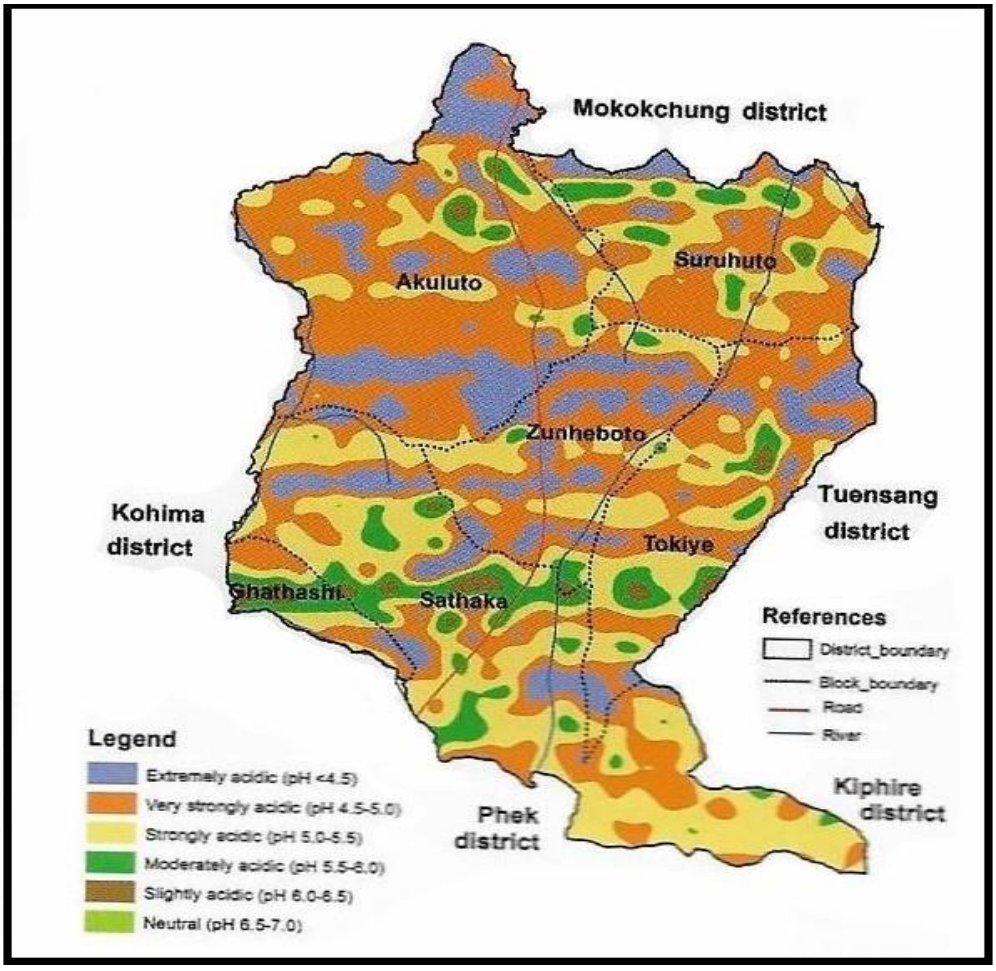
The cycle of shifting cultivation varies from place to place depending on the availability of forest land as well as on the population depending on the cultivation. In some areas of the district all the forest areas are not used for shifting cultivation but instead the forest is divided into different Jhum plots for Jhum cultivation. Every year cultivations is done in these Jhum plots, after completing cultivation the fields are left fallow and barren and shift to other plot for cultivation. After the harvesting of the first year crop, the field is cleared and cleans for second year cropping. The new forest is cleared for cultivation near the abandoned field so that some farmers can cultivate both the current field and the 2^{nd} year fields. In some areas of the district there is 3^{rd} to 4^{th} year cropping in which farmers do not cultivate all the areas of the field but only a small area are cleaned for cultivating which includes chilies, bitter gourd, yam etc. In Zunheboto district, Jhum cycle of 4-20 years has been observed in the study period from 1997 to 2017. Jhum cycle with 4-6 years is 16.07%, 7-11 years is 65.47%, 12- 16 years is 17.40%, and 17-20 years is 1.06%. 7-11 year Jhum cycle is the most prevalent (65.47%) with a mean of 9 years cycle.

4.7 Soil reaction status of Zunheboto district

The table 4.4, shows that the district is dominated by very strongly acidic soils with 42.5 % of total geographical area (TGA), followed by strongly acidic with 32.1% and extremely acidic with 16.4 % of TGA. Moderately acidic soils cover 7.7 % and slightly acidic soils with only 1.3% of the total geographical area of the district. It is said that overall strong acidity of soils predominate in the district as a result of high degree of weathering of acidic parent material under humid climate

with intense and heavy rainfall. Extremely acidic soil reaction is found in the areas where shifting cultivation are dominant.

Fig. 4.6: Soils Reaction (pH) map of Zunheboto District, Nagaland



Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Table 4.4: Soil Reaction (pH) status in Zunheboto District

Sl. No	**Soil reaction**	**pH**	**Area (ha)**	**% of TGA**
1	Extremely acidic	<4.5	20566	16.4
2	Very strongly acidic	4.5-5.0	53390	42.5
3	Strongly acidic	5.0-5.5	40214	32.1
3	Moderately acidic	5.5-6.0	9685	7.7
5	Slightly acidic	6.0-6.5	1645	1.3
	Total		125500	100.0

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig.4.7: Distribution of Soil reaction Status in Zunheboto district, Nagaland

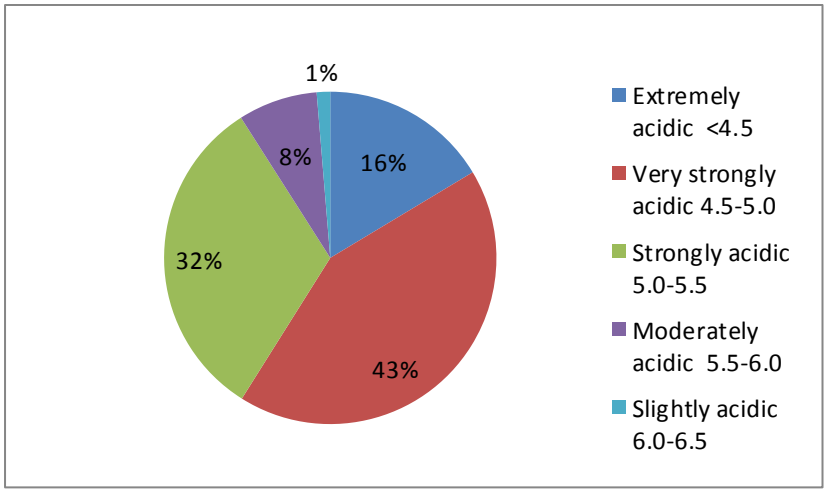


Table 4.5: Block wise distribution of soil reaction in Zunheboto district, Nagaland

Soil reaction	**Ghathashi Area (ha)**	**Zunheboto Area (ha)**	**Tokiye Area(ha)**	**Satakha Area ha)**	**Suruhuto Area (ha)**	**Akuluto Area (ha)**
<4.5	164	4117	2703	3117	1705	8760
4.5-5.0	1295	6599	8578	10317	8500	18101
5.0-5.5	986	3788	5993	17966	5964	5516
5.5-6.0	983	490	1484	4181	1610	938
6.0-6.5	435	50	389	558	49	164
Total Area	**3863**	**15044**	**19147**	**36139**	**17828**	**33479**

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig. 4.8: Area of available soil reaction in Zunheboto District, Nagaland

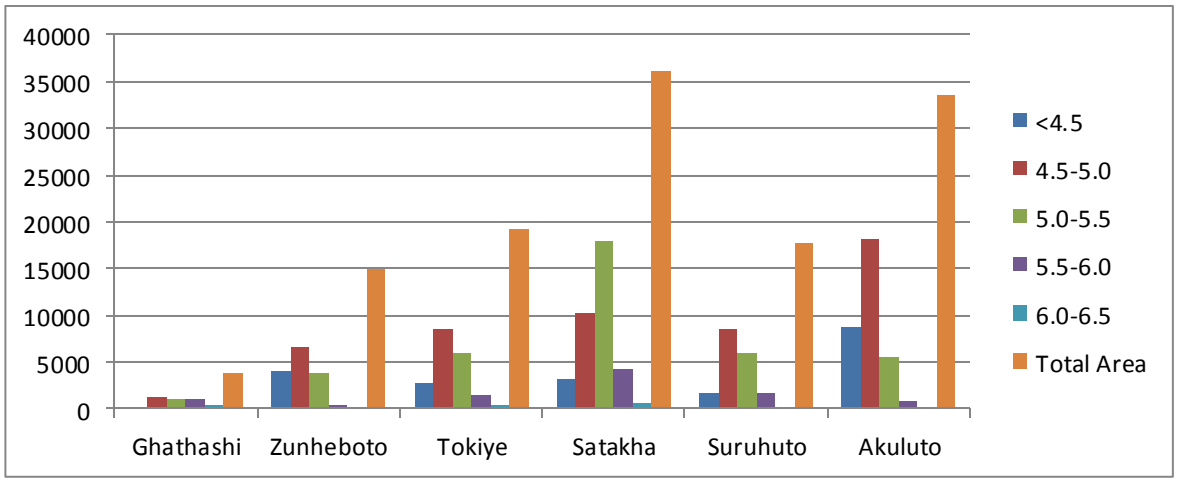
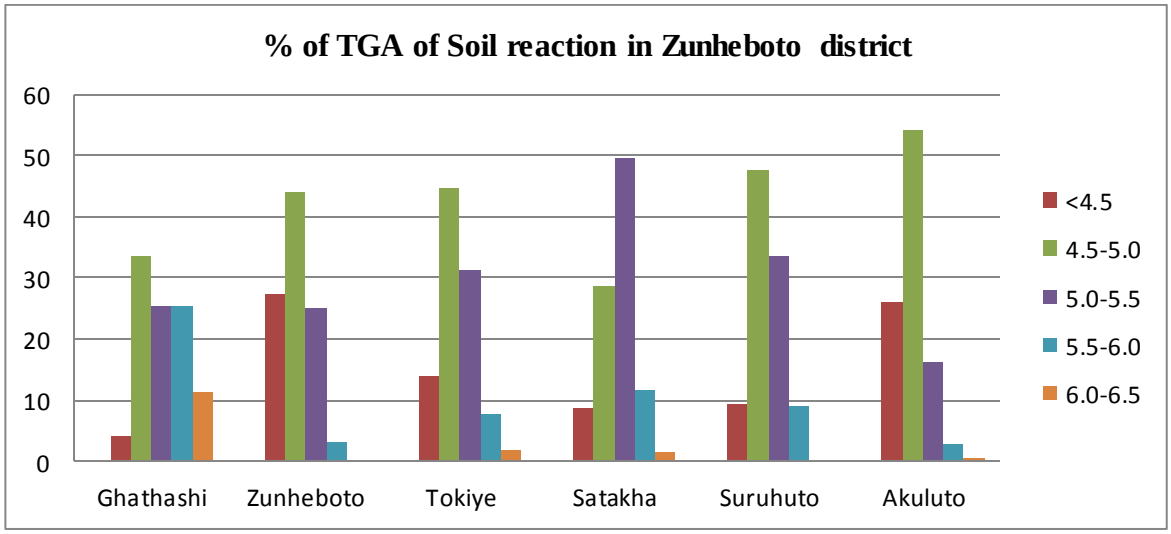


Table 4.6: Percentage of Total Geographical area (TGA) of Soil reaction in Zunheboto district

pH	Ghathashi % of TGA	Zunheboto % of TGA	Tokiye % of TGA	Satakha % of TGA	Suruhuto % of TGA	Akuluto % of TGA
<4.5	4.3	27.3	14.1	8.6	9.5	26.2
4.5-5.0	33.5	43.9	44.8	28.6	47.7	54.1
5.0-5.5	25.5	25.2	31.3	49.7	33.5	16.4
5.5-6.0	25.4	3.3	7.8	11.6	9	2.8
6.0-6.5	11.3	0.3	2	1.5	0.3	0.5
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

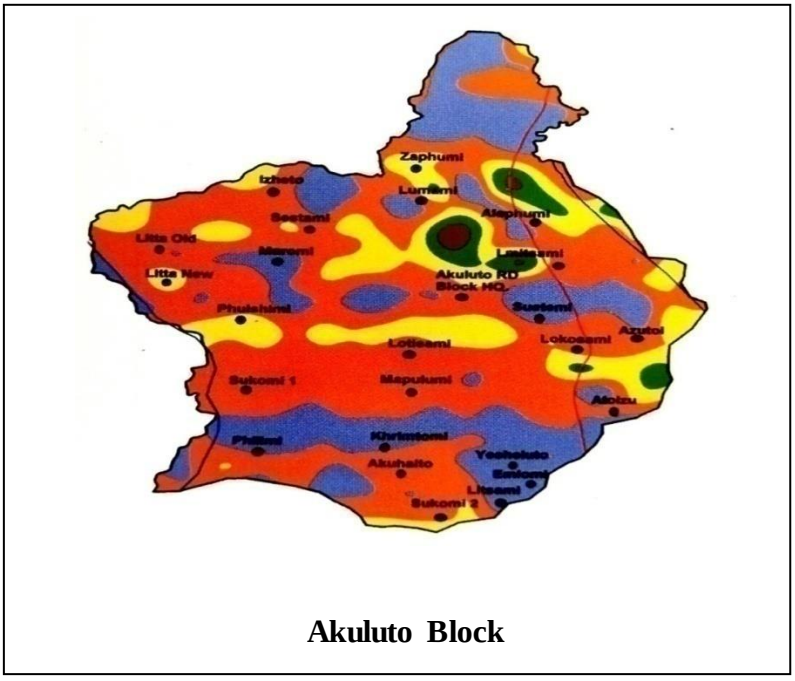
Fig.4.9: Percentage of Total Geographical area of Soil reaction in Zunheboto District



Zunheboto District is dominated by very strongly acidic (4.5-5.0) with 42.5% of total geographical area of 1255 ha and Akuluto block has the highest with 54.1 % followed by Suruhuto block with 47.7 % as this is the major area where shifting cultivation is dominant. Zunheboto district has presently 8 (eight) blocks but the soil nutrient mapping done by the department of agriculture in 2014 includes only 6(six) blocks. In this soil nutrient mapping, Akuhaito block was included in Akuluto block and Satoi block was included in Satakha block. Soil nutrient mapping in Ghathashi

block include only the half part of the block. Akuluto block include both Akuluto and VK circle with total area of 33479 ha. Akuluto block has the highest concentration of very strongly acidic (4.5-5.0) soil reaction with 54.1 % of Total geographical area and low in slightly acidic with 0.5 % of TGA. It is dominated by extremely acidic and very strongly acidic type of soil reaction. Very strongly acidic soil is dominated in all the area of Akuluto block. Extremely acidic soil reaction is found in northern and southern part of the block and some few in the other parts of the block. Slightly acidic with only 0.5% and moderately acidic of 2.8% of soil reaction are found around Akuluto town. Almost all the villages in Akuluto block are dominated by shifting cultivation and most of the villages use salt water for controlling weeds in the paddy field. Block wise distribution of soil status mapping done by the Department of Agriculture are given below.

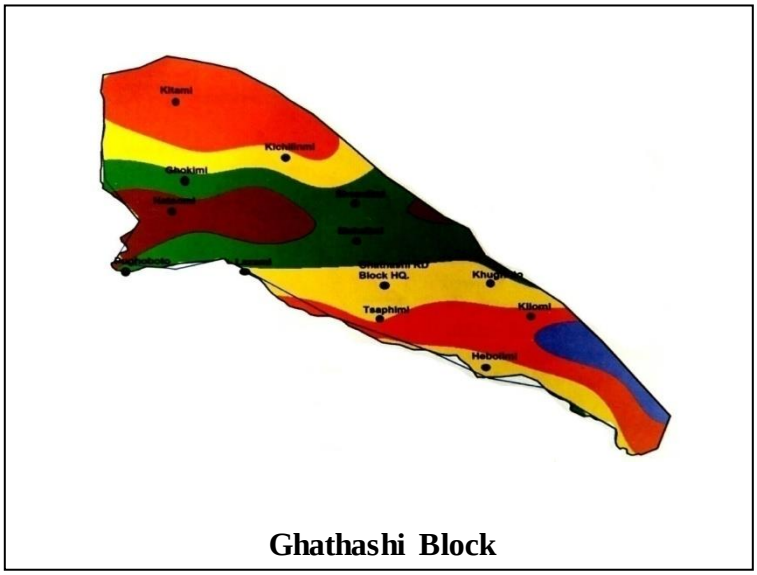
Fig 4.10: Soil reaction map of Akuluto block



Akuluto Block

1. Very strongly acidic- 54.1%
2. Extremely acidic- 26.2 %
3. Strongly acidic- 16.4%
4. Moderately acidic 2.8%
5. Slightly acidic- 0.5%

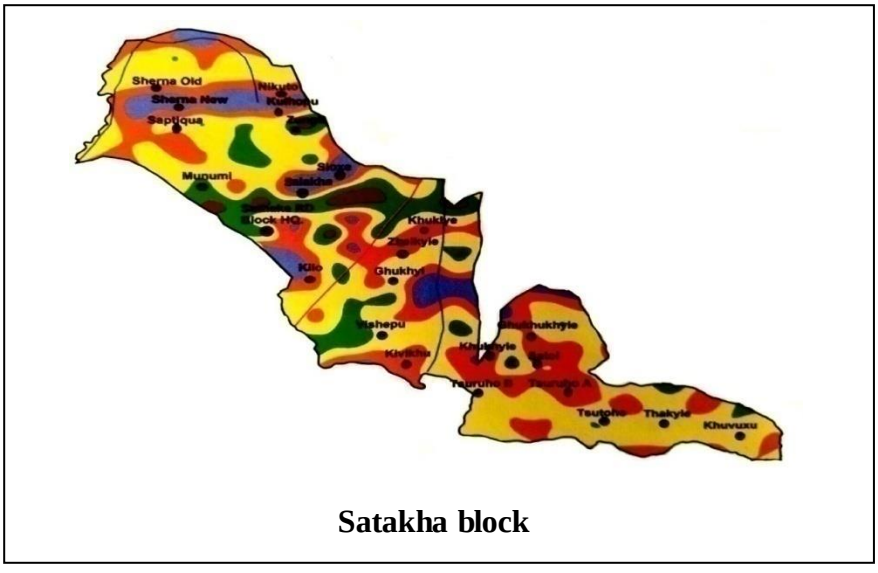
Fig.4.11: Soil reaction map of Ghathashi block



Ghathashi Block

Ghathashi Block includes Pughoboto circle. But half part of Ghathashi block is not included in the map. In Ghathashi block very strongly acidic soil reaction occupy 33.5% of TGA, strongly acidic soil reaction has 25.5 % of TGA. Ghathashi block is the only Block in the district which has the highest moderately acidic soil reaction with 25.4% of TGA and slightly acidic with 11.35% TGA. Moderately acidic pH is concentrated only in the middle part of the block around Mukalimi, Shesulimi, Ghokimi and Lazami. Very strongly acidic pH is concentrated in the area of Kitami village, tsaphimi village and Kilomi village.

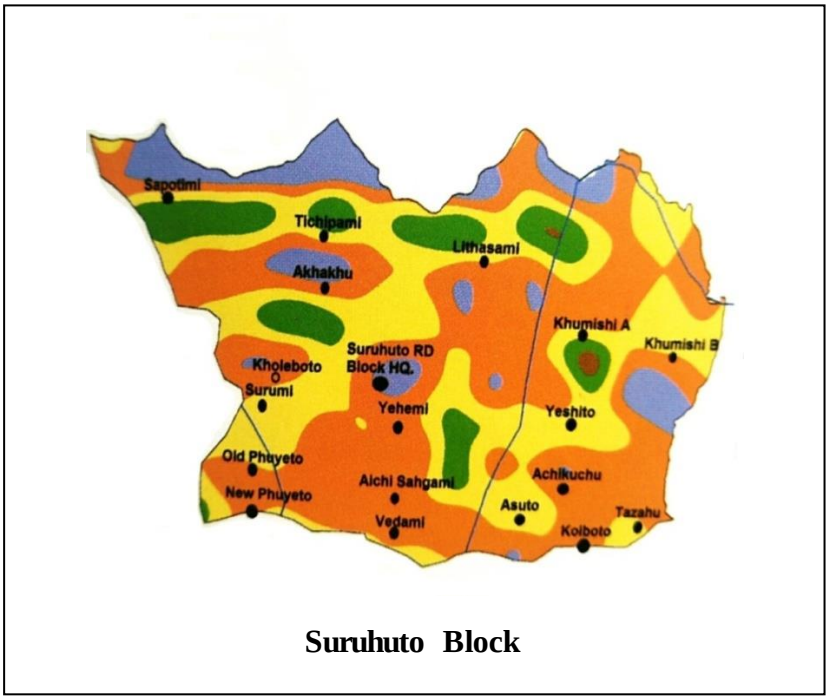
Fig.4.12: Soil reaction map of Satakha block



Satakha block

Satakha block include saptiqa circle but from the map fig ? Satoi circle is also included in this map covering the total geographical area of 36139 ha. Satoi circle is located in the south eastern part of the map where very strongly acidic and strongly acidic soil reactions dominate the area. Moderately acidic soil reactions are found in Satakha area and some small area in other part of the block.

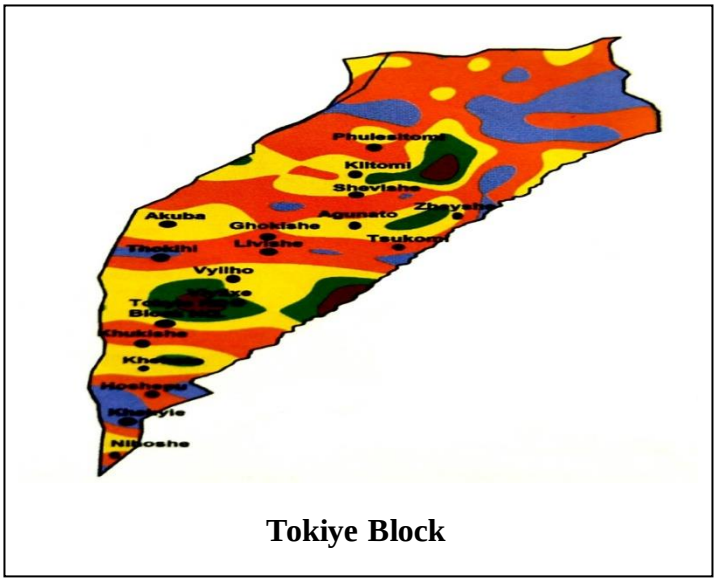
Fig.4.13: Soil reaction map of Suruhuto Block



Suruhuto Block

Suruhuto block include Asuto circle with the total geographical area of 17828 ha. Suruhuto area also has the highest soil reactions of very strongly acidic with 47.7 % of TGA followed by strongly acidic soil reaction with 33.5 % of TGA. Extremely acidic and moderately acidic soil reaction occupy with 9.5% and 9% respectively. All the types of Soil reaction are spread in all the parts of the block. But slightly acidic soil reaction has only 0.3% of TGA around Khumishi village.

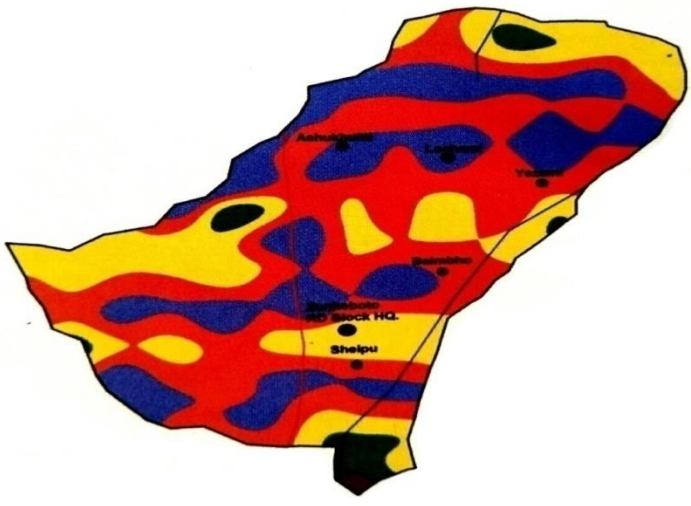
Fig.4.14: Soil reaction map of Tokiye Block



Tokiye Block

Tokiye Block include Aghunato circle with the total geographical area of 19147 ha. Very strongly acidic soil reactions occupy 44.8% of TGA and strongly acidic soil reactions occupy 31.3% of TGA. Extremely acidic soil reactions also occupy 14.1% of TGA. Extremely acidic soil reactions are found in the northern and southern parts of the block with some small area spread around the central part of the block. Very strongly acidic and strongly acidic pH is found in all the areas of the block and moderately acidic pH is found around Keltomi village, Tokiye town.

Fig.4.15: Soil reaction map of Zunheboto Block



Zunheboto Block

Zunheboto block has total geographical area of 15044 ha. Almost all the block is dominated by very strongly acidic, extremely acidic and strongly acidic pH with very strongly acidic pH of 43.9% of TGA, followed by extremely acidic pH of 27.3 % of TGA and strongly acidic pH with 25.2% of TGA. Moderately acidic pH is found only in three parts of the block with only 3.3 % of TGA.

Soil is essentially a mixture of various components, particles and substances. Minerals which are very important are the largest components in the soil making up almost 40% to 45% of the total components. Common minerals found in soils are Iron, Potassium, Magnesium, Calcium, Sulphur etc. One of the most important functions of minerals in soil is the assistance to provide plants life as plants need a number of minerals for a healthy life and growth. The available of different minerals in soils in the district is given below.

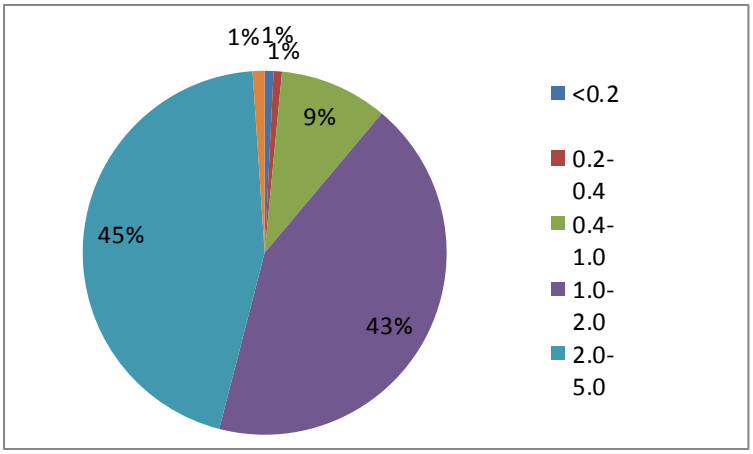
1. **Available Copper (Cu):** The available Copper (Cu) deficient in soils is 0.8% of TGA and sufficient in soils is 99.2% of TGA of the district. Soils in 44.9% of TGA have concentration of Cu in the range of 2.0 to 5.0 mg kg^{-1} and 42.9% of TGA have available Cu in the range of 1.0 to 2.0 mg kg^{-1}.

Table 4.7: Available Copper status in Zunheboto District, Nagaland

Sl. No	Available Cu (mg kg^{-1})	Area (ha)	% of TGA		Rating
1	<0.2	987	0.8		Deficient
2	0.2-0.4	924	0.7	99.2%	Sufficient
3	0.4-1.0	12054	9.6		
4	1.0-2.0	53831	42.9		
5	2.0-5.0	56369	44.9		
6	>5.0	1335	1.1		
	Total	125500	100.0		

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig.4.16: Distribution of available Copper in Zunheboto district, Nagaland



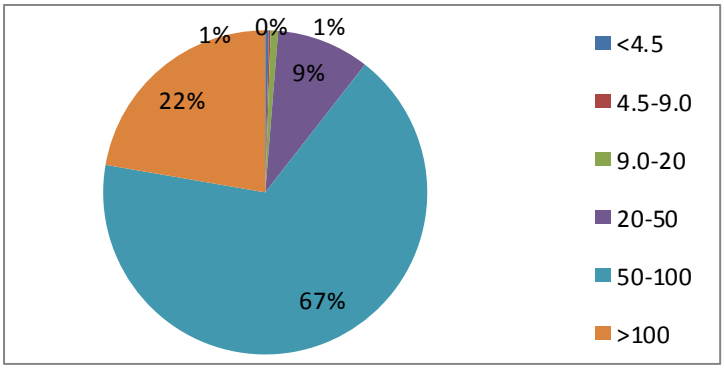
2. **Available of Iron:** The sufficient concentration of available Iron (Fe) in the soils of district is 99.6% of TGA covering almost all the parts of the district and deficient of available Iron in soils is only 0.4% of TGA. The sufficient class is subdivided into five sub classes, i.e 4.5 to 9.0, 9.0 to 20, 20 to 50, 50 to 100 and more than 100 mg kg. The concentration of Fe in the range of 50 to 100 mg kg in soils is 67.1% of TGA. It is said that sufficient concentration of Fe predominance in the district as a result of occurrence of soils from highly ferruginous parent materials with high degree of weathering.

Table 4.8: Available Iron status in Zunheboto district, Nagaland

Sl. No	**Available Fe (mg kg)**	**Area (ha)**	**% of TGA**	**Rating**
1	<4.5	448	0.4	Deficient
2	4.5-9.0	224	0.2	Sufficient
3	9.0-20	938	0.7	
4	20-50	11634	9.3	
5	50-100	84290	67.1	
6	>100	27966	22.3	
	Total	**125500**	**100.0**	

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig.4.17: Distribution of available Iron in Zunheboto district



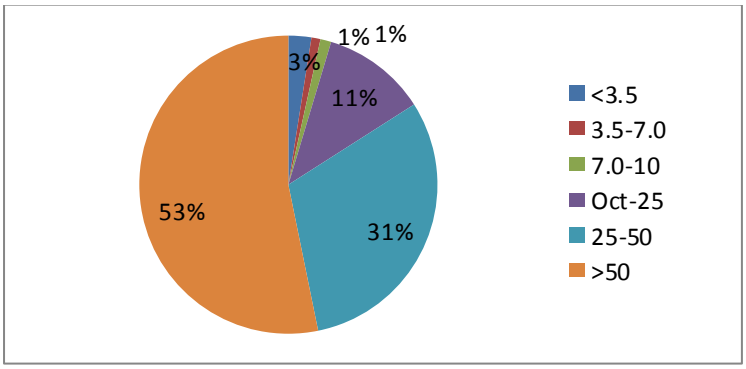
3. **Available manganese (Mn):** The available Manganese (Mn) deficient in soils is 2.5% of TGA only and sufficient in soils is 97.5% of TGA of the district. Soils in 53.2% of TGA have manganese exceeding the concentration of 50 mg kg^{-1} and soils in 30.8% of TGA had available Mn in the range of 25 to 50 mg kg^{-1}

Table 4.9: Available Manganese (Mn) status in Zunheboto district

Sl. No	**Available Mn (mg kg^{-1})**	**Area (ha)**	**% of TGA**	**Rating**
1	<3.5	3116	2.5	Deficient
2	3.5-7.0	1229	1.0	Sufficient
3	7.0-10	1475	1.2	
4	10-25	14213	11.3	
5	25-50	38696	30.8	
6	>50	66771	53.2	
	Total	**125500**	**100.0**	

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig. 4.18: Distribution of available Manganese (Mn) in soils in Zunheboto district



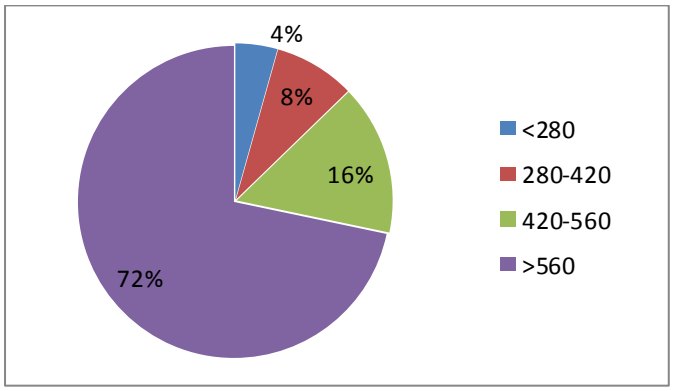
4. **Available Nitrogen:** In Zunheboto district, available Nitrogen in soils is low with 4.4%, medium with 23.9% and high with 71.7% of TGA. In the study area the high availability, predominance of Nitrogen is due to substantial forest vegetation and conventional methods of cultivation with organic amendments.

Table 4.10: Available Nitrogen status in Zunheboto district, Nagaland

Sl. No	**Available N (kg ha^{-1})**	**Area (ha)**	**% of TGA**		**Rating**
1	<280	5467	4.4		Low
2	280-420	10533	8.4	23.9	Medium
3	420-560	19505	15.5		
4	>560	89995	71.7		High
	Total	**125500**	**100.0**		

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig. 4.19: Distribution of available Nitrogen status in Zunheboto district



5. **Organic Carbon (O.C)** The organic carbon of soils is low in 1.0%, medium in 0.6% and high in 98.4% of Total geographical area (TGA) of Zunheboto district. The high class is subdivided into four sub classes to understand the spatial variability with 0.75 to 1.0%, 1.0 to 2.0%, 2.0 to 3.0% and more than 3.0%. Soils with 67.0% of TGA of Zunheboto district comprised of soils having organic carbon content more than 3.00%. The high organic carbon

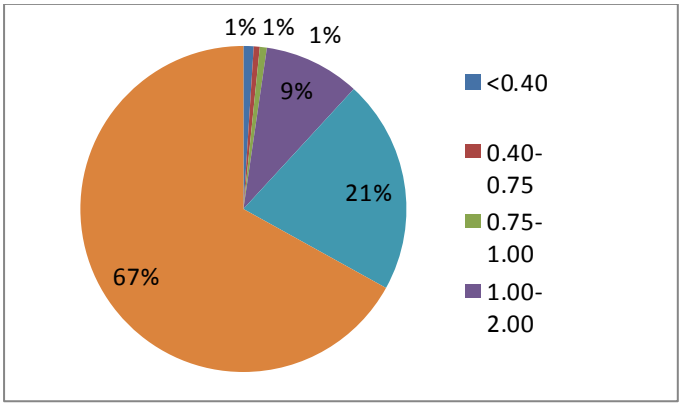
status predominates in the study area is due to dense vegetation cover and long term cultivation practice with organic amendments.

Table 4.11: Organic Carbon status in Zunheboto District

Sl. No	Organic Carbon (%)	Area (ha)	% of TGA		Rating
1	<0.40	1272	1.0		Low
2	0.40-0.75	746	0.6		Medium
3	0.75-1.00	882	0.7	98.4	High
4	1.00-2.00	11952	9.5		
5	2.00-3.00	26622	21.2		
6	>3.00	84026	67.0		
	Total	125500	100.0		

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig. 4.20: Distribution of Organic Carbon in Zunheboto district, Nagaland



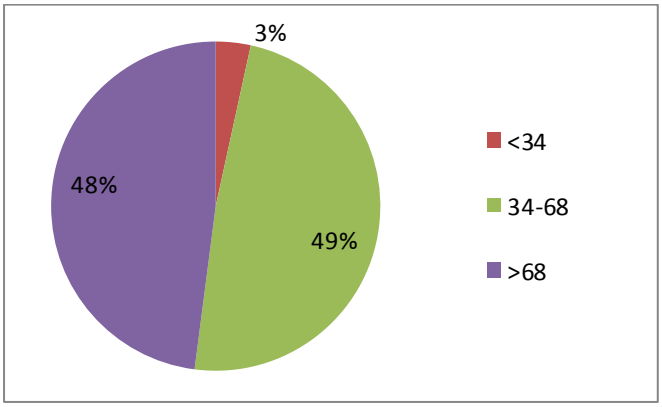
6. **Available Phosphorus Status in Zunheboto district:** The available Phosphorus in soils is low in 3.4%, medium in 48.6% and high in 47.9% of TGA in Zunheboto district. It is said that the predominance of medium to high phosphorus status in the district indicates the availability of P in labile pool of soils.

Table 4.12: Available Phosphorus status in Zunheboto district

Sl. NO	Available P_2O_5 (kg ha^{-1})	Area (ha)	% of TGA	Rating
1	<34	4293	3.4	Low
2	34-68	61033	48.6	Medium
3	>68	60174	47.9	High
	Total	**125500**	**100.0**	

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig. 4.21: Distribution of Available Phosphorus in Zunheboto district



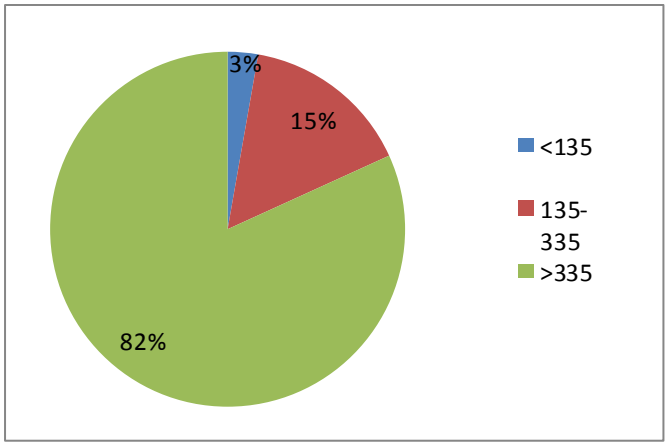
7. **Available potassium (K):** The available potassium in Zunheboto district in soils is low in 2.8%, medium in 15.4% and high in 81.8% of TGA. Most parts of the district bear high concentration of available potassium as a result of occurrence of parent material with potassium bearing minerals and its considerable exchange reactions in soils under acidic environment.

Table 4.13: Available Potassium status in Zunheboto District

Sl. No	Available K_2O (kg ha^{-1})	Area (ha)	% of TGA	Rating
1	<135	3471	2.8	Low
2	135-335	19369	15.4	Medium
3	>335	102660	81.8	High
	Total	**125500**	**100.0**	

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig. 4.22: Distribution of available potassium in Zunheboto district, Nagaland



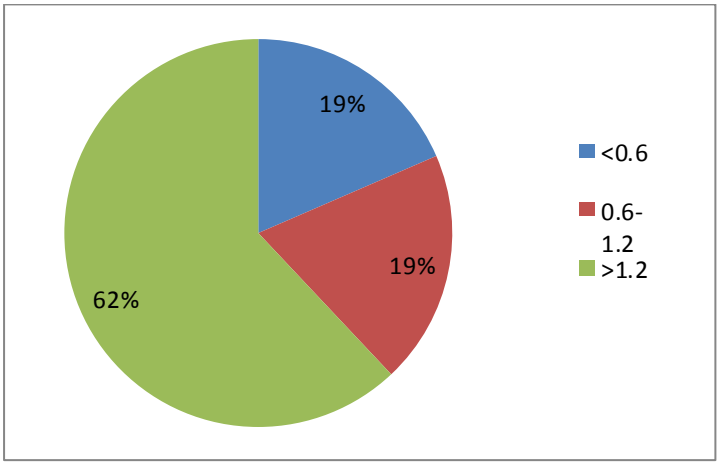
8. **Available Zinc (Zn):** The available Zinc (Zn) deficient in soils is 18.5% of TGA and sufficient in soils is 81.5% of TGA of the district.

Table 4.14: Available Zinc (Zn) status in Zunheboto District

Sl. No	Available Zinc (Zn) (mg kg^{-1})	Area (ha)	% of TGA	Rating
1	<0.6	23212	18.5	Deficient
2	0.6-1.2	24460	19.5	Sufficient
3	>1.2	77828	62.0	
	Total	125500	100.0	

Source: *Soil Nutrient mapping of Nagaland, Department of Agriculture and ICAR (2014)*

Fig.4.23: Distribution of available Zinc (Zn) in Zunheboto district



4.8 Changes in Forest Cover

Forest play an important role in maintaining the ecological balance and it protect wide varieties of flora and fauna. With lots of human activities, forest cover has been decreasing which leads to ecological imbalances in the environment, as many of the flora and fauna has been disappearing due to increased pressure on the forest land for different activities like construction of road, expansion of agricultural activities etc.

Table 4.15: Total Forest Cover of Nagaland (1991-2017)

Year	Geographical area	Very dense forest	Moderately dense forest	Open Forest	Total	% of GA	Scrub
1991	16549	3531		10790	14321	86.54	
1993	16549	3487		10861	14348	86.70	
1995	16549	3487		10804	14291	86.36	120
1997	16549	3487		10734	14221	85.93	70
1999	16549	5137		9027	14164	85.59	14
2001	16549	5398		7952	13345	80.49	47
2003	16549	57	5650	7902	13609	82.23	
2005	16549	236	5602	7881	13719	82.89	13
2007	16549	1274	4897	7293	13464	81.36	2
2011	16549	1293	4931	7094	13318	80.47	3
2013	16549	1298	4736	7010	13044	78.82	2
2015	16549	1298	4695	6975	12966	78.35	622
2017	16549	1279	4587	6623	12489	75.46	503

Source: *India State of Forest Report (1991-2017)*

Fig.4.24: Total Forest Cover of Nagaland

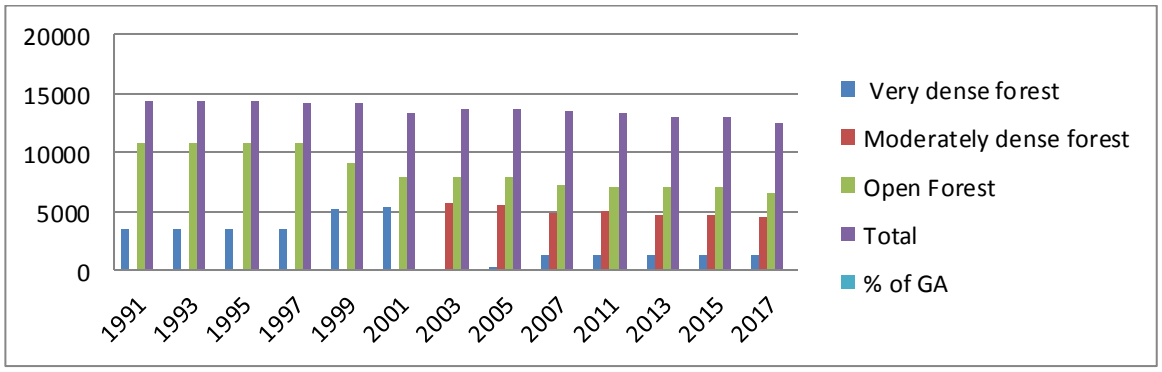


Table 4.16: Forest Cover in Zunheboto District Nagaland (1991-2017)

Sl.No	Geographical area	Year	Very Dense Forest	Moderately dense forest	Open Forest	Total	% of GA
1	1255	1991	70		1029	1099	87.57
2	1255	1993	66		1026	1092	87.01
3	1255	1995	66		1024	1090	86.85
4	1255	1997	66		1006	1072	85.42
5	1255	1999	335		780	1115	88.84
6	1255	2001	385		644	1029	81.99
7	1255	2003	0	461	612	1073	85.50
8	1255	2005	9	510	576	1095	87.25
9	1255	2007	88	427	529	1044	83.19
10	1255	2011	86	416	536	1038	82.71
11	1255	2013	85	385	515	985	78.49
12	1255	2015	85	383	504	972	77.45
13	1255	2017	84	368	481	934	74.42

Source: *India State of Forest Report (1991-2017)*

Fig. 4.25: Forest Cover in Zunheboto District (1991-2017)

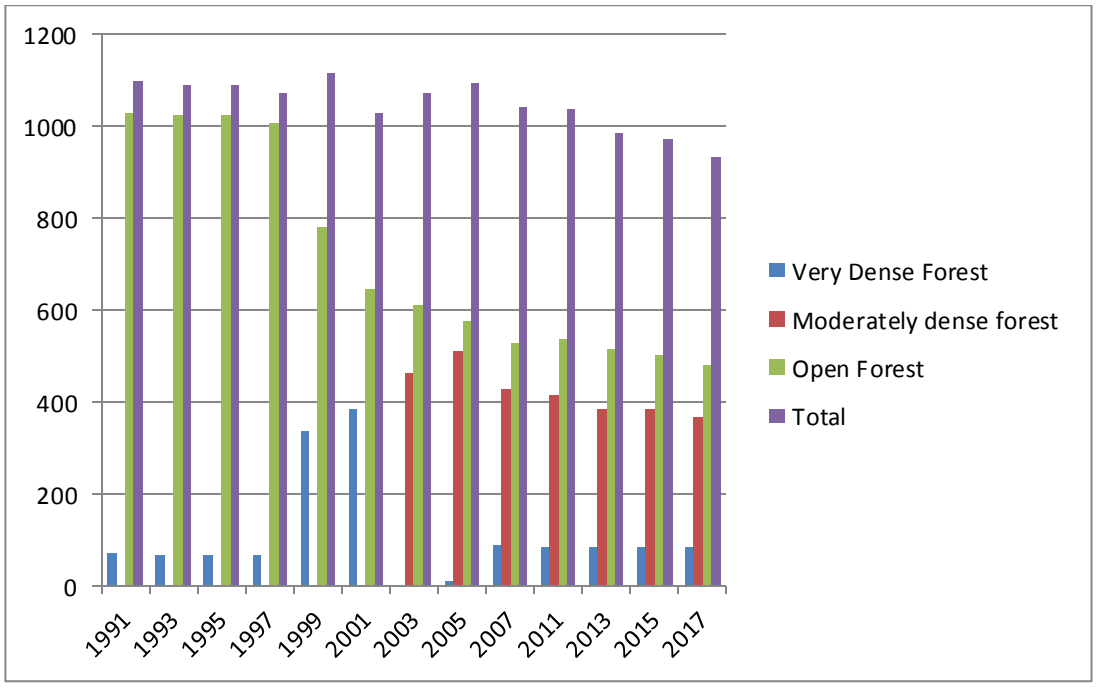
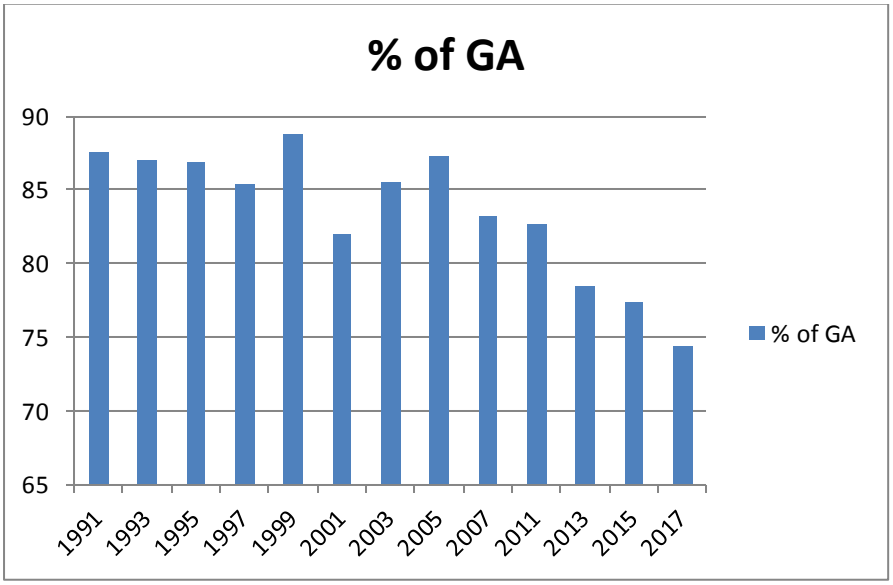


Fig.4.26: Showing the % of Geographical area of Total Forest cover in Zunheboto district, Nagaland (1991-2017)



Zunheboto district has a total geographical area of 1255 sq km according to the government report which has approximately 80 % of the areas covered under forests, with greater number of open forests and least numbered in dense forests. With high altitude and cold climatic condition it has varieties of forests with evergreen forests, deciduous forests and coniferous forests. Total forest cover in the district has been decreasing as shown in the figure. The highest total forest cover in the district is found in the year 1999 with 88.84 % of total geographical area and lowest in 2017 with 74.42 % of total geographical area which shows the decreasing trend of forest cover in the district. The above statistic of forests in Zunheboto district show a decreasing trend in the forests percentages from 1991 – 2017 , which is marked by the constructions and mainly because of the livelihood totally dependent on forests products .

4.9 Changes in Rainfall and Climate in the district

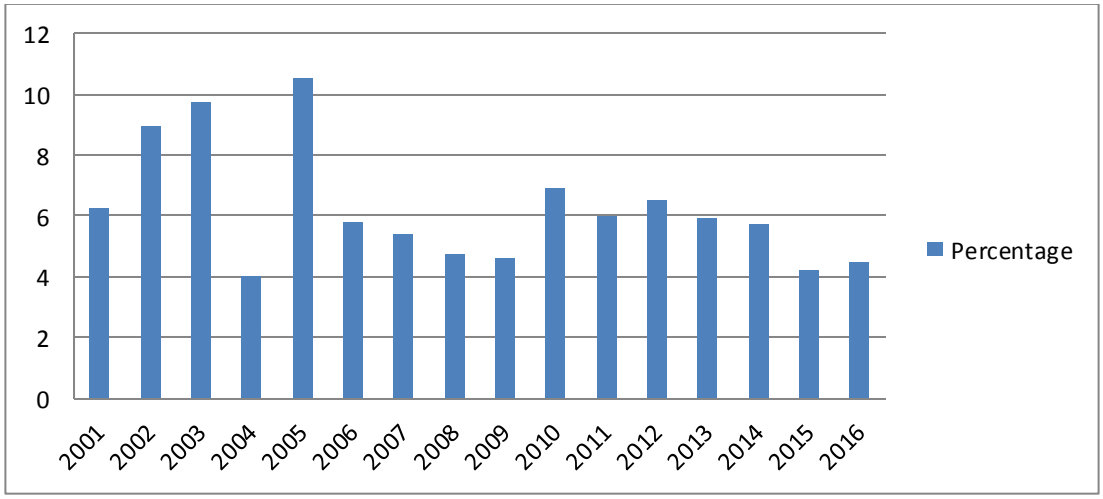
The rainfall and climate varies in the district depending on the latitudinal and longitudinal directions. Rainfall is also one of the factors which influence the agricultural production.

Table 4.17: Average Annual Rainfall of Zunheboto District (2001-2016)

Year	**Annual Rainfall (in mm)**	**Percentage**
2001	1502.7	6.27
2002	2155.2	8.99
2003	2343.6	9.78
2004	961.2	4.01
2005	2530.1	10.55
2006	1393.1	5.81
2007	1293.2	5.39
2008	1133.1	4.73
2009	1108.7	4.62
2010	1662.9	6.94
2011	1435	5.99
2012	1570.6	6.55
2013	1428.9	5.96
2014	1368.1	5.71
2015	1015.4	4.24
2016	1070.1	4.46
Total	**23971.9**	**100**

Source- *Statistical handbook of Nagaland 2017*

Fig. 4.27: Percentage of Annual rainfall of Zunheboto District



Zunheboto district being a hilly area receive more rainfall annually as compared with the low lying areas, as the temperature in the district is lower at sea level with other districts. Annual rainfall in the district decreased from 2001 to 2016 with 6.27% in 2001 and 4.46% in 2016. Highest percentage of rainfall in the district was experienced in 2005 with 10.55 % (2530.1 annual rainfalls in mm)

Table 4.18: Rainy days in Zunheboto district- 2001 to 2016

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Rainy Days
2001	NA	NA	NA	NA	NA	NA	29	25	28	15	0	0	97
2002	8	3	9	23	26	26	31	17	16	12	6	2	179
2003	5	11	13	15	18	25	29	28	26	19	1	0	190
2004	5	0	2	NA	NA	NA	NA	25	26	9	2	0	69
2005	8	1	0	6	30	28	31	30	28	12	2	0	176
2006	0	1	0	11	17	24	24	25	22	8	0	0	132
2007	0	2	3	6	17	26	23	20	26	0	5	0	128
2008	6	0	7	5	22	27	21	19	11	0	0	0	118
2009	0	0	5	10	23	23	16	18	18	13	3	0	129
2010	1	1	5	12	25	29	26	23	25	14	1	3	165
2011	3	3	3	9	20	26	26	24	14	7	2	0	137
2012	5	0	4	14	5	25	30	24	20	11	2	0	140
2013	0	1	10	14	23	20	22.0	24.0	17.0	NA	NA	NA	68
2014													
2015	5	1	2	15	14	25	19	25	17	5	0	0	128
2016	4	2		6	19	17	20	11	19	0	0	0	98
Average	4	1.9	4.8	11.2	19.9	24.7	25	23	21	10	2	0	133

Source*: Department of soil and water conservation*

Fig. 4.28: Average rainy days (2001 to 2016)

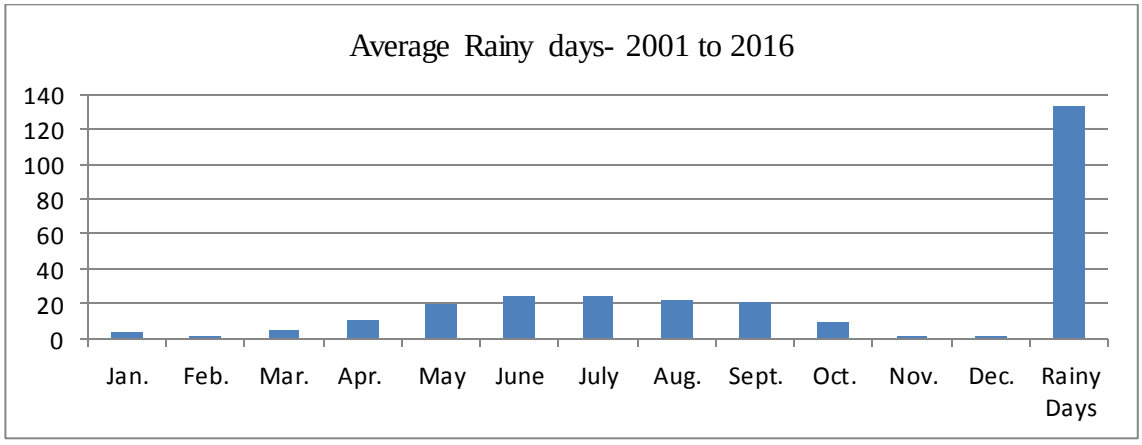
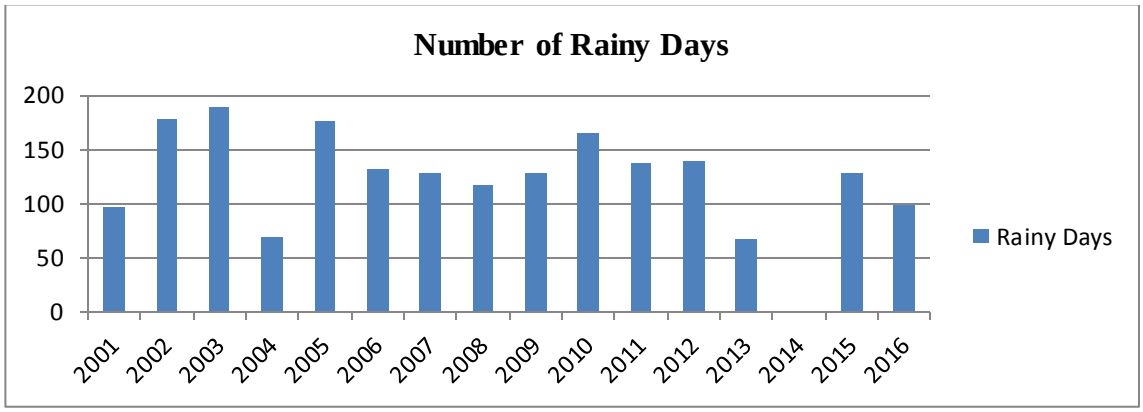


Fig. 4.29: Number of Rainy days in the Zunheboto District



Zunheboto a hilly region with high altitude experience a monsoon climate almost throughout the year. Annual rainy days in Zunheboto district from 2001 to 2016 is shown in the table 4.18. It shows calculation of rainy day in each month annually from the year 2001 to 2016. In the year 2001 it shows moderate rainy days as most of the rainy days of the months are NA (not available).

The district experiences rain for six months annually. With 190 rainy days in 2003 which mark the highest is almost 2/3 number of days in a year. December month do not experience any rainy day as shown in the Table 4.18. 2015 and 2016 shows lower rainy days with 128 rainy days in 2015 and only 98 rainy days in 2016.

Zunheboto is one of the districts in Nagaland which experiences a cold climate throughout the year because of its location in hilly region. As shown in table 4.19, Temperature in Zunheboto district in the year 2001 was 17^{o} C whereas during the year 2002, 2003, 2004 and 2005 it has decline in temperature from 17^{o} C to 13^{o} C. In the year 2006 there was an increase in temperature to 17.1^{o}C experiencing a wide change in temperature since the gap of five years, followed by slight changes in increase and decrease of temperatures in the year 2007 to 2013 with 17^{o}C to 16.1 ^{o}C. In 2014 temperature estimate shows a great increase to 18.4^{o}C which show the highest temperature increase in Zunheboto district during the year 2001 to 2014.

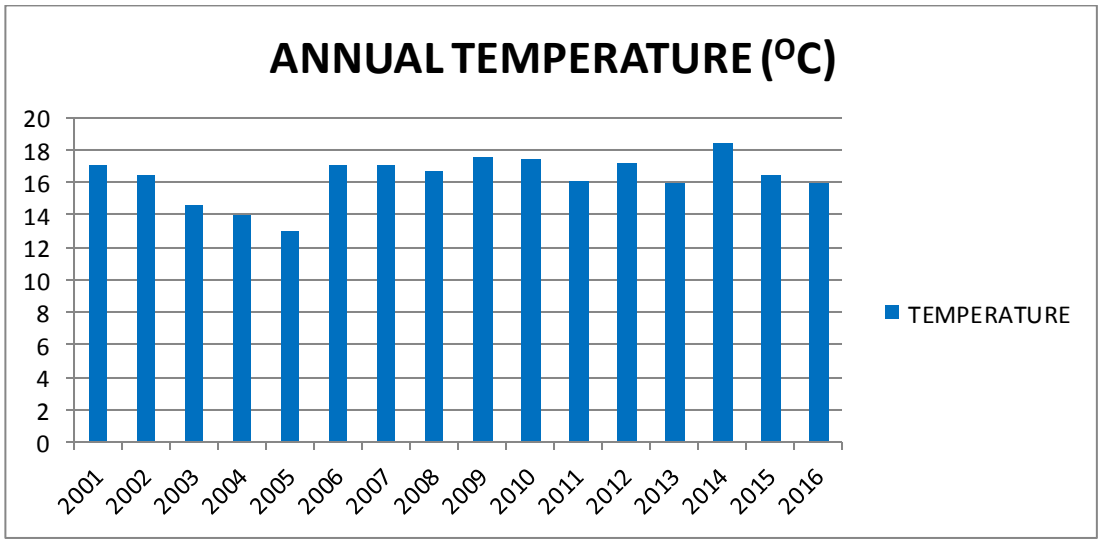
After 2014 the temperature has a gradual decline in 2015 and 2016 with 16.4^{o}C and 16^{o}C respectively.

Table 4.19: Annual Temperature of Zunheboto District (2001-2016)

Year	Temperature (^{o}C)
2001	17
2002	16.4
2003	14.6
2004	14
2005	13
2006	17.1
2007	17
2008	16.7
2009	17.6
2010	17.4
2011	16.1
2012	17.2
2013	16
2014	18.4
2015	16.4
2016	16

Source- *Statistical handbook of Nagaland 2017*

Fig.4.30: Annual Temperature of Zunheboto District (2001-2016)



4.10 Changes in the yields of crops

The stability of agricultural output in the sense of elimination of large year to year fluctuations in output due to weather and rainfall changes is important for economy and the growth in output over time. The fluctuations in agriculture disturb the rhythm and the mutual balance among many interdependent processes in the economy and enhance the degree of uncertainty about the future that is faced by policy-makers as well as producers and consumers in the economy (Ranjan, 2000).

The growth and yield of the crops depend on many factors; improper distribution of Government projects, schemes and also one of the major factors is natural calamities which effects the growth and yield of crops in the field. Growth of the crops also depends on the soil fertility and the maintenance of the field by the farmers. Natural calamities like landslide, flood, drought etc plays an important role in the production of the crops. Over flow of water in the irrigation canal can lead to landslide which destroy the irrigation canal, footpath leading to the field or sometimes it destroys the field. Following are some of the disaster caused by the natural calamities and mismanagement of Government benefits during the past few years in the surveyed villages:

a. Landslide destroyed two terrace fields in 2017 at Hoishe village.
b. Heavy rainfall causing landslide which destroyed water canal leading to terrace rice cultivation in 2018 at Tukunasami village.
c. Landside destroyed the road leading to the cultivation site at Kichilimi in 2017.
d. Crops and fruits were destroyed by hailstone in Puneboqa village.

e. Paddy field destroyed by insects at Kitami (3 to 4 household field were badly affected).
f. Terrace field were destroyed by flood at Hoshepu village.
g. Destroying of paddy field at Shena old village by wild elephant
h. Many centrally sponsored schemed has been implemented in many areas and villages, but many farmers were not aware of all the plans and schemes given by the government.
i. Many schemes and projects in the villages for improving the life of the farmers benefit only few people.
j. Construction of storages and wayside marketing sheds do not benefit all the village because of the accessibility of the village road connectivity or because of the poor road condition people are not able to supply or sale their agricultural products to the other villages or towns.
k. To increase the production and productivity of the crops, the farmers were encouraged by the government to use fertilizers and pesticides etc

Thus it is clearly mentioned that the agricultural activities has great impact on the environment. Shifting cultivation is one of the major factors resulting in the loss of forest cover and converting it into scrub lands and fallow lands ultimately results in the change of climate, change in soil fertility and effects the environment. For better environment and community at large, forest preservation and conservation should be a prominent priority as well as recycling the wastelands through artificial or natural ways by planting more trees or setting up recreation lands. Thus immediate efforts need to be taken up to expedite the recycling of wastelands and converting into more efficient and eco-friendly environment.

Reference

Choudhury Jayanta and Das Manoshi (2007), Rehabilatation of shifting cultivators in the State of Tripura, India. In: Saxena, K.G. Liang Luohui. and Rerkasen Kanok. (eds.) *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood,* bishen Singh mahendra Singh. Pp 33

Dhar P.K (2002), Status of Jhum cultivation in the North Eastern Region and strategy to change such status, (fourth conference of the north eastern economic association) proceeding volume, *Agricultural transition in the hill areas of the north eastern region* , published by B. Syiem. Pp 18

Gupta Das Malabika (2002), Status of Jhum cultivation in the North East, (fourth conference of the north eastern economic association) proceeding volume, *Agricultural transition in the hill areas of the north eastern region*, published by B. Syiem. Pp 1, 7

Gopalkrishanan. R (2000), *Assam, land and people*, Omsons publications. Pp 116

Jha L.K (1997), *Shifting cultivation*, APH Publishing Corporation. Pp. 134

Kumar Rajesh, Sharma. K.Y, Pal. B (2012), Effect of saline water irrigation and nitrogen on yield and chemical composition of lemon grass and salt balance of sandy loam soil, (eds.) R.C. Gupta, *Nagaland University Research communication*, Manas Saikia for Cambridge University press India Pvt.Ltd. pp 119, 126

Prasad Chandra Shekhar (2009), *Agriculture and rural development in India since 1947*, New century publication. Pp. 17

Pebam Rocky (2018), A novel approach to understand the spatial and temporal pattern of shifting cultivation fields using GIS techniques in Longding division of

Arunachal Pradesh, India, Int. *Journal of Engineering Research and Application*, 8(10):61-67.

Soils Nutrients mapping of Nagaland, Department of Agriculture, Government of Nagaland and ICAR- National bureau of Soil survey and land use planning, Nagpur, Maharastra, NBSS publ. 1080, November 2014. Pp 1, 6, 85-111

Thong Pentile, Pebam Rocky and Sahoo UK (2018), A geospatial approach to understand the dynamics of shifting cultivation in Champhai district of Mizoram, *North-East India. J Indian Soc Remote Sens*. 46(10):1713–1723.

CHAPTER V

DETERMINANT OF AGRICULTURAL DEVELOPMENT

5.1 Introduction

Agriculture is one of the important economic activities and it acts as the supplier of raw materials for manufacturing/food processing and provider of food to the people. Agricultural activities such as growth of plants, yield of crops depend on many factors which determine the growth or failure of the agricultural development. With the realisation of the importance of agricultural development and the need to improve agricultural activities, the planners and policy makers of the Government and private enterprises for development of agriculture come up and with the advancement of science and technology, there are many changes taking over in the field of agriculture by improving seeds, invention of agricultural machineries etc. There are many factors which contribute to the development of agriculture but at the same time, it is hindered by different factors. Understanding of different factors contributing to the failure or growth of agricultural development will help improve agricultural activities for sustainable development. Agricultural development is an integral part of economic development as it is through agricultural sector that contribute to the growth of economy. Majority of the people are engaged in the agricultural sector but in some areas, they are unable to produce output on a large scale due to many factors. Factors effecting agricultural development vary from one region to other.

5.2 Factors promoting Agricultural Development

Some of the factors which help in promoting agricultural development are follows:

1. **Improved agricultural Machineries**: Mechanisation has improved the life of the farmers, increased agricultural products, replaced the use of animal power and has minimised the use of human labour. Some common equipments and machineries used on farms include tractor, baler, mower, planter and sprayer. Farming with modern equipped machinery made agriculture no longer a small scale production but rather its production is increased on large scale as it benefit farmers to cultivate larger area in short period of time. Mechanisation has encouraged farmers to cultivate more efficiently for large scale production as it improves the quality of farm productivity. It has replaced many farm jobs which are formerly carried out by manual labours and with animals. Improved agricultural machineries have opened a wide scope in agricultural production in large scale industries besides producing production efficiency.
2. **Infrastructure development**: Investment of infrastructure for agricultural development is an important factor which ensures the efficiency of agricultural productivity. Development of agricultural activity depends on the improved infrastructure development, road leading to the agricultural site and proper agricultural marketing site for the sale of agricultural products etc. As farmers rely on infrastructures to deliver productions and to enhance their productivity. Improved infrastructure can mobilise agriculture market to a larger scale by initiating its investment on irrigation and storage for good

production, if infrastructural development is not balanced with the need for agricultural field it is not possible for agricultural sector to flourish smoothly.

3. **Favourable climatic condition**: The role of climate in the field of agriculture plays a crucial part in good productivity as it is the one and only nature's natural method plants and crops adapt with it for its activities, Agricultural development is greatly influence by the climatic condition as favourable climate helps in the growth of agricultural development which ultimately affects the outcome of the harvest. Climate alters from place to place according to the physical features of the areas and it becomes a very important part for the farmers to understand the favourable climatic conditions needed by the crops to grow. It is not possible for every crop to grow in every natural condition so it should be properly understood by cultivators to know the climatic condition favourable for crops to yield a good productivity.
4. **Soil fertility**: It is the ability of the soil to sustain agricultural plant growth. Apart from favourable climatic condition for agriculture soil provides nutrients, minerals and water for crops/plants which on the other hand is an important factor for good productivity in agriculture. Soil fertility enhances the ability to supply essential plant nutrients and water in adequate amount and proportion for growth, as well as it allows plant to take up essential needs for growth by avoiding toxic substances which may inhibit growth. Soil fertility is natural and it can profitability enhance the growth and yield of crops depending on the availability of resources.
5. **Different scheme**: There are many plans and programmes initiated by the Government and varieties of schemes have been provided to the farmers. Agriculture census schemes are Rashtriya Krishi Vikas Yojana (RKVY),

Rainfed Area Development (RAD), Seed Production Programme (RKVY), Farm Mechanization under SMAM AND RKVY, Women in Agriculture, and National Food Security Mission (NFSM).

6. **Use of improved seeds**: Majority of the production and crops yield was at subsistence level but with the improved seed in use, it has offered farmers a better chance to produce / harvest lucrative crops. Improved seeds have brought a wider scope in agricultural field for increased productivity, as uses of improved seeds increases the yield of agricultural activities. Some of the benefits of the uses of improved seeds are that it has a better yield, pest resistance, drought tolerance, herbicide tolerance and much more are delivered to the framers with the improved certified seeds. Some advantages of the improved seeds over natural organic seeds noticed in the district are that, farmers with most of the organic seeds are either destroyed by natural factors, pests, insects where as for the case of improved seeds there are much of the resistance against those invading agents.

5.3 Factor hindering agricultural development

There are many factors hindering the agricultural development in the district, some of the few problems are listed below:

1. **Land holding system:** Land holding system is one of the important factors which influence the agricultural development as agricultural activities are not possible without managing land for cultivation. In the study area land management system ties with the customary laws. Traditional hereditary system of holding land is practice in which majority of land is owned by the chiefs along with private and individual ownerships with their descendents in

most of the villages. This practice of land holding system has halted the progress in agricultural land expansion, as it need consent approval from the ownership of the landlords. In most of the villages, cultivation is done in group where the decision and selection of the field plot is done by the chief or the land owner. Plantation activities are mostly done by the individuals who owned lands in the village.

2. **Hilly Terrain:** Development depends upon the accessibility of the area. Hilly terrain of the area creates constrain for any agricultural development. As agricultural productivity is mostly dependent on factors like availability of water, good climatic conditions, fertility of soil etc which are not available in abundance in hilly terrains, thus, it becomes a major problem for cultivation. Major problems that constrain the crop production in hilly terrains are soil degradation, soil erosion, transportations, marketing, insufficient labour activity, climate and topography. All these factors make it hard for agricultural activities in hilly region.
3. **Soil problem:** Soil is an important part of the agricultural activity as the growth of the plants depends on the soil fertility and availability of minerals and nutrients. Soil has been polluted by different activities which result to the low yield of agricultural products. Once the soil has reached its field capacity it practically loss the ability to provide nutrients to crops as no water movement occurs in it, as well as the quality of soil affected by agricultural activities which includes compaction, loss of soil structure, soil salinity and soil degradation. As quoted "The multiple roles of soils often go unnoticed. Soils do not have a voice, few people speak out for them. They are our silent ally in food production." by Jose Graziano da Silva, FAO Director-General.

4. **Irrigation problem:** Irrigation is one of the factors effecting the growth or increase of the agricultural produces. Irrigation problem is also one of the reasons why people choose to practice shifting cultivation than other types of agriculture, as shifting cultivation is one of the agricultural systems where irrigation is not required and it is one of the easiest forms of agricultural systems which is cultivated without irrigation and less capital investment. Kadam (2009) stated that the availability of irrigation facilities not only enables farmers to make use of fertilisers and new varieties of seeds but also helps to raise the cropping intensity in agriculture thereby raising the level of output and farm income. Both the level and quality of irrigation are important in determining the efficiency of agriculture. Department of Irrigation and flood control, Nagaland target for the provision of adequate water infrastructure to farmers and in 2014-15, 5689 hectares has been brought under Gross Irrigation through canals, tanks and tube wells etc.
5. **Inadequate transport:** Lack of efficient means of transportation is one of the main problems in the modern agricultural activities as transportation play an important role in different ways by transporting agricultural products to the market site, home or supply to other place or area. Road connectivity plays an important role in transporting and supplying agricultural products from one region to another. Road is the only means of transportation in the district but many villages do not have proper road connectivity to the villages. Most of the roads leading to different villages in the district are unsurfaced roads and it become inaccessible in the rainy season which hinders in transporting agricultural products.
6. **Lack of agricultural marketing:** Marketing is still inefficient to many of the villages which discourage the farmers to produce more crops. Marketing

should be equipped with proper marketing areas, proper road conditions for transportation of goods and services, and good agricultural productivities, where in the district such facilities are not initiated or given much importance on it. Most of the farmers could hardly sale a handful of their surplus crops for passersby and some as street vendors for their daily needs. Lack of agricultural marketing has affected the district as the goods which are sold goes unnoticed by needy, for this reason most of the farmers cultivate a subsistence crop.

7. **Inadequate storage facilities:** Lack of storage facility in the district has influence farmers to practice subsistence agriculture. Due to the absence of storage facilities most of the agricultural products are wasted and it also compel the farmers to sell the produce immediately after the harvest at low price. Lack of storage led to the wastage of many agricultural crops as majority of the vegetables and fruits cannot be processed or kept for a longer period. As such some villages with few surplus crops and fruits are preserved by drying in the fire and sun.
8. **Ignorance of the people towards government plans and policies:** Many of the farmers are not aware of all the plans and programmes provided by the government for the improvement of the agriculture. Government objectives of plans and programme in agricultural sector are to contribute to increase per capita income, moreover it promotes the proper condition for planting and harvesting to be efficient so it can reduce poverty, but often these plans and programmes lacks to be implemented as maximum number of farmers in the district have no proper idea regarding the benefit and usage of modern farming technique, method of soil preparation, and uses of improved seeds. Moreover their low level of education, lack of communication, undue

importance on the plan and programmes, has resulted in general lack of awareness of the benefits initiated by the government on agricultural sector.

9. **Capital:** Investing in agriculture with capital is an important factor towards production of agriculture as it is also one of the important factors effecting agricultural development in the district. Mostly the villagers who cultivate for the surplus crops to be sold in market does not benefit due to lack of storage and marketing areas which encouraged them to go along with their subsistence farming and that affects their capital investment in agricultural activities in return, as the management of the field depend on the availability of the capital. Majority of the farmers prefer for the easiest way of cultivation due to unavailability of the capital investment. Moreover those who can effort their investment of capital in agriculture does not seem to find their interest in agricultural sector as they totally depend on their capital for buying goods. 'As the investment on agriculture is poor, agriculture is not taken as a source of livelihood, it is subsistence in nature. So the agriculture in North east region remained in most primitive form' (Roy and Das, 2003).
10. **Decrease in crops varieties:** There is a decrease in the varieties of crops and livestock produces as dependence on selected varieties of crops for the needs has led to decrease in crop diversity decline. Crop diversity decline 'threatens food security' Mark Kinver (2014), environment reporter, BBC news warned that a loss of diversity meant more people are dependent on key crops, leaving them more exposed to harvest failure. Higher consumption of energy-dense crops could also contribute to a global rise in heart disease and diabetes. There is decrease in the varieties of crops as most of the people prefer more on cultivating few selected crops and fruits which has commercial value or which is suitable for the soil in their area.

11. **Lack of Mechanisation:** Mechanisation of agriculture improves the life of the farmers as it replaces the use of animal and human labour which in return helps the farmers to expand their agricultural land use. The topography of the district does not support much of the mechanisation as it is hilly and moreover it cannot be afforded by poor farmers who practice farming for daily needs. Lack of farm mechanisation results in low production comparing to those with the farm mechanisation.
12. **Old traditional practices:** Despite with development in agricultural technologies and machineries, farmers in Zunheboto district practices old traditional methods of cultivation, which in return has hindered a lot in advancement in agricultural field. Agricultural activity is still practicing in an old traditional way depending on the traditional tools and seeds. Many developmental programmes and facilities provided by government to enhance development in agriculture remains unnoticed and unpractised by the farmers in the district.
13. **Climate:** Agricultural productivity is influence by good climatic condition as for which the district being a hilly terrain is not much favour by suitable climate for yielding more productivity. Instability of climate has its effects on agricultural development in the district. Heavy rainfall or lack of rainfall damages or effects the growth of plants. Temperature, rainfall, air, wind and relative humidity etc are some of the factors which have influence agricultural development and agricultural output. Saikia (1992), said that 'Climate is influenced by altitude and also slope aspects, soil by rainfall and evapo-transpiration etc' and stated that the role of these factors in the areal agricultural complex is undeniable.

14. **Unwanted species:** Decrease productivity in agriculture is also affected by unwanted species in the agricultural activities. These includes pests, insects, grasshoppers, fall army worms, birds etc. Presence of such unwanted species in the field cause damage to the crops which affects the harvest. These species spoil crops in the district otherwise on the other hand could have harvested more surpluses.
15. **Problem with seeds:** Production of crops depends on the quality of seeds and efforts have been made by the Government for the production and distribution of quality seeds for attaining higher crops productions and for the sustainable development. But unfortunately, majority of farmers are out of reach of availability and such supports initiated by government remains with few educated people who fail to initiate with farmers. Most of the farmers being illiterate fail to properly understand the benefits of the use of improved seeds and continue with their qualified method of older tradition.

Bhattacharjee (2003) explained the two issues related to agricultural development in North east India. The first issue is related in finding the peasant farmers production system which has to be made cost-effective, efficient and competitive and his household must earn enough income. The second issue is related to the questions of effecting a smooth transition from shifting cultivation to settled agriculture.

Though there are many problems and hindrances faced by the people for the development of the agricultural productivity, but there are so many ways in which the Government and the people are trying to improve agricultural activities in the district. While the central and state government has taken up many measures for the improvement and development of agricultural sectors, the existing agricultural

system in the district is mainly shifting cultivation where thousands of hectares of forest is destroyed every year which can cause ecological imbalances. The practice of shifting cultivation cannot be eliminated as it has been deeply rooted in the lives of the people and hence there is no suitable scheme or programmes which can replace the practice of shifting cultivation. Therefore proper plannings and programmes should be made to improve shifting cultivation. Proper utilization of the available land in the area by converting it to other system of agriculture like settled farming or terrace farming can help reduce the practice of shifting cultivation in the district.

5.4 A Proposed 12th Five Year Plan for Agriculture sector of Nagaland State

The following activities and components which are being proposed for agriculture sector during the 12th year plan of 2012-2017 for Nagaland State:

1. **Integrated development of major food crops**: This plan is implemented to replace the low yielding traditional varieties of crops. Certified HYV seeds are been proposed to be procured for distribution to the needy farmers free of cost so as to increase production as well as productivity of crops in the State.
2. **Cash crop development:** The agenda of this programme is to increase the income of the farmers by taking up some cash crops like cardamom, turmeric, Naga king chilly, ginger, potato, tea, coffee etc as a remunerative crop which are grown successfully in the State.
3. **Market infrastructure development:** This programme is implemented to promote market development and to facilitate market facilities, rural go downs and marketing sheds in rural areas as well as the proposal to take up

small primary agro processing unit as an alternative arrangement of value added programme by procuring small equipments such as fruits juice extracting unit, potato chips making, chilly and ginger drying and soya processing unit.

4. **Promotion of organic farming:** This programme is implemented to enhance the organic crop production in scientific farming methods and increase availability of inputs. With this regard, it is said that the State Agriculture department going ahead with the promotion of organic farming in batches and production of green manures, vermin-compost, bio fertilizers etc is highly indispensable. Green manure production programme is proposed to cover during the plan period which will help to reduce the application of nitrogenous fertilizers to a great extent.
5. **Development of rainfed farming system for Jhum cultivation:** The agenda of this programme is to provide assistance for the development of land as well as assistance for the development of cereals and horticultural crops for the upliftment of economic status of the rural people. It is also implemented to distribute HYV seeds as well horticultural saplings to the needy farmers free of cost.
6. **Capacity building:** Farmer exposure trip programme have been implemented to take up during the plan period in order to sensitize and motivate the farmers about the latest agriculture technology. Training of farmers at the block and district levels has been prioritize to acquaint and equip the farmers with the latest technical know-how on the cultivation of various crops. Training halls and farers hostels are established during the plan period.

7. **Farm mechanization**: It is said that the farm mechanization programme has been the prioritize sector under agriculture policy of the state. However the programme has not achieved the optimum level due to financial constraints. In order to achieve the programme, procurement of farm machineries such as Power Tiller, Pump Set, Maize Sheller, Thresher, Cane Crusher etc are being considered to save manual labour and to increase the efficiency of work for more production. It is also implemented to supply the small agricultural tools and implements such as Spade, Hoe, Shovel, Sickle, Rake etc to the farmers free of cost.
8. **Power Tiller Path:** This programme is implemented to provide agri link road connecting main road to a particular place in the potential area for the movement of agricultural machinery like Power Tillers to move from one field to another field as well as lifting of produce from field to village. Movement of machines without proper path connectivity to the field hinders farmers to go for mechanization inspite of having its potentiality.
9. **Integrated Pest Management (IPM):** Adoption of IPM method of control of pests and diseases becomes all the more significant as the state is going ahead with the organic farming programme to reduce the use of chemicals if not totally avoided. Conducting IPM trainings and demonstrations, establishment of farmer's fields schools (FFS) and provision of IPM kits, etc are also earmarked during the plan for the benefit of the farmers.
10. **Mobilization of Farmers**: The agenda of this programme is to organize and form self help group comprising both men and women SHG's in which the department provide financial assistance for revolving fund and seed money and it also award cash incentives to the best SHG annually to encourage the SHGs.

11. **Value addition**: This plan is implemented to procure dehydrator machines for drying and curing of spices crop such as ginger, turmeric, cardamom, chilly etc for its preservation so as to get better market price.
12. **Land and water management:** Land shaping has been adopted with an objective to develop new era for cultivation which will increase the production of crops. The lunching of double cropping in the state has necessitated to solve the irrigation problem through construction of tube wells and other surface water management activities such as water harvesting tanks, check dams etc.
13. **Establishment of seed village**: The agenda of this programme is to establish the seed village where the farmers themselves will produce the quality seeds for their cultivation. The department facilitates identification and implementation of seed village in the district so as to reduce the procurement and supply of seeds from external source.
14. **Strengthening of Agricultural establishments:** This Plan is implemented to strengthen and upgrade the Agricultural Training Institute of the State namely IETC, Research Station (SARS) and departmental laboratories which are located in different districts of the State.
15. **Innovative activity**: This plan is to provide the advisory platforms and services to farmers by experts to be taken up on cropping practices, technology dissemination, crop protection from pests and diseases, clinical services for animal health etc. The plan also envisage to provide input supply, farm equipments' and other services through Agri clinic and Agri business centre so as to generate self employment for many unemployed graduates. Procurement of animal power may also prove beneficial for some small farmers. The plan also identify, document and promote local species of plants

and trees which acts as natural pesticides and insecticide to support the State organic programme where the use of fertilizers and chemical pesticides are being discouraged.

5.5 Important Schemes and Programmes in Agriculture by the Government

At present, Agriculture has been given a special emphasis by the Government for the welfare of the farmers and also to improve the economic condition of the country. To improve the life of farmers and revitalize the agricultural system, the Government is implementing several schemes, initiatives, programmes and plans. Following are the plans, schemes and programmes of the government to benefit all the farmers:

1. **Soil Health Card scheme:** This scheme is launched in 2015 to assist State Government to issue Soil Health cards to all the farmers in the country to provide information to farmers on nutrient status for improving soil health and its fertility. Recommendation on appropriate dosage of fertilizer application based on test values and requirement of crop, use of organic manures and soil amendments to acidic, alkaline, sodic soils.
2. **NCU- Neem Coated Urea:** This scheme is initiated to regulate use of urea, enhance availability of nitrogen to the crop and reduces cost of fertilizer application and slow down the release of fertilizer and to make it available to the crop in an effective manner. It is said that the use of urea reduces the cost of cultivation and improves soil health management.
3. **PMKSY- Pradhan mantra sinchai yojana:** This scheme is launched on 1st July 2015 for providing end to end solution in irrigation supply chain like

water source, distribution network and farm level applications with the motto of Har Khet Ko paani.

4. **PMFBY- Pradhan mantra fasal bima yojana:** This scheme is based on actuarial premium under which farmer has to pay maximum premium of 2% for Kharif, 1.5% for Rabi food and oilseed crops and 5% for annual commercial, horticultural crops and remaining part of the actuaria premium is shared equally by the centre and State Government. The objective of this scheme is to facilitate prompt claims settlement in which the claim must be settled within two months of harvest subject to timely provision of both yield data and share of premium subsidy by the state government. Under this scheme, the use of technology are to be encouraged to a great extent resulting in operational efficiency where smart phones are used to capture and upload data of crop cutting to reduce the delays in claiming payment to farmers. They used Remote sensing to reduce the number of crop cutting experiments.
5. **Livestock insurance scheme:** This scheme is launched with the aim of providing protection mechanism to the farmers and cattle rarers against any eventual loss of animals due to death and the ultimate goal of this scheme is to attain qualitative improvement in livestock and their products.
6. **National scheme on welfare of fishermen:** This scheme is launched to provide financial assistance to fishers for the construction of house, community hall for recreation and common working place and it also aims to install tube well for drinking water and assistance during lean period.
7. **Scheme on Fisheries training and extension:** This scheme aim to provide training for fishery sector to assist in undertaking fisheries extension programmes effectively.

8. **Gramin Bhandaran Yojna:** The objectives of this scheme is to meet the requirements of farmers for storing and processing farm products and create scientific storage capacity with allied facilities in rural areas for improving their marketability by promoting grading, standardization and quality control of agricultural produce.
9. **RADP-Rainfed Area Development:** This is a sub-scheme which is implemented under RKVY with the aim of improving the quality of life of the farmers especially for those small and marginal farmers by offering a complete package of activities to increase their farm returns. This scheme also aims to increase agricultural productivity of rainfed areas in a sustainable manner and minimise the adverse impact of possible crop failure due to natural calamities like drought, flood or uneven rainfall distribution.
10. **NWDPRA- National Watershed Development Project for Rainfed Areas:** This scheme is launched in 1990-91 based on twin concepts of integrated watershed management and sustainable farming systems. The aim of this scheme is to enhance agricultural production and productivity in a sustainable manner and also to restore ecological balance in the degraded and fragile rainfed eco-systems by greening these areas through appropriate mix of trees, shrubs and grasses.
11. **PKVY- Paramparagat Krishi Vikas Yojana:** This scheme is implemented to promote organic farming in the country and to improve soil health and organic matter content and increase net income of the farmer to make them realise the premium prices. The aim of this project is to maximize the utilization of natural resources through eco-friendly cultivation and encourage the farmers to cultivate the land and raise the crops in such a way to keep the soil alive and healthy by using organic wastes such as crops,

animal, farm and aquatic wastes as well as other biological materials along with beneficial microbes for increasing sustainable production in an eco friendly pollution free environment.

12. **e-NAM- National Agriculture Market:** This scheme aim to provide e-marketing platform at national level and support creation of infrastructure to enable e-marketing. This scheme provides transparency and competition to enable farmers to get improved remuneration for their produce moving towards 'One Nation One Market'.
13. **MIF-Micro Irrigation Fund:** This scheme is created along with NABARD to encourage public and private investments in micro irrigation with the aim to facilitate the states in mobilizing the resources for expanding coverage of micro irrigation.
14. **Agriculture Contingency Plan:** This is the scheme prepared by CRIDA (Central Research Institute for Dry land Agriculture) and ICAR for district level agriculture contingency plans in collaboration with State Agricultural University using standard template to tackle aberrant monsoon situations which adversely affects crops, livestock, fisheries and horticulture.
15. **SMPP-Strengthening and Modernization of Pest Management Approach in India**: This Scheme launched in 1991-92 as a cardinal principle and main plank of plant protection strategy in overall crop production programme in order to minimize the use of hazardous chemical pesticides and to manage the insect pest and disease attack to increase the crop production.
16. **Krishonnati Yojana:** It is an umbrella scheme which include the following 6 schemes:

i. National Food security mission (NFSM)

ii. National Food Security mission-commercial crops.

iii. Mission for integrated development of Horticulture (MIDH).

iv. National Mission on Oilseeds and Oil Palm.

v. National mission for sustainable agriculture.

vi. National mission on Agricultural extension and technology.

17. **NFSM-National Food Security Mission:** NFSM is a centrally sponsored scheme launched in October 2007 and consists of five components viz Rice, Wheat, Pulses, Coarse Cereal and Commercial crops. The main objective of the program is to increase the production of rice, wheat and pulses, to restore soil fertility and productivity at the individual farm level and to enhance farm level economy. It is said that the mission is being continued during 12^{th} plan with new target of additional production of 25 million tonnes of food grains comprising 10 million tonnes of rice, 8 million tonnes of wheat and 4 million tonnes of pulses and 3 million tonnes of coarse cereals.
18. **National Food Security Mission- commercial crops:** This is also one of the schemes under the umbrella of Krishonnati Yojana. This is a crop development programme which aim at enhancing the production of cotton, Jute and sugarcane.
19. **Mission for Integrated Development of Horticulture (MIDH):** It is also a scheme under the umbrella of Krishonnati Yojana scheme and it covers wide horticulture base, which includes fruits, Vegetables, Tuber crops, Mushrooms, Spices and aromatic plants flowers and foliage and plantation crops like coconut, arecanut, cashew nut, cocoa and bamboo.
20. **National Mission on Agricultural Extension and Technology:** It is a scheme under the umbrella of Krishonnati Yojana and the aim of this programme is to restructure and strengthen agricultural extension to enable

delivery of appropriate technology and improved agronomic practices to the farmers consists.

21. **NMOOP- National Mission on Oil Seed and Oil Palm**: This scheme is implemented in the year 2014-15. This scheme aim at enhancing production of traditional oilseed and tree-borne oilseed. This scheme is implemented through active involvement of all the stakeholders. Fund flow is strictly monitored to ensure that benefit of the mission reaches the targeted beneficiaries in time to achieve the results. Under this two mini-missions implemented in the State: Mini Mission-I which aims at increasing production of oilseeds and Mini Mission-II which aim at bringing additional area under oil palm cultivation through area expansion including the utilization of wasteland for this purpose. This scheme also envisages increase in production of vegetable oils sourced from oilseeds, oil palm and tree borne oilseeds.
22. **National Mission for Sustainable Agriculture (NMSA):** It is also one of the eight missions under National action plan on climate change (NAPCC). This plan aim at promoting sustainable agriculture through climate change adaptation measures, enhancing agriculture productivity in rainfed areas focusing on integrated farming, soil health management and synergizing resource conservation.

    Following are the Schemes under NMSA

    i. RAD-Rainfed Area Development: It was launched during 2014-15 covering 11 districts of Nagaland.
    ii. Soil Health Management(SHM)
    iii. Sub Mission on Agro Forestry (SMAF)
    iv. Paramparagat Krish Vikas Yojana(PKVY)

v. Soil and Land use survey of India (SLUSI)

vi. National Rainfed Area Authority (NRAA)

vii. Mission Organic Value Chain Development in North Eastern Region (MOVCDNER)

viii. Central Fertilizer Quality Control and Training Institute (CFQC&TI)

23. **Initiative for increasing flow of credit:** This programme aim to ensure that all eligible farmers are provided with hassle free and timely credit for their agricultural operation. Under this programme Kisan Credit Card (KCC) was introduce in 1998-99 with an objectives to meet the short term credit requirement for cultivation of crops, post harvest expenses, Consumption requirements of farmer household, produce marketing loan, working capital for maintenance of farm assets.

24. **Krish Kalyan cess**: Through this programme the proceeds of cess is exclusively to be used for financing initiatives relating to improvement of agriculture and welfare of farmers. This programme was introduced under the union budget for 2016-17 (April-march).

25. **DBT-Direct Benefit Transfer for fertilizer sector**: The Government announced to introduce direct benefit transfer of fertilizer subsidy to farmers on pilot basis in few district of the country.

26. **ATIF- Promotion of National Market through Agri Tech Infrastructure Fund:** It is a central sector scheme where Rs.200 crores has been sanctioned during the financial year 2014-15 to 2016-17 with the aim to envisage initiation of e-marketing platform at the national level and to support creation of infrastructure to enable e-marketing in 642 regulated markets across the country.

27. **MUDRA- Micro Units Development Refinance Agency Bank:** This plan is put forward by the Finance Ministry to create a MUDRA activities allied to agriculture like dairy animal, inland fishery etc and the investment credit require for agriculture and allied activities like pump sets, sprayers, dairy animals etc.
28. **Mera Gaon, Mera Gaurav:** This scheme is launched by involving agricultural experts of Agricultural Universities and ICAR Institutes for effective and deeper reach of scientific farming to the villages. The groups of experts are to be associated with one particular village to create awareness and adoption of new technologies including farm investment, loans, availability of inputs and marketing.
29. **Krishi Dak:** This scheme is initiated by IARI in 20 districts in which postmen supplied seeds of improved varieties of crops to the farmers in far-flung areas. After the success of the programme in 20 districts, the scheme is extended to 100 districts of 14 states with the association of Krishi Vigyan Kendras (KVK). The aim of this scheme is to provide improved seed to farmers at their doorsteps.

5.6 Nagaland State Plan for Agricultural Development

The following are the agricultural developmental activities adopted in Zunheboto district:

1. **RKVY- Rastriya Krish Vikas Yojana:** This programme is launched during the 11^{th} plan in the State and continues till the 12^{th} plan. The main objective of the program is to enhance overall agriculture production by giving flexibility to State priorities with an aim to achieve agricultural growth in the

country. RKVY was funded by Government of India granted as Additional Central Assistance (ACA) under State plan till 2014-15 and the funding pattern is changed to 90:10 from 2015-16. RKVY is implemented by eight departments such as Agriculture (Nodal department), Horticulture, Soil and water conservation, Veterinary & AH, Land Resource Department, Co-Operation, Fisheries, Sericulture and three missions such as Honey Mission, Bamboo Mission for Agro Forestry and Bio-Resource Mission covering 11 districts of the State. Scheme under RKVY are as follows:

i. ICDP-Integrated Cereal Development Programme
ii. Integrated Pest Management
iii. Seed Production Programme
iv. Farm Mechanization
v. Farm Development
vi. Sugarcane Development
vii. Women in Agriculture
viii. Integrated farming and fallow management
ix. Cash Crop Development
x. Balance and Integrated use of fertilizer and INM
xi. Organic Programme.
xii. Marketing Promotion (storage)
xiii. Power Tiller Path
xiv. Agricultural tools and Implements
xv. Surface run off Management
xvi. Strengthening of IETC and SAMETI (Hostel building)

2. **Rural road projects:** This project is under Rural Infrastructure Development Fund (RIDF-XIX) programme which is finance by NABARD. This project is

to provide motorable road connectivity for the agricultural productive areas with major district roads or the village for further linkages with the markets. It is said that there has been an increase in cash crops production in the state with marketable surplus mainly after the construction of road connectivity with the market outlets under this project.

3. **SMSP- Sub-Mission on Seeds and Planting Materials:** This programme is a sub mission under NMAET-National Mission on Agriculture Extension and Technology which is implemented in the State since 2014-15.The crops covered under this programme are jobstear, millet, soyabean, maize, kholar, mustard and up land paddy. The objective of this programme is to make seeds available to the villages and the neighbouring villages. The seed villages have been distributed seed storage bins and seed treatment drums for seed health and viability.
4. **Integrated Nutrient Management:** The main aim of this programme is to encourage farmers to use organic manures along with chemical fertilizers as an integrated approach for sustainable agriculture because the continuous cultivation of crops without adding any manures and fertilizers depletes soil fertility. Various components under this programme are green manuring, bio-composting, vermi-composting, promotion of macro and micronutrients and distribution of soil health card.
5. **NeGPA-National E-Governance Plan in Agriculture:** NeGP-A was officially launched by the department of agriculture, Nagaland on 29th July 2015.This is a mission mode programme which is introduce by central government during the last phase of 11th plan to achieve rapid development in agriculture in India through the use of ICT. The aim of this programme is to offer Government to Citizen (G2C), Government to Farmer (G2F) and

Government to Business (G2B), Government to Government (G2G) various services in an integrated manner through central Agricultural Portal (CAPs) and State Agricultural Portal (SAPs).

6. **Agricultural Marketing:** This scheme is launched with the objective to facilitate the farmers to dispose their surplus produces in time with remunerative return to enhance the rural economy by providing financial assistances to construct storage, collection centre and way side marketing shed at National and State highways and farm level.
7. **Agriculture Information/Extension and Publicity:** The main objective of this programme is to educate and create awareness on the methods and technologies of modern farming system and also to provide extension services through various print media and information Technology (IT).
8. **Improved Seeds Programme:** This programme is a State plan which aim to grow and promote good identified local cultivars of cereals, pulses and root crops.
9. **Jhum- Fallow Management:** This programme help the farmers to gain higher productivity and maintain soil fertility by planting alder and nitrogen fixing trees in Jhum field before abandoning the field.
10. **MoVCD- Mission Organic Value Chain Development for North Eastern Region:** This scheme is launched with an aim to develop certified organic production in a value chain mode to link growers with customers and to support the development of entire value chain starting from inputs, seeds, certification, creation of facilities for collection, processing, marketing and brand building initiative.

With all the above plans and programmes and efforts by the government to improve the agricultural system, many of the farmers could not be benefited with all the plans and programmes provided by the Government. Rising of agriculture from traditional level to scientific level is a difficult task in India settings. They need to be prepared mentally and emotionally to accept new ideas and practices. These willingness and acceptability may be created, developed and sustained in them by continuous supply of information regarding different aspect of farm operations and constant education and training (Pandey, 1989)

Different schemes implemented in different villages under Zunheboto District are given in the following Table 5.1

Table 5.1: Name of Villages under different schemes

Sl.No	**Project**	**Schemes**	**Villages**
1	RKVY- Rashtriya Krishi Vikas Yojana	Water Harvesting Pond (WHP) and Bench Terracing	Satami, Kawoto, Xukhepu Suruhuto, Ghathashi
2	IWMP- Intergrated Watershed Management Programme	Countoour Trenching (C/T) and Water Hrevsting Pond (W.H.P)	Lochomi, Ghathashi, Phulesheto, Melahu
3	ILDP- Integrated Land Development Project	Vermi compost and Contour trenching (C/T)	Usutomi, Satami, Khekiye, Khukishe, Rotomi, Kivikhu, Kitami, Lithusu
4	ICATP- Integrated Catchment Area Treatment Project (ICATP)	EPA, Farm pond, Gully Plug, G.B.S, LBCD (upper/lower), Contour Trenching, Afforestation, Footpath	Lokobo, Philimi, Rotomi, Sukomi, Atoizu town, Usutomi, Shena

Source: *District soil and water conservation office (DSCO), Zunheboto, Nagaland*

Besides the schemes implemented under various villages for the development of agricultural sectors, Cooperative Society which is an autonomous association finances various economic activities and promotes livelihood earnings to marginal

farmers, small businesses, small and cottage industries in Nagaland. During 2016-17, 926 societies are accounted for primary cooperatives in which 16 societies are audited under Zunheboto District. Integrated Cooperative Development (ICDP) is implemented in three districts such as Dimapur, Mon and Zunheboto and ICDP is a project that promotes economic activities through cooperative initiatives in the sphere of agriculture, agro based industries and creation of infrastructure facilities like go-downs, transport vehicles, banking counter, small processing units, piggery, poultry, diary units etc. The number of societies that are assisted under the beneficiaries of ICDP in Zunheboto district is 364 societies with 98887 numbers of members benefited.

5.7 Nagaland State Vision 2025 for Agricultural Development

The importance is being given for the improvement and development of agricultural sector as agriculture is one of the most important economic activities which are a priority sector of development. Effective measures to improve the technology of Jhum cultivation and the plan to popularize settled cultivation are invariably to be undertaken to overcome the detrimental effects of Jhum cultivation on the environment. The vision 2025 expresses the aspiration, determination and commitment for self realization and the visioning exercise begin by cataloguing the untapped potentials and underutilized resources that are available and then turn their attention to the present problems and emerging opportunities which constitutes the raw materials from which they try to fashion a better future for the people of the State. It is a vision towards social, economic and cultural progress by increasing the production and productivity of agricultural sector in a sustainable way, employment generation by establishing agro-based food product and animal feed product industries in order to increase the per capita income of the farmers, attract educated

youth toward agricultural activities by utilizing the potential for earning through value addition both for domestic and export market. The objective of the vision is to protect the existing forest for overcoming the evil effect of Global Warming by means of awareness programme and cultivation of quick growing species of trees to meet the requirement of fuel and fodder.

It is said that the vision 2025 envisages the goals toward sustainable agriculture in which the implementing Government agencies and the stake holders must put a concerted effort together to achieve the desire goals. The main aim of this vision is to replace the practice of Jhum cultivation to permanent farming system particularly in horticulture crops, organic farming, agro forestry and small holder plantations through proper extension services.

The objectives of the vision 2025 are as follow:

1. To increase the production and productivity in a sustainable way.
2. Employment generation by establishing agro based food product and animal feed product industries.
3. To attract educated youth toward agricultural activities by utilizing the potential for earning through value addition both domestic and export market.
4. To protect the existing forest for overcoming the evil effects of global warming.

The following steps are taken up by the Government to meet the needs of food for the growing population:

A. Infrastructure Development

1. Establishment of Rural back linked with marketing chains.
2. Construction of warehouse and cold storage facilities.

3. Development of seed farms and nurseries.
4. Development of soil testing laboratories.
5. Establishment of nurseries for mass production of horticultural crops.
6. Construction of green house and poly houses.
7. Establishment of farm implements or tools production units.
8. Establishment of feed production unit for livestock and fisheries.
9. Construction of model organic farms including organic certification.
10. Construction of organic fertilizer and pesticide production unit.
11. Establishment of hatcheries for poultry.
12. Establishment of pre-processing and packaging units for cut flower and fruits.

B. Technology generation and dissemination

1. State Agricultural University and Research Centre to be entrusted with the task for strengthening of research on improved seed and livestock.
2. New extension policy of Public Private Partnership (PPP) to be involved to disseminate the modern technology to the farmer's field.
3. To export the organic production of crop and animal husbandry products.
4. To make available the farm credit to the farmers for commercialization.
5. To provide crop insurance support in case of any loss due to adversity.
6. Watershed development and emphasis on rain fed agriculture to meet the food security in the area under Jhum cultivation

Table 5.2: 2025 Vision for Nagaland (food for all)

Year	Population	PROD Target (000MT)	Requirement (in 000MT)	Status (000MT)	Outcome
2011-12	2030047	382.38	569.97	187.59 D	11th Plan achieved 6.14% Agril. Growth rate
2012-13	2080725	405.18	584.2	179.02 D	12th Plan Target 6.50% Agril. Growth rate
2013-14	2132669	429.34	598.78	169.44 D	Projected
2014-15	2185910	454.95	613.74	158.79 D	Projected
2015-16	2240479	482.08	629.06	146.98 D	Projected
2016-17	2296411	510.82	644.77	133.95 D	Projected
2017-18	2353740	541.29	660.86	119.57 D	Starting of 13th Plan Projection
2018-19	2412499	573.56	677.35	103.79 D	Projection
2019-20	2472726	607.77	694.26	86.49 D	Projection
2020-21	2534456	644.01	711.6	67.59 D	Projection
2021-22	2597727	682.41	729.36	46.95 D	Projection
2022-23	2662577	723.11	745.57	22.46 D	Starting of 14th Plan Projection
2023-24	2729046	766.23	766.23	0	Projection
2024-25	2797175	811.92	785.35	26.57 S	Projection

Source: *State Agriculture Plan, Department of Agriculture, Nagaland*

The current statistic table 5.2 show the achieved and targeted five-year plan outcome in agricultural growth rate listed from the year 2011 to 2025. In the year 2011-2012 with the population of 2030047 the statistic outcome of 11th five-year plan is achieved with a growth rate of 6.14%. With the implementation of 12th five-year plan from 2012-2013 till 2016-2017 and with increase in population from

2080725 to 2296411 by the end of the five-year plan in 2016-2017 the outcome of 12th five-year plan is projected with a target of 6.50% agricultural growth rate.

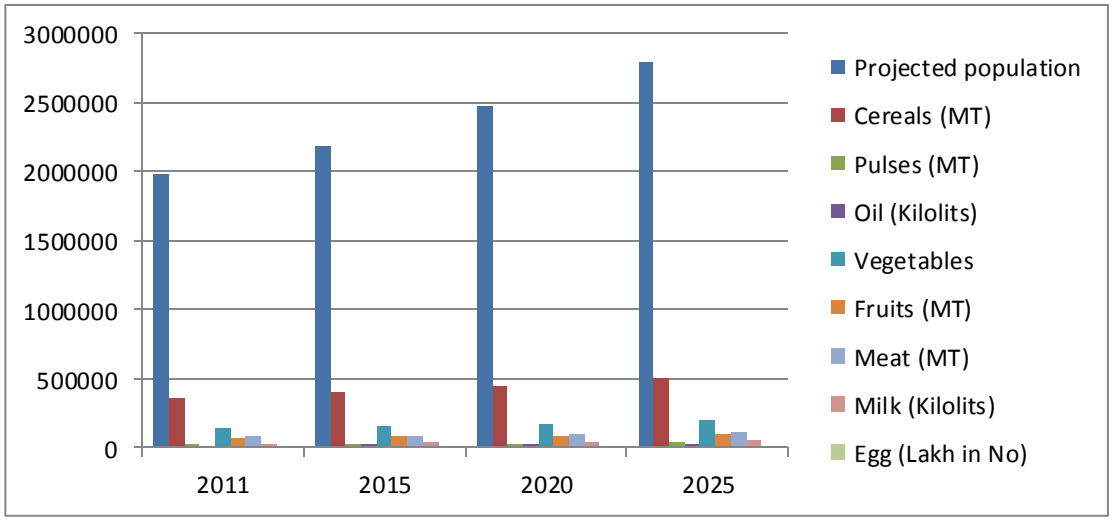
With the end of projected 12th five-year plan, the 13th five-year plan is initiated from 2017-2018 till 2021-2022 and the projection with the increase in population from 2353740 in 2017-2018 to approximately 2597727 in 2021-2022 by the end of the 13th five-year plan is to achieve the % of agricultural growth rate with the growing population. The 14th five-year plan starts from 2022-2023 with an estimated population of 2662577 which will still be projection on agricultural growth rate % to meet the requirement of the growing population with agricultural products focused on vision 2025.

Table 5.3: The vision 2025 for Nagaland Agriculture

Sl. No	**Item**	**Population (as per 2011 census and projected population)**			
		2011	**2015**	**2020**	**2025**
1	Projected population	1980602	2186214	2473500	2798539
2	Cereals (MT)	361460	398984	451414	510733
3	Pulses (MT)	28917	31919	36113	40859
4	Oil (Kilolits)	21688	23939	27085	30644
5	Vegetables	144584	159594	180566	204293
6	Fruits (MT)	72292	79797	90283	102147
7	Meat (MT)	83136	91766	103825	117469
8	Milk (Kilolits)	36146	39898	45141	51073
9	Egg (Lakh in No)	2060	2274	2572	2910

Source: *State Agriculture Plan, Department of Agriculture, Nagaland*

Fig.5.1: The vision 2025 for Nagaland Agriculture



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Vision 2025 by department of Agriculture, Nagaland begin its plan in the year 2011 with an aim to attain the status of a State in surplus food production by the end of 2025 and projected its plan into three different five year plan period , i.e. from 2011-2015, 2015-2020, 2020-2025. The total population according to 2011 census is 1980602 and its projected population in three different plan periods is 2015-2186214, 2020-2473500, 2025-2798539. Selected food items for the projects are Cereals (MT), Pulses (MT), Oil (Kilolits), Vegetables, Fruits (MT), Meat (MT), Milk (Kilolits), Egg (Lakh in No.). With the sky rocketing of population there is steady growth in the projected food items as shown in the table 5.2. The motive of the vision is to shift its primitive way of cultivation to settle cultivation and the progression from Jhum to settled cultivation will benefit the cultivator and improve the environment quality and reduce the pressure on land. To achieve the Vision targets it will depend on many things but most importantly it will depend on our self confidence, self reliance and determination to make it a reality. In the process, the people should be motivated through the introduction of improvement over the existing shifting cultivation gradually to win over to the permanent farming system

particularly in horticulture crops, organic farming, agro forestry and small holder plantations through proper extension services which can increase levels in its own setting in a sustainable manner. Such innovation ideas can wean away from shifting cultivation. Agarwal (2003) stated that the present practices of slash/burn cultivation in the hills and single crop traditional agriculture in the plains will not lead the region anywhere.

Soil conservation, water harvesting and water management projects generally have economic rates of returns of 18% annual and above (Alagh, 1996). Agricultural products has been and has enriched the needs for the population in a various forms, along with the proper planning, management, sustainable agriculture, modern technologies in agricultural sector has made a remarkable progress to cope with the current needs of the population in modern world. However this upgraded change had been inefficient in many regions. There are various factors of contribution in it, some of which is its lack of implementation and infrastructure unavailability. Similarly people with less equipped knowledge and awareness in agricultural field contributes towards its inefficiency. Moreover those who can effort, does not seems to find their interest in agriculture. Thus for the better outcome along with the use of modern equipments and programme, planning should be initiated where every individual literate or illiterate can easily access to the availability of the needs for agriculture.

References

Alagh H Joginder (1996), *Land and Man - essay in sustainable development*, Har-anand Publication. Pp 4

Agarwal (2003), Economic reforms and agricultural development in North-East India- some issue, (eds.) Sengupta Keya and Roy Niranjan, *Economic reforms and agricultural development in North-East India,* Mittal Publication, New Delhi. Pp 6

Annual Administrative report 2015-16, Department of Agriculture, Government of Nagaland.

Bhattacharjee P.R (2003), The main issues in agricultural development of North-East India, (eds.) Sengupta Keya and Roy Niranjan, *Economic reforms and agricultural development in North-East India,* Mittal Publication, New Delhi. Pp 22-24

District Soil and Water Conservation Office (DSCO) Zunheboto, Nagaland

https://iasscore.in/upsc-prelims/agricultur-schemes

https://www.bbc.com/news/science-environment-26382067

Kadam N Santoshi (2009), *New Agricultural Technology: Socio-economic Impact*, Reliance publishing house, New Delhi. Pp 74-75

Nagaland Economic Survey 2016-2017, Government of Nagaland, Directorate of Economics and Statistics Nagaland, Kohima

Pandey K.N (1989), *Adoption of Agricultural innovations- A study of small and marginal farmers of Varanasi (U.P),* Northern Book Centre, New Delhi. Pp. 1

Roy Hiranmoy and Das Ashim (2003), Food Security in Liberalised economy- A Review, (eds.) Sengupta Keya and Roy Niranjan, *Economic reforms and agricultural development in North-East India,* Mittal Publication, New Delhi. Pp 99

State agriculture plan, under NADP/RKVY programme during 12th five year plan (2012-2017) the State of Nagaland, Department of Agriculture, government of Nagaland.

Saikia Haren (1992), *Pattern of land holding and agricultural productivity-A case study of upper Brahmaputra valley of Assam,* Thesis submitted to NEHU. Pp 24

CHAPTER VI

SUMMARY AND CONCLUSION

This research is an endeavour to study the impact of agricultural activities on environment in Zunheboto district and it discuss different types of agricultural activities, factors influencing agricultural activities, origin and traditions, social and cultural life of the people in the district, different agricultural plans and programmes by the government towards the development of agricultural activities etc. Research study is preceded by introduction to the research topic, importance of the study, objectives, data base and methodology, chapterization followed by discussion on the study area (Zunheboto district), about the history of the district, origin, social and cultural life of the people, population etc. Zunheboto district which is located in the heart of Nagaland share a boundary with Mokokchung district in the north, Wokha and Kohima district in the west, Phek district in the south and Tuensang and Kiphire district in the east. Though the district share a boundary with six districts out of 12 districts in Nagaland, poor road connectivity to other districts lead to drawbacks of the district. Zunheboto district is divided into two physiographic division i.e Western and Eastern Zunheboto where there are some differences between the two divisions such as climatic conditions, types of agricultural activities, crops etc. 1) Western region is situated in the western part of the district bounded by Mokokchung, Wokha and Kohima districts in the North, West and South. Eastern region of the district is bounded by Tuensang, Kiphire and Phek district in the North East and South. In the Western region, Akuluto, V.K and Suruhuto circle are connected to Mokokchung

District, Saptiqa, Akuhaito and V.K are connected to Wokha district and Pughuboto, Ghathashi are connected to Kohima district. In the Eastern region, Asuto circle is connected to Tuensang district, Aghunato and Satoi to Kiphire district, Southern part of Satoi, Satakha and Ghathashi are also connected to Phek district. 2) Western Zunheboto is hotter than Eastern Zunheboto because of the differences in the geographical feature. Eastern parts of the district are hillier than the Western parts. There is variation in the climatic conditions because of the forest type and agricultural system. Western parts of the district have less forest cover with more shifting cultivation. 3) Western part has the lower altitudinal with maximum height of about 1800m and the eastern part has higher altitudinal with maximum height of about 2500m. 4) Western Zunheboto is called Ghaboh implying hot climate and Eastern Zunheboto is called Ajo implying cold climate. Out of 13 circles in the district, 7 circles with total population of 45229 and 68 towns and villages are under Western region and 6 circles with total population of 95528 and 118 towns and villages are under Eastern region. Aghunato, Asuto, Satakha, Satoi, Suruhuto and Zunheboto circle falls under Eastern region and Akuhaito, Akuluto, Atoizu, Ghathashi, Pughuboto, Saptiqa and V.K circle under Western region. 5) Important rivers in the Western region are Doyang and Dikhu with many tributaries. Doyang river pass through Pughuboto, Ghathashi, Saptiqa, Akuhaito and V.K circles. Dikhu river flows through demarcating the border of Akuluto circle in the west and Suruhuto circle in the east. Tizu, Tsutha and Mela are three important rivers in the Eastern region where all terrace rice fields are located. Tizu flows through Aghunato, Zunheboto and Satoi circle, Mela flow through Asuto circle and Tsutha river through Satoi, Aghunato. Tsutha river flow through the eastern side of Aghunato and down to south western side of Satoi circle. Mela and Tsutha are two important tributaries of Tizu River. 6) Shifting cultivation is more dominant in the Western region and terrace

cultivation on the Eastern region because the rivers flowing through the Western parts of the district are not suitable for irrigational purpose with seasonal overflow of water and it flows through rough terrain and cliff as well as the people of the Western region are more comfortable with the shifting cultivation as it is closely interwoven with their social and cultural life. Terrace field in the Eastern part of the district are located around Tizu river, Mela river and Tsutha river.

Social and cultural life of the people is connected with agricultural activities. There is a decadal change of population in the district where there is decrease in the population during 2011 census comparing to 2001 census. Zunheboto district is endowed with rich natural vegetation and Satoi range being a part of the region is the only remaining virgin forest in the district. Nagaland has 407 documented community conserved areas (CCAs) out of which Zunheboto district have 31 self initiated CCAs. Ghosu bird sanctuary is a bird sanctuary in the district which is maintained by the village community providing habitat to more than twenty species. Many economic activities like hunting, agricultural activities, development activities, cutting of trees for different purpose leads to the degradation of flora and fauna in the district.

The third chapter explicates the agricultural system prevailing in the district. Agriculture is the primary economic activities of the people in the district and most of the people living in the rural areas depend on agriculture and forest resources. Approximately 90% of the populations in the rural areas are engaged in agricultural activities and the remaining 10% who are not engaged in agriculture sectors are old people and those involved in Government sectors. The people in the district depend directly or indirectly on agricultural activities, livestock and animal husbandry. Terrace rice cultivation and shifting cultivation are the two main agricultural

activities in the district. Shifting cultivation is done for both paddy and maize as the main crops whereas Terrace rice cultivation is done mainly for Paddy cultivation. Home Garden is cultivated for mixed cropping by those people who own a land near the house. Different plantation activities are also done by the majority of people in the district. Different types of agricultural activities are practiced by the people depending on the availability of agricultural land.

Fourth chapter studies the impact of agricultural activities on environment in Zunheboto district where majority of the population practice shifting cultivation which leads to the loss of forest cover, increased soil acidity, soil erosion etc. Dynamic of shifting cultivation during the last two decades (1997-2017) of Zunheboto district has been explained in this chapter where there is a drastic change in the total area of Jhum cultivation in Zunheboto district from 1997 till 2017. There has been a decreasing trend in the annual area under Jhum field and the decrease has been more prominent from the year 2010. The cycle of shifting cultivation varies from place to place depending on the availability of forest land as well as on the population depending on the cultivation. In some areas of the district all the forest areas are not used for shifting cultivation but instead the forest is divided into different Jhum plots for Jhum cultivation. Zunheboto district is dominated by very strongly acidic (4.5-5.0) with 42.5% of total geographical area of 1255 ha and Akuluto block has the highest with 54.1 % followed by Suruhuto block with 47.7 % as this is the major area where shifting cultivation is dominant. Zunheboto district show a decrease in the forests percentage from 1991 – 2017, which is marked by the construction and mainly because of the livelihood totally dependent on forests products. Landslide, fluctuation in the rainfall, temperature and flood etc are some of the natural calamities which affect agricultural activities.

Fifth chapter is in view of the determinant of agricultural development. Agricultural activities and the growth of plants and yield of crops depend on many factors which determine the growth or failure of the agricultural development. After the realisation of the importance of agricultural development and the need to improve the agricultural activities have wake up the planners and Government for the development of agriculture and with the advancement of science and technology, there are many changes taking over in the field of agriculture by improving seeds, inventions of agricultural machineries etc. Understanding of different factors contributing to the failure or growth of agricultural development will help improve agricultural activities for the sustainable development. Agricultural development is an integral part of economic development as it is through agricultural sector which contribute to the growth of economy. Though there are many problems and hindrances faced by the people for the development of the agriculture, there are also so many ways in which the Government and the people are trying to improve agricultural activities in the district. Though the Central and State Government has taken many plans and programmes for the improvement and development of agricultural sector, the existing agricultural system in the district is mainly shifting cultivation where thousands of hectares of forest is destroyed every year which can cause ecological imbalances.

Final chapter is a composition and sum up of all the research works done for the study of agricultural activities and its impact on environment in Zunheboto district. It concludes with the findings and suggestions for the improvement of agricultural activities and for the protection of environment.

Human activities has a great impact on environment and its impact varies depending on the type of activities and agricultural activities are also one of the

major factors which affects environment in a varieties of ways. The increase practice of shifting cultivation has direct negative impact on the forest cover, soil fertility and biodiversity etc. The effects of one automatically affect the other. Cutting down of trees for Jhum cultivation decrease forest cover which causes deforestation, deforestation causes soil erosion, soil erosion decrease soil productivity and finally it causes social and ecological poverty. Shifting cultivation is the simplest method of agricultural system practiced mainly by the people living in the hilly region. People find shifting cultivation as the more easy way of cultivation and also the less in expenses for cultivation. In shifting cultivation many valuable trees and vegetations get extinct. Saptiqa area is the only area under Zunheboto District where other agricultural systems are not practice except shifting cultivation. Even the tree (Sapti) after which the area is named is hardly found in the area because of the practice of shifting cultivation. If this continues without taking any steps for improvement then it will have a negative impact on the environment such as reduce of forest cover and loss of flora and fauna. Shifting cultivation cannot be eliminated as most of the people depend on shifting cultivation for their livelihood and also it provides them with all the types of crops even though it sustain only for few months (depending on the amount of crops harvested) and the rest of the year they have to depend on the outside markets. Therefore existing method of shifting cultivation should be improved and create awareness among the farmers to increase the production of crops and protect forest, soil erosion and environmental degradation. Horticultural seeds and planting materials which are supplied to the farmers by the Government should be made available to all the people. In the study area, the cycle of rotation have increase as many of the village farmers migrated to town sectors for other economic activities, while some depend on the markets as they have other source of income, and the old aged farmers stop cultivating as they cannot work in the field.

The decrease of shifting cultivation will have a positive impact on the environment and the cycle of rotation will also increase but it will affect their economy because they will have to depend more on the products from the markets. People in the district should be encourage to rehabilitate and divert to other agricultural system such as settled agriculture, for better livelihood without destructing the environment and for a better sustainable development.

Agriculture is the main economic activities of the people and with the increase in population dependence on the agricultural product has also increased. With the increase of agricultural activities, there has been more pressure on the forest cover which ultimately brings negative changes in the environment such as climate change, sudden rainfall, fluctuation in temperature etc. Jhum cultivation which is a slash and burn activity effects the environment by drying of perennial rivers and riverlets, increase in soil acidity in Jhum areas due to use of salt and weedicides, and loss of forest trees in agricultural areas. With the changes in environment, agricultural output will decrease. Negative changes in the environment, when not checked, affect everything around us. Efforts are made by the Government to improve the agricultural development by implementing different plans and programmes, providing loans and different schemes for the improvement of agricultural development at different levels. The decreasing trend in the annual area under Jhum field show positive response to the efforts given by the Government to reduce the practice of shifting cultivation. But the district is hilly and most of the people live between 1500 and 2500 meters altitude in which other types of cultivation is not practicable except shifting cultivation.

Therefore proper planning has to be made for the improvement of agricultural activities in the district by encouraging the farmers for terrace cultivation

in the low-lying areas and settled agricultural system. Shifting cultivation is closely interwoven in the life of the people and it cannot be eliminated, so improved method of shifting cultivation should also be popularized in dominant shifting cultivation areas to stop the decrease of forest cover and for the better environment. The Shifting cultivation system is sustainable if the cropping period is not more than 2 years and the fallow period is not less than 15 years (Thematic Report 2009). They also suggested that one year cropping period followed by 8-10 years fallow period has several advantages.

Findings

1. Jhum cultivation is interwoven with social life.
2. Hilly topography leads to more practice of Jhum cultivation than other environment friendly cultivation.
3. Total geographical area of Zunheboto district is 1255 Sq. km (census 2011) whereas 1595.88 Sq.km in Satellite Imagery.
4. 55.54 % (886.29 Sq.km) of the total geographical area (1595.88 Sq.km) is affected by Jhum cultivation during the past 21 years.
5. Average 1st year crop is 4.9% of the total geographical area.
6. 2nd year crop is 3.229% of the total geographical area.
7. 7-11 years Jhum cycle is most prevalent with a mean of 9 years.
8. Practice of Jhum cultivation has been decreasing.

9. Decrease in the forest cover mainly in the area where shifting cultivation is dominant. Forest cover recorded highest in 1999 (88.84%) and lowest in 2017 (74.42%).

10. Loss in forest cover from 1999 to 2017 is 14.42% (180.971 Sq.km).

11. 42.5% of the total geographical area is acidic i.e (4.5-50 pH value) with highest of 54.1% in Akuluto block followed by 47.7% in Suruhuto block where Jhum cultivation is dominant.

12. Annual rainfall shows a decreasing trend. Highest in 2005 (2530 mm) and lowest in 2016 (1070 mm).

13. Hindrances to the growth of agricultural development are land holding system, inadequate transport, inadequate storage facilities, inaccessibility to market, soil fertility etc.

14. Shifting cultivation is the dominant agricultural system in the district in which out of 186 towns and villages, 48 (25.8%) towns and villages practice only shifting cultivation.

15. 138 (74.2%) towns and villages practice both shifting and terrace cultivation where 27 villages have less terrace field.

16. Shifting cultivation is more dominant in the Western part of the district.

17. With an increase in area of cultivation, there is an increase in production according to statistical data.

18. Saptiqa circle is the only circle in the district where all the villages practice only shifting cultivation i.e 5 villages.

19. Out of 41 sample villages, 18 villages use salt water in the paddy field whereas 23 villages practice organic farming.

20. Recently 9 villages have banned the use of salt water in the field.

21. With the change in environment, agricultural output will decrease.

22. The growth of the flowering scrub Zunhesu after which the name of the district is given has decline due to shifting cultivation and only few are visible at present.

23. Loss of forest trees in agricultural areas with increase of scrub land.

It is found out that due to agricultural activities in the study area it shows a significant effects on climate change, causes of deforestation, over-irrigation causing deep drainage and low soil fertility, erosion of top soil, and soil degradation with decline in soil quality.

Suggestion

1. Emphasis should be made to increase production and productivity of the district in agriculture sector to meet the demand of the increasing population.

2. The crops are available only during the harvest time and after the crop season is over, farmers depend on the market products. Therefore crop preservation methods should be taught to the people so that they can preserve the crops for the off season.

3. Trainings and seminars should not only focus on few groups of people but it should involve all the farmers.

4. Making awareness to all the people specially villagers for the climatic change which is caused by their daily activities.

5. Survival of human depends on plants and animals so the importance for the protection and conservation of wildlife and forest should be made aware to all the people in the district.

6. Wherever possible terrace cultivation should be encourage to prevent the washing away of soil nutrients by the rain. Soil nutrients leads to the growth of healthy crops.

7. People should be encouraged to convert the waste land to productive land for more efficient outcome and replenish resources.

8. For better environment planting of trees in all the possible agricultural areas such as Jhum fields, permanent cultivation, plantation farming and home gardens.

9. To improve the environment, community participation is more important to make the differences.

10. Educating the farmers about the proper use of different pesticides and fertilizers in the field should be imparted.

11. Encouragement to the farmers to cultivate the same field for consecutive years to save the forest.

12. Farmers should be encouraged to utilize their own plot of land for agricultural activity to minimize the destruction of large area of forest for shifting cultivation.

13. People should be encouraged to cultivate agriculture for their home consumption to reduce the dependence on agricultural products from others.

14. Permanent agriculture with irrigation facilities should be encouraged for decreasing the practice of shifting cultivation.

15. Awareness should be made for encouraging the people for proper utilization and management of wasteland.

16. Different plans and schemes available for the farmers should be made aware to all the people and guidance should be giving on how to avail the existing services at different levels.

17. Importance of trees and forests should be taught to the farmers and trainings should be imparted for raising trees, plant protections, orchards etc.

18. Awareness and encouragement should be created among the people to be a responsible citizen towards protection of environment without depending only on the Government efforts and plans for the improvement and protection of environment.

BIBLIOGRAPHY

Books

1. Achumi Hekhevi (2005), *"Sutsah kuthoh",* S.P. printer, Kohima road, Dimapur.
2. Agarwal (2003), Economic reforms and agricultural development in North-East India-some issue, (eds.) Sengupta Keya and Roy Niranjan, *Economic reforms and agricultural development in North-East India*, Mittal Publication, New Delhi.
3. Agarwal V.P (1990), *Forest in India*, Oxford and IBM Publishing co.pvt ltd.
4. Agrawal A.N and Lal Kundan (1996), *Agricultural problems of India*, Vikas publishing house pvt Ltd
5. Assumi Zhekugha (2009), *The Sumi Ahuna*, Heritage publishing house, Dimapur, Nagaland
6. Aier Anungla (2004), *Cultural change among the Nagas-festivals and dress,* (eds.) Venhu N and Kalam abdul Maulana, Naga Society-continuity and change, Azad institute of Asian studies.
7. Alauddin Mohammad and Tisdell Clement Allan (1998), *The environment and economic development in south asia – an overview concentrating on Bangladesh*, The Ipswich book company Ltd, Ipswich, Suffolk.
8. Alagh H Joginder (1996), *Land and Man - essay in sustainable development*, Har-anand Publication.
9. Aye Kashito (2012), *Nagaland G.K*, current affairs and lastest who's who, 7th edition, ATICOS, Ltd, Dimapur Nagaland.

10. Bagchi K.K (2008), *Agricultural development in North-East India- issues and options*, Abhijeet publication.
11. Baishya P (2012), *Economy of Nagaland in Transition- a case study on infrastructure facilities*, Global publishing house (India).
12. Barik S.K (2007), Spatial and temporal variations in shifting cultivation in north-east India: Is sustainable land use possible with Jhum around?, In: Saxena, K.G. Liang Luohui and Rerkasen Kanok. (eds.), *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood*, Bishen Singh Mahendra Singh.
13. Benerjee Amalesh (2006), Agriculture in the Twenty-first century in the North-eastern State-challenges and opportunities, (eds.), Deb J Bimal and Ray B. Datta, *Chamging agricultural scenario in North-east India*, Concept publishing company, New Delhi.
14. Buchi K Nana (1997), Shifting cultivation and its impact on forest eco-system, (eds.) Mohapatra P.M and Mohapatro P.C, *Forest management in tribal areas- forest policy and peoples participation* (Proceeding of the seminar, forest policy and tribal development during 15-16 february 1994 at koraput), Concept publishing company.
15. Bhagabati Kumar Abani (2008), environmental problems in Indias Northeast: some obervistions, (eds.) Sujit deka, *Northeast India Geo-environmental issues*, EBH Publishers, India.
16. Bhatia, B. M.(1998) *Indian Agriculture: A Policy Perspective*, Sage Publications India Pvt. Ltd..New Delhi.
17. Bhattacharjee P.R (2003), The main issues in agricultural development of North-East India, (eds) Sengupta Keya and Roy Niranjan, *Economic reforms and agricultural development in North-East India*, Mittal Publication, New Delhi.
18. Bhattacharjee J.B (1994), *Studies in the economic history of North East India*, Har-anand publication.

19. Bijalwan, Arvind, Prakash, Chandra Kala (2013), *Forest biodiversity conservation and Management,* Pointer publisher, Jaipur India.
20. Burman Roy K B (1984), *Towards poverty alleviation in Nagaland and Manipur*. Mittal publications.
21. Callaghan O R J (1996), *Land use and Land cover*, chapman and hall, 2-6-boundry row, london SEI 8HN, UK
22. Chakrabarti B. S (2003), Agrarian relations in the tribal Milieu, (eds.) Subba B. T and Ghosh G.C, *The anthropology of North-east India*, Orient Longman private limited.
23. Chaku (1992), Need to save environment and ecosystem of Siwaliks of Jammu Region, (eds) Rai R.K, Mohapatra A.C, Goel N.P, *Environmental Management*, Vol. II, Socio-economic facets, Rawat publication.
24. Choudhury Jayanta and Das Manoshi (2007), Rehabilatation of shifting cultivators in the State of Tripura, India. In: Saxena, K.G. Liang Luohui. and Rerkasen Kanok. (eds.). *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood*, Bishen Singh Mahendra Singh.
25. Das, H. C. (1993). *Agricultural Efficiency in India*. New Delhi: K.M. Rai Mittal for Mittal Publications.
26. Deka Sujit (2008), *North-East India geo environmental issues*, EBH Publishers (India) Guwahati.
27. Deka, P. (1992). *Geography Economic and Regional*. New Delhi: H.S. Poplai for Wiley Eastern Limited.
28. Deori Pushpanjoli (2005), *Environmental history of Naga hills*- 1881-1947, Anshah publishing house.
29. Deb J Bimal (2010), Population and development in North east India, Concept publishing company Pvt. Ltd.

30. D.K. Asthana, Meera Asthana. (1998). *Environment: Problems and Solutions*. New Delhi: S. Chand & Company Ltd.
31. Fournier A.G.F and Wolmom G. M (1987), Land Transformation in agriculture, British library cataloguing in publication data.
32. Ganguly Baran Jalad (2006), *An economic history of North east India*, Anshah publishing house.
33. Ghosh B.B (1979), *Nagaland District Gazetteers*, Zunheboto, Government of Nagaland, Kohima. B.C Bhattachariee at Labanya art press.
34. Ghosh K.G, (1992), *Tribals and their culture in Arunachal Pradesh and Tripura,* vol. II, Ashish publishing house.
35. Ghosh R.N, Gabbay. R, Roy. K.C (1999), *Sustaining development-Human resource, gender and environment,* Atlantic publishers and distributors.
36. Gopalkrishanan. R (2000), *Assam, land and people,* Omsons publications.
37. Gopalkrishinan, R. (1996). *Geography of India.* New Delhi: Jawahar Publishers and Distributors.
38. Gupta J.P, 2002, Future and prospects of agroforestry in 2000 A.D for the Arid Tropics, (eds.) Khan. M.A, *Watershed management for sustainable agriculture*, Updesh Purohit for Agrobios (India).
39. Glaeser Bernhard (1995), *Environment, Development, Agriculture- integrated policy through human ecology*, ULC Press Limited.
40. Goel P N, Mohapatra C A, Rai K R (1992), *Environmental Management,* vol II, Socio-economic facets, Rawat publications.
41. Hazarika C (2006), Status of agricultural sectors in North-east India-problem and prospects, (eds.), Deb J Bimal and Ray B. Datta, *Chamging agricultural scenario in North-east India,* Concept publishing company, New Delhi.

42. Haque ,T.(1996), *Sustainability of Small Land Holder Agriculture in India*, Concept Publishing Company, New Delhi.
43. Husain, M. (1996). *Systematic Agricultural Geography*. Jaipur: Prem Rawat for Rawat Publications.
44. Jamir Wangshimenal and Lanusosang T (2014), *Forest atlas of Nagaland*, G.B Books New Delhi.
45. Jain C.K (1988), *Pattern of Agricultural development in Madhya Pradesh*. Northern book centre, New Delhi.
46. Jha L.K (1997), *Shifting cultivation*, APH Publishing Corporation,
47. Jha Kumar Ramesh (1999), *Deforestation and village life*, Naurang Rai for Mittal publications.
48. Jha Jaykar (2005), Biotechnology and sustainable agriculture, (eds.) Thakur Bakeshwar, Sinha V.N.P, Sharma. N, Pratap Rana, Mandal R.B, Singh R.B.P, *Urban and regional development in India*, vol.1, concept publishing company, New delhi-110059.
49. Jhonson D. Gale (1984), World Food and Agriculture, (eds.) Simon Julian L and Kahn Herman, *The resourceful Earth- a respond to Global 2000*, Basil Blackwell
50. Jocobs Julian (1990), *"The Nagas-hill people of Northeast India"*, editions hansiorg mayer.
51. Kadam N Santoshi (2009), *New Agricultural Technology: Socio-economic Impact*, Reliance publishing house, New Delhi.
52. Kant Surya (2005), Agricultural development in Himachal pradesh, (eds.) Thakur Bakeshwar, Sinha V.N.P, Sharma. N, Pratap Rana, Mandal R.B, Singh R.B.P, *Urban and regional development in India,* vol.1, concept publishing company, New delhi-110059.

53. Krishna Murali KVSG (2010), *The book of environmental studies*, Savera publishing house.
54. Kumar Abhay (2005), *Environmental protection in India- social-economic aspects*, new century publications.
55. Lalrinchhani, 2015, "Cultural identity and the problems of translating mizo folksongs", (eds.) malsawmdawngliana, Lalrameng K. Gangte and Rohmingmawii (2015), *Orality and folk literature in the age of print culture: India's Northeast experience,* scientific book centre Guwahati.
56. Longchar Wati A (1995), *The Traditional tribal worldview and modernity- focus on North East India*, N. Limala Lkr Eastern Theological College, Jorhat, Assam.
57. Lekhi K R and Singh Joginder (1996), *Agricultural economic- an Indian perspective*, Kalyani publishers.
58. Mahanta K.C (2008), *NorthEast India- The horizon of anthropology*, Kalpaz publication.
59. Mahajan V.S (1987), *Emerging pattern of North-eastern Economy*, Deep and deep publication.
60. Mazunder Sukhender (2006), Agricultural scenario in the North-east with special reference to Mizoram, (eds.), Deb J Bimal and Ray B. Datta, *Chamging agricultural scenario in North-east India,* Concept publishing company, New Delhi.
61. Mohapatra, A. (1999). *Man and Environment*. Rynjah, Shillong: Star Publishing House.
62. Mohammad, N. (1992), *Anthropogenic Dimensions in Agriculture*, Concept Publishing Company, New Delhi.
63. Mohammad, N. (1992), *Historical Dimensions of Agriculture*, Concept Publishing Company, New Delhi.

64. Neog A.K(2006), WTO and agricultural development in backward regions, (eds.) Basu Debadhis, Kulirani Francis B, Ray Datta B, *Agricultural food security nutrition and health in Northeast India,* A mittal publications.
65. Nagabhushana H.M (2006), *Agricultural development through watershed approach- an economic analysis of kabbalanala watershed in Karnataka,* Himalaya publishing house.
66. Norton, D. Roger, (2004), *Agricultural Developmental Policy*, John Wiley & Son Ltd, England.
67. Nshoga A (2009), Traditional Naga village system and its transformation, Anshah publishing house.
68. Nuh V.K (2016), *The Naga Chronicle 2nd edition*, (eds.) Wetshokhrolo Lasuh, Regency publications- A division of Astral international (P) Ltd, New delhi.
69. Orlovsky Nicolai, Glantz Michael and Orlovsky Leah (2001), Irrigation and land degradation in the Aral Sea Basin, (eds.) Breckle S W, Veste M and Wucherer W, *Sustainable land use in deserts*, Publication in part funded by UNESCO, UNCCO and BMBF.
70. Pandey C.M (1994), Agriculture development in the north-Eastern Region science Independence. In: Bhattacharjee B. J (eds.). *Studies in the economy history of North east India,* Har-anand publications.
71. Pandey K.N (1989), *Adoption of Agricultural innovations- A study of small and marginal farmers of Varanasi (U.P),* Northern Book Centre, New Delhi.
72. Prasad N S (2000), *Environment biology,* Campus books international.
73. Prasad Chandra Shekhar (2009), *Agriculture and rural development in India since 1947*, New century publication.

74. Pirazizy A. A (1992), *Environmental geography and Natural Hazards*, Concept publishing company, Concept international series in environment-1, General Editor, Paliwal K.V.

75. Ramachandra T.V (2006), *Soil and ground water pollution from agricultural activities*, Capital publishing company.

76. Ranjan K.P (2000), *Agricultural growth and economic stability- case study of North Bihar*, Rawat Publication, Jaipur and New Delhi.

77. Rizvi M.H.S and Roy Shibani (2006), *Naga tribes of North east India*, B.R. Publishing corporation (A division of BRPC India Ltd).

78. Roy Hiranmoy and Das Ashim (2003), Food Security in Liberalised economy- A Review, (eds.) Sengupta Keya and Roy Niranjan, *Economic reforms and agricultural development in North-East India,* Mittal Publication, New Delhi.

79. Roy, P.K. (2005), *Economic Geography*, Central Educational Enterprises (P) Ltd.Kolkata.

80. Roy Niranjan and Sengupta keya (2003), Economic reforms and agricultural development in North-east India, Mittal publication.

81. Roa. K.S, Maikhuri. R.K and Saxena K.G, Restoration of degraded forest lands in north-east India. In: Saxena, K.G. Liang Luohui and Rerkasen Kanok (eds.), *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood,* Bishen Singh Mahendra Singh.

82. Rotokha H.S (2013), Atsa eno pimhe gholah (Akippi eno akiye), Sumi tsaikoh mippi Zunheboto, Nagaland. Pp74

83. Saikia Anup (2008), Forest fragmentation in Northeast India, (eds.) Sujit deka, *Northeast India Geo-environmental issues*, EBH Publishers, India.

84. Saxena H.M (2011), *Environment geography*, Rawat publication.

85. Saxena H.M (2010), *Environmental management* (second edition), Rawat publication.

86. Satyanarayana, G. (1992), *Changing Agrarian Structure and Labour Relations*, Rawat Publications, Jawahar Nagar, Jaipur

87. Sedjo A Roger and Clawson Marion (1984), Global forests, (eds.) Simon L Julian and Kahn Herman, *The resourceful earth-a response to Global 2000*, Basil Blackwell.

88. Semple C Ellen (2009), *Environmental geography- influences on man on the basis of Ratzel's system,* Dominant publisher and distributors, New Delhi.

89. Sudarsha Cherry K and Sinah K R (1996), *Ecological restoration and global politics*, Commonwealth publishers

90. Sachdeba Gulshan (2000), *Economy of the North east- policy, present conditions and future possibilities*, Konark publisher Pvt Ltd.

91. Sachchidananda (1989), Shifting cultivation in India, concept publishing company, New Delhi.

92. Sharma C T and Coutinho O (1989), *Green Revolution Gap- A Geographical analysis*, Rawat publications.

93. Sharma, B.L. (1991), Applied Agricultural Geography, Rawat publication, Jawahar Nagar, Jaipur.

94. Sema Yeptho Najekhu (1985), *Sumi Chine-apine (Gennas and festivals of the sema)*, Sema literature board Zunheboto

95. Sengupta, Keya and Roy, Niranjan, (2003), *Economic Reform and Agricultural Development in North East India,* A Metal Publication, New Delhi.

96. Sumi kiphimi Kuqhakulu (1995), *Mhesho mheghi eno Sulimi sutsa*, Modern publications.

97. Singh A K, Kumra V.K, Singh J, (1987), *Forest resource, economy and environment*, concept publishing company, New Delhi-110015

98. Singh Kr Awadhesh and Srivastava Ashutosh (2006), Tribal land alienation: a case study of Uttarnchal and Uttar pradesh, (eds.) Sarkar R.M, *Land and forest right of the tribal today*, serial publication New Delhi

99. Singh Surjit (2010), Introduction, (eds.) Singh Surjit and Rathore M.S, *Rainfed agriculture in India Perspectives and challenges*, Rawat publications.

100. Singh Surendra (1994), *Agricultural development in India- a regional analysis*, Kaushal publishing, Shillong.

101. Sema Lhozhevi (2012), *Sumi tsashe anglo sumi dictionary*, sola printing press, Patkai Ghakhu publishing group, Dimapur.

102. Thakur. R (2005), Problem and strategies of agricultural development in India, (eds.) Thakur Bakeshwar, Sinha V.N.P, Sharma. N, Pratap Rana, Mandal R.B, Singh R.B.P, *Urban and regional development in India*, vol.1, concept publishing company, New delhi-110059.

103. Thanmawia L. R (2015), *Women as traditional knowledge keepers:* with special reference to mizo folk narratives, (eds.) malsawmdawngliana, Lalrameng K. Gangte and Rohmingmawii (2015), *Orality and folk literature in the age of print culture: India's Northeast experience*, scientific book centre Guwahati.

104. Tiwari B.K (2007), Shifting agriculture: spatio-temporal patterns and processes in north eastern India, In: Saxena, K.G. Liang Luohui and Rerkasen Kanok (eds.). *Shifting agriculture in Asia: Implications for environmental conservation and sustainable livelihood,* Bishen Singh mahendra Singh.

105. Verheyen. K, Honnay. O, Bossyut. B and Hermy. M (2004), what history can teach us about present and future forest biodiversity, (eds.), *Forest biodiversity-lesson from history for conservation,* CABI publishing.

106. Yepthomi Vihuto, Yepthomi Hokishe, Yepthomi Kughazhe, Yepthomi Ghuutoshe, Rochil Yeshito, Yepthomi Kaiho, *Yepthomi Chronicles* (2011), vision press kohima

107. Yadava P.S, Sanjay N, Bhogen Th (2002), Deforestation and shifting cultivation in Manipur, (eds.), Singh Ravindra Pratap, *Environment and change*, Rajesh publications, New Delhi.

Journals and Magazines

1. *Annual Administrative report 2015-16*, Department of Agriculture, Government of Nagaland
2. Bindumathi. S and Sannashiddannanavar. S. Subash (2016), *The Deccan geographer*, Vol 54, No 1, June 2016 (peer review refreed journal), the deccan geographical society, India.
3. Changkija Sapu, Rongsensashi and Mozhui Renchumi (2012), Threatened plants of Nagaland (eds.) R.C. Gupta in *Nagaland University Research communication*, Manas Saikia for Cambridge University press India Pvt.Ltd.
4. Chattopadhyay Srikumar and Trivandrum (2015), Human dimension of environmental change with special references to water system and river restoration, *Transactions*, Vol. 37, No.2
5. *Data based on village level development indicators as on 31 March 2014*, Directorate of economics and statistics Nagaland: Kohima, Government of Nagaland.
6. *District census handbook*, Zunheboto, Census of India 2011 Nagaland, Directorate of census operation Nagaland, Series-14, Part XII- B
7. District Soil and Water Conservation Office (DSCO) Zunheboto, Nagaland
8. *District Human Development Report Zunheboto 2013,* FOI-UNDP Project, Bridging inequalities towards human development, Government of Nagaland, Department of planning and coordination, Nagaland.
9. Deol Sukhraj, Kumar Ramesh, Dhaliwal G.S and Sangha G.S (1998), Impact of changing land use pattern on environmental degradation, (eds.) Dhaliwal G.S, Arora

Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development*, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development.

10. Dhillon S.S (1992), Origin and development of agriculture, (eds.) Mohammad Noor, *New dimension in agricultural geography- Historical dimensions of agriculture*, Vol.1, Concept publishing company, New delhi.
11. Dhar P.K (2002), Status of Jhum cultivation in the North Eastern Region and strategy to changge such status, (fourth conference of the north eastern economic association) proceeding volume, agricultural transition in the hill areas of the north eastern region , published by B. Syiem.
12. *Ground water information Booklet Zunheboto District, Nagaland*, Central ground water Board, North Eastern Region, Ministry of Water Resource, Guwahati, September 2013.
13. Gupta Das Malabika (2002), Status of Jhum cultivation in the North East, (fourth conference of the north eastern economic association) proceeding volume, *agricultural transition in the hill areas of the north eastern region*, published by B. Syiem.
14. Gomathi and Kumaraswamy (2016), Patterns of crop concentration and diversification in Aiyar Basin, central Tamil Nadu, *Punjab geographer- A Journal of the APG*, India and Isper India, Panchkula
15. Herren R Hans (1998), Global environmental and food security: Importance of arthropod diversity, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development*, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development.

16. Khepar S.D and Sondhi S.K (1998),Water management strategies for sustainable irrigated agriculture, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development*, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development.
17. Kumar Rajesh, Sharma. K.Y, Pal. B (2012), Effect of saline water irrigation and nitrogen on yield and chemical composition of lemon grass and salt balance of sandy loam soil, (eds.) R.C. Gupta in *Nagaland University Research communication*, Manas Saikia for Cambridge University press India Pvt.Ltd.
18. Jauhri P.K (2005), *Encyclopedia of resource geography*, Vol-2, Anmol publication Pvt. Ltd.
19. Jr. Sewell William (2008), "The concept(s) of culture" from beyond the cultural turn: New directions in the study of society and culture (1999), (eds.) Oakes S Timothy and Price L Patricia, *The cultural Geography reader, Routledge*, Taylor and Francis group.
20. Muru Y. Vihoshe, Zunhesu, *Zunheboto town Platinium Jubilee magazine,2017*
21. Mishra .N.B and Mishra Pankaj (2015), Agricultural land resource utilization in Trans-yamuna Region in Allahabad District, Uttar Pradesh, *The Deccan geographer*, Vol 53, No 1, June 2015 (peer review refreed journal), the deccan geographical society, India.
22. Mills Peter (2011), Efficient statistical classification of Satellites measurements, , *International Journal of Remote sensing incorporating Remote sensing Reviews,* Vol. 32, Number 21, 10 Nov 2011, ISSN 0143-1161.
23. *Nagaland Economic Survey 2016-2017*, Government of Nagaland, Directorate of Economics and Statistics, Nagaland, Kohima.
24. Nagaland University, Headquarters, Lumami, Prospectus for academic session 2014-15

25. Omutto C.T (2011), A new approach for using time-series remote sensing images to detect changes in vegetation cover and composition in dry land: a case study of eastern Kenya, *International Journal of Remote sensing incorporating Remote sensing Reviews*, Vol. 32, Number 21, 10 Nov 2011, ISSN 0143-1161.
26. Paul A.K and Paul S.K (2017), *Nagaland G.K and current affairs*, J and C Newspaper group (Regd.).
27. Pathak M.D and Mishra R.P (1998), Environment and farmer friendly technology for reclamation of waste and marginal lands, (eds.) Dhaliwal G.S, Arora Ramesh, Randhawa N.S, Dhawan A.K, *Ecological agriculture and sustainable development, Vol. 1, Proceedings of international conference on ecological agriculture: Towards sustainable development*, November 15-17, 1997 chandigarh, India, Indian Ecological Society and Centre for research in rural and industrial development.
28. Pebam Rocky (2018), A novel approach to understand the spatial and temporal pattern of shifting cultivation fields using GIS techniques in Longding division of Arunachal Pradesh, India, Int. Journal of Engineering Research and Application, 8(10):61-67.
29. Rokde Jyoti, Daripa Amrita and Chaturvedi Arun (2015), Dynamic of land cover/ land use change in Salekasa Tahsil in Gondia district, Maharastra state, T*he Deccan geographer,* Vol 53, No 2, December 2015 (peer review refreed journal), the deccan geographical society, India.
30. Roy Niranjan (2002), shifting cultivation in the north eastern region: a concern for sustainabiltiy, (fourth conference of the north eastern economic association) proceeding volume, *agricultural transition in the hill areas of the north eastern region*, published by B. Syiem.
31. Saikia Haren (1992), *Pattern of land holding and agricultural productivity-A case study of upper Brahmaputra valley of Assam,* Thesis submitted to NEHU.

32. Singh R.B and Gurjar Kumar Ajay (2011), Climate change vulnerability of agriculture in arid region on Rajasthan, India, *Annals of the National association of geographer India*, Vol xxxi, No.1, June 2011
33. Sumi kiphimi Kuqhakulu (1995), *Mhesho mheghi eno Sulimi sutsa*, Modern publications.
34. *State agricultural plan, Under NADP/RKVY programme during 12th Five Year plan (2012-17) activities proposed for the state of Nagaland*, Department of agriculture, Government of Nagaland.
35. Sumi Totimi hoho (2013), *Sumi Tuphimini eno Anannuqo,* NagalandSumi Alino and Shohe Kimiyekato (2018), Ethnomedicinal plants of Sumi Nagas in Zunheboto district Nagaland, Northeast India, *Acta scientific pharmaceutical sciences*, Research article, Volume 2 Issue 8 August 2018.
36. Soils Nutrients mapping of Nagaland, Department of Agriculture, Government of Nagaland and ICAR- National bureau of Soil survey and land use planning, Nagpur, Maharastra, NBSS publ. 1080, November 2014.
37. Thakur Nath Som, Kahlon Simrit and Bhutani Smita (2016), Impact of human and environment on landuse/landcover change in Gaddi region, western Himalaya, *The Deccan geographer,* Vol 54, No 1, June 2016 (peer review refreed journal), the deccan geographical society, India.
38. Thong Pentile, Pebam Rocky and Sahoo UK (2018), A geospatial approach to understand the dynamics of shifting cultivation in Champhai district of Mizoram, North-East India. J Indian Soc Remote Sens. 46(10):1713–1723.
39. Thakur B.N (1997) Impact of shifitng cultivation on forest and eco-system, (eds.) Mohapatra P.M and Mohapatro P.C, *Forest management in Tribal areas- forest policy and peoples participation* (Procedding of the seminar, forest policy and tribal development during 15-16 february 1994 at koraput), Concept publishing company

40. *World food and agriculture statistical pocketbook 2018*, food and agriculture organization of the United Nations, FAO statistics.
41. Yepthomi Z Libo, Wangshimenla, Pebam Rocky (2019), Shifting Cultivation Dynamics for the last two decades. 1997-2017, Zunheboto District of Nagaland using Geospatial Techniques, *Research Reinforcement (A Peer Reviewed International Refereed)* Vol.7, issue 1.
42. Yepthomi Z Libo, Wangshimenla (2019), Cultural Activities in Agriculture, Zunheboto District, Nagaland, (eds.) Mishra G.C, Majumdar Saikat, Dutta Papiya, *International Conference on recent trend and practices in science, technology, Management and Humanities for sustainable rural Development (Conference Proceedings),* Krishi Sanskriti publications.

Websites

1. https://www.flowersofindia.net/catalog/slides/Hairy%20White-Wand.html
2. https://a-z-animals.com
3. https://en.wikipedia.org/wiki/Leucosceptrum
4. https://en.wikipedia.org/wiki/Sumi_Naga
5. https://Forest.nagaland.gov.in/biodiversity
6. https://en.climate-data.org/asia/india/nagaland/zunheboto-101263
7. https://iasscore.in/upsc-prelims/agricultur-schemes
8. https://www.bbc.com/news/science-environment-26382067
9. https://wikivisually.com/wiki/sumi_Naga
10. http://en.m.wilipedia.org/wiki/history_of_agriculture
11. https://www.environmentalscience.org/history-agriculture
12. https://geography-revision.co.ul/gcse/agriculture/types-of-agricultural-activity

13. http://www.afterschoolafrica.com/47413/top-seven-countries-that-developed-with-agriculture/
14. http://www.plantauthority.gov.in/pdf/CropSpeciesnotified.pdf
15. http://www.inspection.gc.ca/plants/grains-and-field-crops/list-of-grains-and-field-crops/eng/1323244558875/1323244642996
16. http://www.fao.org/fileadmin/templates/ess/documents/world_census_of_agriculture/appendix4_r7.pdf
17. http://fieldguide.mt.gov/displaySpecies.aspx?family=Triaenonychidae

Plate 1: Details of the Study area

Hairy white (Zunhesu)

View of Zunheboto Town

Aerial View of Zunheboto Town

Aerial View of Agricultural sites in the Study Area

Plate 2: Tourist Destinations in Zunheboto district


Sumi Baptist Church Zunheboto (Asia largest Church)

Keltomi Village (Model village 1988)

Rotomi Village (Green village)

Nagaland University, Lumami Campus

Aerial View of Nagaland University


Aizuto Mission Centre

Plate 3: Cultural Activities

Preparation for the festival

Rice pounding song

War Dance

Unity or Oneness dance

Cooking of rice from bamboo which is called Ahuna

Plate 4: Shifting Cultivation


View of Jhum Field before Planting Paddy After Planting Paddy

Plate 5: Stages of Shifting cultivation


Clearing of forest


Burning of the field


After Burn


Leveling of field


Bunding


Construction of farm House

Farm House


Planting of Seeds


Weeding

Harvesting

Thrashing of Paddy

Winowing of Paddy after harvesting

Storing of paddy in granary

Drying of paddy for pounding

Grinding of paddy from Rice mill

Abandoned Field

Second year cropping Jhum field

Plate 6: Terrace rice Cultivation


Terrace Rice Field at Tizu river bank (Akulu)


Terrace Rice Field in the hilly area (Ato kulu)

Clearing of Terrace field before plouging

Nursery of Paddy for the Terrace rice field

Plouging of terrace field by bull

Cleaning of Terrace field after plouging

Transplanting of paddy in the terrace field

Construction of Water cannel for the terrace field

Paddy after transplanting from the nursery and fully ripped paddy

(1) (2) (3)

1. Terrace field after harvest.
2. Growing of pulses after harvest.
3. Abandoned Terrace rice field.

Plate 7: Home Garden

Home garden with mixed cropping

Growing of different crops from the house terrace

Growing of Chayote at home

Use of wood Mulch and Cow dung manure in Home garden as fertilizers

Plate 8: Cropping Pattern

Mixed cropping in Jhum Field

Fully riped paddy

Collection of harvested crops

Drying of chilly

King chilly

Ball chilly

Sunflower seed

Potato

Plate 9: Different Implements used in the Study area

Quivers

Winnowing fan and Sift Basket

Bamboo Mat

Pounding Table

Scuffle Hoe, Spade

Rack

Shovel

Sawmill

Rice mill

Blacksmith


Slender Basket (Aqhupu)
Quiver (Akho)
Small bamboo Basket (Asuphe)
Sift Basket (Amto)
Bushel/Basket (Ashoghi)
Winnowing Fan (Apighi)
Pounding pole (Akhumu)
Pounding Table (Aboshu)

Plate 10: Harvesting Season

Harvesting of Maize and Jhum Paddy

Plate 11: Granary

A barn Yard area (Aleto) Barn/Granary

Plate 12: Preservation of Seeds

Chilly seed Beans

Maize Millet and Sunflower

Plate 13: Cutting down of trees for different purpose

Collection of firewood

Transporting of firewood

Cutting down of trees for cultivation and Timber

Plate 14: Destroying of crops in the field

(1) (2)

1. Paddy field destroyed by Elephant (Shena old village 2019)
2. Attack on Maize by Fall Army Worm

Plate 15: Marketing

Sale of agriculture products at roadside

(1) (2)

1. Sale of agricultural products by Local vendors.
2. Sale of dry agricultural products during the off season

Plate 16: Sale of Agricultural products by organizing sales day during the crop season

Pumpkin Cucumber Potato Beans

Yam Banana King chilly

Plate 17: Repellent agent use in agricultural activities

Roundup used for killing weeds

Spraying of Salt water in the paddy field

Plate 18: Impact of Shifting cultivation

Land after shifting cultivation

Scrub land after shifting cultivation

Land Degradation

Soil erosion

Plate 19: Different schemes by the Government

(1) (2)

1. Ginger plantation by SHG women group at Lumami village Sponsored by KVK
2. Plantation Project sponsor by Horticulture department at Atoizu

Construction of Drainage at Village Agri Road Fishery

Plate 20: Plantation activities

Banana Plantation Litchi Plantation

Ginger Plantation Cardamom Plantation

ANNEXURE I

QUESTIONNAIRES

For the Topic: **"Agricultural Activities and its Impact on Environment in Zunheboto District, Nagaland"** to help the research work of miss Libo Z Yepthomi (Research Scholar) Department of Geography, Nagaland University Lumami.

Name of Respondent : .....

Village : .....

Block/Town : .....

District : Zunheboto

State : Nagaland

1. Total number of population in the village/town:

2. Number of household involve in agricultural activities:

3. What is the household's main field of economic activity?

a. Agriculture/ Forestry b. Agricultural labour
c. Other d. All the above

4. What is your main reason for your involvement in agricultural activities?

a. Sale b. Home Consumption
c. Other d. Not stated

5. Type of agriculture practice:

a. Terrace cultivation b. Shifting cultivation
c. Both a & b d. Other

6. Nature of agricultural land:

a. Own b. Lease
c. contractual d. Other

7. Uses of seeds:

a. Traditional b. HYV Seeds
c. both A&B d. Other

8. Types of fertilizers used in agricultural field:

a. Bio fertilizer b. Chemical fertilizer
c. both a & b d. Other
e. None

9. Are you aware of government plans and facilities?

a. Yes b. No
c. Don't know

10. Is there any help from the government?

a. Yes b. No

11. Name some development program taken up by the government in your village/town?

……

12. Do you get seeds and fertilizers in time?

a. Yes b. No
c. Don't know

13. What factors affect your yield?

a. Natural calamities b. Lack of finance
c. Unavailability of resources d. Other

14. How many hacters/area of land are used for agricultural purpose?

15. Is the agricultural land under cultivation?

a. Yes b. No

16. What tools are used in agricultural fields?

……

17. Which type of pesticides is generally used in agricultural land for controlling unwanted species of plants and animals?

……

18. Types of crops grown with different season:

Season	Crops

19. Have you grown any commercial crops?

a. Yes b. No

If yes, specify……

20. How do you market your crops?

a. Direct b. Through middle men
c. Through agencies d. Others

21. Your opinion about the expenses in agriculture?

a. Very high b. Moderate
c. Less d. Don't know

22. Did yield of your main crops change (increase or decrease) over the last few years. In case of change, describe some main reason.

……

23. What environmental services are important for you from your village/town?

……

24. What are the advantage and disadvantage of agricultural activities?

Advantages	Disadvantages

ANNEXURE II

Research paper published

Sl. No	Title of the Research paper	Name of Journal	Remarks
1	Cultural Activities in Agriculture, Zunheboto District, Nagaland	Conference proceeding (International Conference on STMH-2019), Krish Sanskriti Publications ISBN: 978-93-85822-92-6, Pages: 21-27	Published
2	Shifting Cultivation Dynamics for the last two decades, 1997-2007, Zunheboto District of Nagaland using Geospatial Techniques	Research Reinforcement (A Peer Reviewed International Refereed Journal),Vol.7, Issue 1, UGC App.No.64785, Impact Factor: 4.213, ISSN 2348-3857, May 2019- Oct 2019, Pages: 1-9	Published

ANNEXURE III

Paper Presented

1. "**Shifting Cultivation in Saptiqa Area of Zunheboto District Nagaland",** National Seminar on Climate Change and sustainable development with special focus on North East India on 17-18 may 2017, Nagaland University.
2. **"Shifting Cultivation Dynamic for the last two decades, 1997-2017, Zunheboto District, Nagaland",** 40th Indian Geography Congress 2018, organized by National Association of geographers, India (NAGI) and Department of Geography, Rajiv Ghandhi University, Itanagar, Arunachal Pradesh from 29th to 31st October 2018.
3. **"Cultural Activities in Agriculture, Zunheboto District, Nagaland",** International Conference, organised by Department of Rural development, University of Science and Technology, Meghalaya and State Institute of Panchayat and Rural development, Assam, NIRD and Panchayati Raj-North East Regional Centre and IIE, Guwahati on 6-7 September 2019.