AN ANALYSIS OF AGRICULTURALLY INDUCED LANDUSE CHANGES IN ZUNGERU, NIGER STATE, NIGERIA

BY

EMENOGU, CHINYERE CECILIA
M. Tech/SSSE/2006/1492

DEPARTMENT OF GEOGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

APRIL, 2010

AN ANALYSIS OF AGRICULTURALLY INDUCED LANDUSE CHANGES IN ZUNGERU, NIGER STATE, NIGERIA

BY

EMENOGU, CHINYERE CECILIA
M. Tech/SSSE/2006/1492

A THESIS SUBMITTED TO THE
POSTGRADUATE SCHOOL,
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY
(M. TECH) IN GEOGRAPHY (ENVIRONMENTAL MANAGEMENT)

APRIL, 2010

ACKNOWLEDGEMENTS

My profound gratitude goes to the Almighty God, whose wisdom, protection and wonderful blessings make me what I am today. My sincere appreciation and recognition go to my transparent Project Supervisor Prof. J. M. Baba, who devoted his time and energy towards making sure a good project work is produced. His constructive criticisms and advice were a great encouragement, paving way for me to aim high in my future academic pursuit. I owe it a duty to express my gratitude to the Head of Department Dr. P. Akinyeye and other lecturers in the Department, Dr. Okhimamhem A. A.; Dr. Usman, M. T.; Dr. Halilu Shaba; Prof. G. N. Nsofor; Mr. Salihu Saidu; Mr. Samsideen Ojoye; Mr. Olawale Hamzat, and various others whose names were not mentioned here. You all were of great assistance to me during my course of study in the department. Thank you so much. I very much acknowledge the friendship and encouragement I shared with some of my course mates, as it affected my life positively. Some of them like, Mr. Abbas, Mr. Peter, Madam Faith, Madam Memuna, Col Awwal Faggae and many others whose names are not mentioned here. I enjoyed every moment that we spent together. My sincere thanks go to my other sisters and brothers, my husband and my in-laws. I also acknowledge the encouragement from my work place, advice from people like the Rector, Niger State Polytechnic – Alh. Garba K. Mohammed and the Registrar – Alh. M. Z. Bawa, my HOD – Mallam Nagya, Mallam Idris M. Knotagora, Mallam Lawal.

ABSTRACT

Man cannot be separated from his environment, hence all the resources he needed is derived from it. The problems lies on the extent and ways in which man tapped all these resources, thereby inducing same negative changes to the environment, through agriculture. The aim of the study is to analyse the agriculturally induced landuse changes in Zungeru, Niger State. Data collected were from primary and secondary sources. The use of questionnaires which was randomly distributed to 150 respondents including farmers, pastorists and other agriculturalists was utilized, 80 persons responded. Furthermore, SPOT image Remote Sensing data of the study area was analysed to give clue to the various land usages in the area. Having analyzed all, the result obtained indicated that activities like Manual Bush Clearance, and bush burning were prominent in the area, hence, contributing to deforestation. The induced changes are in terms of tree loss, wildlife and crop losses. The recommendation focused primarily on the principle of sustainability which emphasize that while we exploit the resources available in the environment, it is important to be mindful of the aftermath of the results of our activities in the environment for the sake of the future generation.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

theoretical but also at a practical level.

1.2 STATEMENT OF RESEARCH PROBLEM

In summary, many authors and scholars have presented in their studies, the extent to which agricultural land use and deforestation affect the environment. Many studies of this type have been carried out in other towns, but they may not really show the same result, depending on the study area in question. In the study of this kind, is there any causes concerning the phenomena in question that might be prevalent in the area concerned. All these facts are to be found out in order to know the missing gaps in the study.

First, the study area in question is unique as compared to any other area of study. It includes its location, soil, flora and terrain. For instance, the rate of deforestation and its damages in the course of agricultural practice in the Northern Zone will differ from that of eastern and southern Zones. The type of flora like shear butter tree that is prevalent in the Northern part of the country is not seen in the eastern parts.

Secondly, the climate also determines the type of farming method, crops, time of planting and harvesting periods in different areas. In eastern part of the country, rain starts from February and planting season starts form such period. In the North, rain starts end of April and planting season starts from May and sometimes there is late planting due to delay of rain. This means that the Eastern part of the country flora will regenerate easily as they still receive early and late rain, even after harvesting periods. But in the Northern part their harvest season corresponds with dry season.

This means less rain for plant regeneration.

Thirdly, the method of farming and crops planted matters. In the Eastern part of the country, they apply slash-and-burn method to eliminate weeds while in the North, chemicals called 'weed out' is use in eliminating weeds. The Northern zone plants rice beans, corn and yam in large quantities while in the Eastern part, the y plant less of these, pre-dominantly cassava.

Therefore, the amount of environmental effect of agricultural land use depends on the area, and the extent of its impact to such area. This also is determined by the method and extent of agricultural practice in the area. Eventually, all these will be determined the strategies to propose in achieving sustainable agriculture, and how to reduce its future impact to the environment.

1.3 AIM AND OBJECTIVES

The aim of the study is to analyse the agriculturally induced changes in Zungeru, Niger State.

The aim will be pursued through the following specific objectives;

i. To identify the Agricultural land use types in the study area.

ii. To identify other agricultural related activities that affect the environment.

iii. To assess the effect of Agriculture and other related activities on the environment.

iv. To recommend strategies to tackling these environmental problems.

1.4 JUSTIFICATION OF THE STUDY

The following points justified the above study.

i. Agriculture is fundamental to the sustenance of man; hence, adequate attention must be accorded to it.

ii. The harmful ones should not be produced nor used.

iii. The use of chemical should be reduced. Compost manures and animal dumps should be encouraged.

iv. The danger of some Agricultural related activities should be stopped by the rural populace. However, the solution to those problems should be communicated through training.

v. The use of cover crops that will protect the soil should be ensured and appropriate farming methods that will help to conserve the soil be used to ensure regeneration of land resource-based crops.

vi. The study would also be a guide to further researches that will help in promoting proper protection of the environment.

1.5 SCOPE AND LIMITATION OF THE STUDY

The study will mainly focus on the agriculture induced changes in deforestation in Zungeru Niger State.

The limitation of the study includes the following;

1. The behavioural reaction of the inhabitants of the area, as many who are involved in Agricultural activities are illiterates and tried to avoid giving relevant information needed.

ii. Many shy away from answering questions thereby hindering receipt of relevant information due to fear or rather inferiority complex.

iii. Language barrier was another problem as many can only speak their local dialects, and the researcher was left with an option of seeking for an interpreter.

1.6 THE STUDY AREA

1.6.1 Origin and Growth

The entity called Zungeru, Niger State today happened to be under the Sokoto Caliphate. The Calphate was established in 1810 when Uthman Dan Fodio completed the conquest of most parts of Northern Nigeria. Dan Fodio waged war against the Hausas in the North and it did extend to the South, up to the present Kwara State.

Zungeru at that time existed just like a compound, which was established by a Gwari Local Guitarist who left his relations as a result of disagreement. He settled down with his family near the bank of a river called River Nnamayi. The name of the man was called Dunguri (meaning local musical instrument called Dunguri).

Nda Dunguri as he was usually called played his Dunguri at the bank of the River to

entertain hunters and fishermen as he waited for buyers of his own catch. His music was probably aimed at attracting buyers.

Gradually, he became popular around the area, people from other villages, far and near came to listen to his music. It came to the point people started referring to the place as Dungurum. Dungurun therefore became the name of the place, until the Europeans came and took over the place and established the Colonial Capital called the Capital of the Northern Nigeria, thereby changing the name of the place to Zungeru.

Zungeru in recent times had Wushishi as the local government headquarters and Minna as the state capital in Niger State.

1.6.2 Location

Geographically, Zungeru lied on latitude 9° 38C North and on Longitude 6° 10C East; a small town located at the center of the present Niger State of Nigeria. It is surrounded by old indigenous and important towns in Niger States which include Kontagora to the North, Minna to the East and Bida to the south. It has a good road network linking to all parts of the country. (Field Survey, 2008).

The major roads run through Tegina to the North, Wushishi and Bida to the south and Minna to the East. (Field Survey, 2008).

1.6.3 Drainage System

The Town has a natural drainage the discharges run-off into the river round about the town. Though, the recently constructed drainages were mainly at the local

government headquarters. (Field Survey, 2008).

1.6.4 Climate

Zungeru area is a typical middle belt town in Nigeria. It experiences distinct dry and wet season. The duration of sunshine ranges from 8 hours per day, in the South, and 11 hour in the North from January to April/May. There is usually an increase in sunshine per day in the months of July/August; due large increase in cloud cover. There is also rise in rainfall in September as a result of decrease in cloud cover. (Field Survey, 2008).

However, rainfall varies from time to time. The annual rainfall is approximately 1.650mm. It is above 60% of annual rainfall within the month of July, August and September. The factor is of great significance in planning of drainage for disposal of storm water. This is important because rainfall of high intensity often cause serious damage to buildings and crops. (Field Survey, 2008).

1.6.5 Soil

The soil in the area shows a high degree of variability, comprising of sand, clay, slit and gravel soils. The incidence of soil erosion is quite small because of high level vegetal cover and any uncontrolled clearance would result to more erosion in the area. The soil is said to be suitable for growing many savanna crops and cereals. There is also the indication that mineral resources like gold might be found in the area. (Field Survey, 2008).

1.6.6 Socio- cultural Activity

The dominant religion in Zungeru/ Wushishi is Islam. Islam also forms the basis of the traditional cultural element of ethnic groups in the area, especially in the mode of dressing, festivals and other ceremonies. The major group in the area are the Gbagyis, popularly called the 'Gwaris'. Other notable ethnic groups in the area are the Nupes, Fulanis, Yorubas, Ibos, Edos, among others. (Field Survey, 2008).

1.6.7 Demographic Characteristics

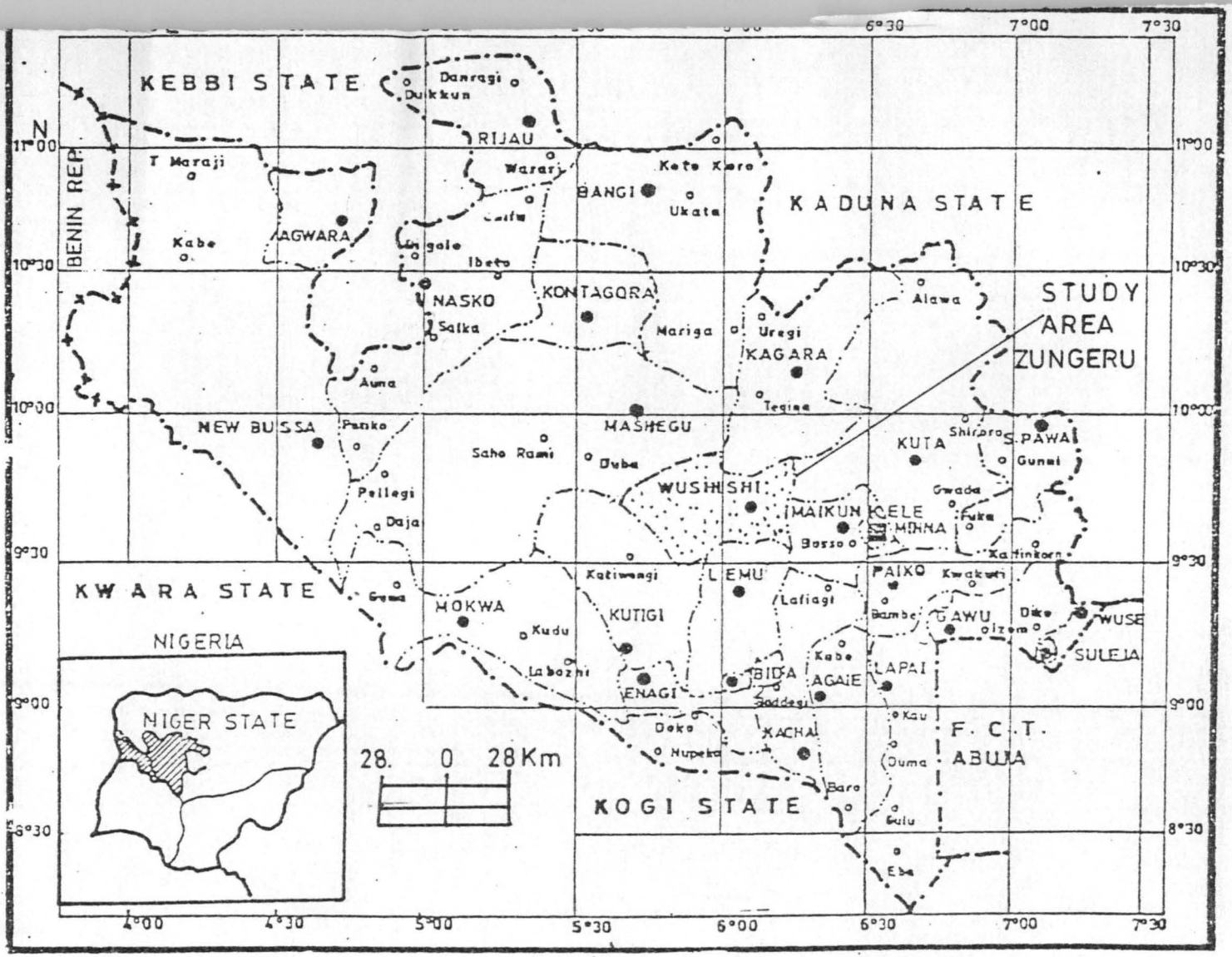
The town's population according to the 1991 census was placed at about thirty thousand people (30,000), but recent population data records a figure significantly higher than the former (2006 Population Census report). With a population of over 75,000 people, Wushishi/Zungeru has grown into a major town in Niger state and the dominant age group according to the 2006 population census report was reported between 15-49 years. (Field Survey, 2008).

1.6.8 Economic Activities and Infrastructural Facilities

The major economic activities in the area are farming, fishing and small number engaged in trading. The presence of Niger State Polytechnic Zungeru and the local government secretariat brought large number of Civil Servants to the area. People come from other towns to buy farm produce.

In terms of infrastructure, Zungeru town has three Government Primary Schools other private Primary Schools. Two Government Secondary Schools and Private Secondary Schools. There are two Rural Health Centers, a Standard Hospital and relatively stable supply of electricity. It has three banking institutions, a Post Office

and two Magistrate Courts. There are also Railway Station, two divisional Police Stations and a Polytechnic. There is also presence of a Water Board and other social amenities. (Field Survey, 2009).



Source: Field Survey 2008

FIG 1 ADMINISTRATIVE MAP OF NIGER STATE SHOWING THE STUDY AREA

LEGEND

National Boundary —+—+— State Boundary ··· — · — Local Govt Boundaries ·· — ·· —

State Capital.. □ Minna Local Govt Headquarter---○ MASHEGU Major Town----●

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 MAN'S RELATIONSHIP TO THE ENVIRONMENT

Man as living being forms part of the environment known as the biosphere, though according to (Erichlich et al 1977), history he appeared after other creatures were fashioned out by God. This is to say that he is made to be the steward of all things that existed. History has it that the earth is about 4.5 billion years old and living organisms originated about 2.2 billion years age. The first small population of human beings probably appeared on the earth more than 2 million years ago, especially in the continent of Africa [Erhlich et al 1977].

Indeed, at early times human population was very small and their needs limited. Man only lived by food gathering and hunting. According to Clayton, (1992), "man's place in food chain was a predator and a prey. His mythology was at least 40,000 years old reflecting in cultural artifacts, tools, instruments, cave, painting and so on". In the same vain, Emman. (1995), goes on to say that: "his achievements include the discovery of fire, the fashioning and improvement in agriculture and the invention of machines". All these show that man continued to increase in ability to harness what his environment offered to him. In doing this he demonstrated it by inventing necessary tools deemed fit to achieve his desired objectives.

However, the environment itself is a complex system made up of, the atmosphere, hydrosphere, lithosphere and biosphere. All these components work together to

form a harmony known as a state of equilibrium (balance). In environmental Management, the main focus is to ensure that the maintenance of this equilibrium (balance). Is it indeed possible, considering the existence of man in the environment? Environment in its complex form has been defined by many authors of who are the following;

Hagget, (1995), defined environment as "the sum of all conditions that surround man at any point in time on the earth surface". This explains the inter-dependence between man and the environment. Sogo-Temi, (2000), sees the environment as-"a condition, circumstances and influencing surrounding affecting the development of an organism or group of organisms". In the words of Arosanyi (2000), environment is seen as "forces, conditions that surround and influence living and non-living things". Sada, (1998), viewed environment as a "system within which living organisms interact with the physical elements".

The above definitions portrayed the interaction of living things and non-living things with the physical environment. This interdependency link is a process of 'give and take', depending on the part of the environment it is taking place. Therefore, an environment can be classified into physical (natural), human, cultural, social, economic and political environment. The physical environment mostly is where man derives all his physical needs. The more he searches for fulfillment, devising innovative means, the more he depends and imprint influencing effects on the environment. This in the longrun becomes positive or negative feedback. This can disintegrate the equilibrium balance of nature, thereby leading to global atmospheric

disturbances.

2.2 AGRICULTURAL LAND USE AND ITS ENVIRONMENTAL EFFECTS

According to Ibrahim (2001), land is known as "the geosphere where human activities such as food production are carried on within the environment and it forms part of the earth subsystems". In law of real property, land includes things permanently affixed to the earth such as water collected from the wells, houses and fences" [Shaba, 2007]. And land could also be defined as a "relationship between man and nature itself and majority of people see land as space for human activities".

Land use has been defined in many dimensions to portray its usefulness and

relationship between man and the environment. It connotes the different uses to which land is put. The term land use originally belongs to the group of concept in agricultural economy. Land use in agriculture includes construction of dams, open cast mining, forestry, grazing and farming to fishing activities.

Agriculture is an act and science of managing growth of plants and animals for the use of man and other purposes. In a broad sense, agriculture includes, cultivation of land, growing and harvesting of crops (crop farming), breeding and raising of livestock (animal husbandry), diary farming, forestry and poultry [Jule, Verne, 2004].

Modern agriculture depends heavily on engineering and technology, biological and physical sciences, irrigation, drainage, conservation and sanitary engineering.

Agricultural chemistry deals with other vital farm problems such as the use of fertilizer, insecticides and fungicides, soil make-up, analysis of agricultural products and nutritional needs of farm animals.

In agriculture, the condition that determines what will be raised includes climate, ecology, water supply, waterworks and terrain. Problems over extensive deforestation for agriculture in developing countries have intensified in recent decades. Tropical deforestation increased rapidly after 1950, helped by increased availability of heavy machines [Jules, 2004]. Historically as it developed over centuries in temperate regions, agriculture has depended on forest removal [Jules, 2004]. This forest removal or removal of vegetation cover coupled with poor farming practices, overgrazing and wrong use of chemicals causes a large amount of soil to wash into local rivers, which then flood as their channel silted up. Other effect of agricultural land use is in the area of vegetal cover removal causing high infiltration problem producing high- rise in temperature.

Overgrazing as part of agricultural activities leading to plant destruction through trampling of plants, disturbance of roots system by scuffing, and compaction of the surface reducing rainfall infiltration.

Over-cultivation, according to Shaba (2003), "a shorter fallow period leads to nutrient depletion which is a serious problem in Africa's dry lands. This therefore lowers the potential for production and reduces yields. Soil erosion by wind and water may result from weaker soil structure especially at this growth of mechanized

agriculture with its attendant large fields, particularly the use of plough, which in turn contributes to the damage of the soil structure". All these effects can further cause drought, desertification, which degrade the environment.

According to Baba, (2007), "social science critics have faulted colonal development policies of export crop production on ground that they (colonial policies) were selfish and prone to marginal use of the country's rural labour force. In addition to alienating land and its produce from the need of local people". However, in recent times, our rural communities in term of agriculture are lagging behind and much attention is not given to this area of the economy by the government. Though, new improved seedlings are being supplied, chemicals produced for weed and pest control, but the local farmers can still not produce substantially to meet local demands. The question therefore, is how best can our agricultural lands be managed and what are the best agricultural practices for sustainable agriculture? How can our environment be conserved even within an intensive agricultural practice?

According to Olorunfemi and Jimoh, (2000), in agricultural activities where soils and Vegetal covers are being degraded, "there will be a downward trend in agricultural development as many vegetal resources could become extinct".

2.3 EVOLUTION OF AGRICULTURE IN RELATION TO DEFORESTATION

Man has no other place to fall to in times of need than to agriculture, whether it is land meant for crops, woods, plantations or grassland. The elementary products used for further production are from land resources.

Agricultural practice having been the only life known to the primitive man and it's still maintained by the modern man; though in an increased innovative means. It is the creator's ordinance that man should meet all his needs from land resources whether he is involved in inventing cars, medicine, housing and so on. They are all land resource-based, although they are more refined by human ingenuity. As man increases in number, so do his need for more resources increase, the greater the exploitation of land resource to the extent of depletion.

According to Erhlich, (1977) "the size of human population at various times from the onset of Agricultural revolution increased from natural step of gathering food to producing it. However, they not only produce food, but constantly search for it. It also permitted people to settle in one place which in turn generated possibilities of storing vegetables and food in granaries, meats on hoofs". Man in his ingenuity's insatiable, he not only gathers for today but also for tomorrow, as compared to animals that eat what they can get today. As man increases in population so do they expand their territory in search of food with the aim of exhausting the available one at that location.

Malthus, (1830) predicted that "productive capacity of world's resource, especially agriculture, intimately could never increase quickly enough to sustain the needs of human population if unchecked". This is evident, but in recent times where agriculture has brought several ways of exploiting land resources. New methods, tools, seeds, fertilizer, chemicals, pesticides and new ways of raising agricultural products are the order of the day. Heavy machines are used to clear large areas of

forest for the purpose of cultivation. The clearance of these forests has a devastating effect on the environment; in terms of deforestation.

Forest clearance increases the rate of runoff of surface water and also speeds up soil erosion with subsequent silting. Artificial fertilizer during cultivation, though it increases yield, adds to loss of soil and its nutrients. Widespread use of herbicides in agriculture can cause a local decline in aquatic vegetation. Deforestation has taken a vital place in recent agricultural practice being regarded as a removal of part or all vegetal cover in a given area. This includes indiscriminate felling of trees, wanton exploitation or clearance of forest in a particular geographical location with no effort to replacing them [Ibrahim, 2002].

In the words of Olanrewaju et al (2000), "deforestation is a removal of forest to make way for housing, or agricultural development. They also raise the issue of increasing demand for firewood. This, according to them contribute to deforestation, increase in commercialization of rural fuel supplies and increased in fuel poverty of rural consumers". Deforestation can also be seen as over-cultivation of agricultural land without allowing the regeneration of such land. This leads to loss of agricultural yield in subsequent years. According to Shaba, (2001), "introduction of modern farm implements and other methods of modern agriculture and clearance of large parcels of land through mechanized ploughing encourage deforestation. Also the application of irrigation scheme encourages the use of large deforested areas".

However, increase in demand for charcoal for domestic fuel wood, large scale clearance of land for cultivation, bushfires and other vices have increased the rate of diminution of important plant and animal species. Shaba, (2001) stressed that "there are minor causes of deforestation, though, not widely recognized, as in extraction of leaves, branches, barks and root of trees depending on the type of medicine and intensity of extraction". In reality, deforestation has a great impact on agricultural land as many areas cleared might be susceptible to erosion. The productivity and biological reproduction of land is reduced leading to desertification.

Furthermore all those vices can lead to drastic reduction in fraction of soil covered by vegetation. It then lay bare the soil, resulting to rise in reflective capacity of surface radiation. This will in turn lead to climate change. Other resultant effects as stressed by Shaba, (2001) are "loss of agricultural land, famine, hunger, loss of animals and human death. This will involve shift in population (migration), to urban centers, increasing inadequate water supply, due to low water table and then conflict over grazing lands".

2.4 ENVIRONMENTAL EFFECTS OF DEFORESTATION

Deforestation and its effect in the environment affect both the developed and the developing economies. However, many reports concerning deforestation are most applicable to developing countries. The developing world is estimated to have over 200 million ha (494 million acres) between 1980 and 1995 according to research carried out by Botkin and Keller, (2003). Many of these countries in the developing countries are characterized with mountainous regions, high latitude, high population

growth, examples of the tropical areas are the Amazon basin, Western and Central Africa, South East Asia and pacific regions. According to the research, Asia cleared 30%, Africa 18%, Latin America 18% and the world as a whole cleared 20% of tropical forest between 1960 and 1990 [Botkin and Keller, 2003].

The continuous warning concerning reduction in greenhouse gases, effect of climate change, ozone layer depletion as part of the effect of deforestation pose a threat to the environment and life itself. This has also taken a global concern. According to Shaba, (2001) "there has been a growing perception that, deforestation is one of the most pressing, contemporary environmental problem. The United Nations Conference on Environment and Development (UNCED, 1999) identified deforestation as one of the three specific topics (other two being, bio-diversity and climate change), to be treated as a national issue". The Environmental effect of deforestation cannot be overemphasized. It has been noted to render the soil bare, thus increasing the surface Albedo and making the atmosphere warmer. It acts against the wind by reducing speed and changing its direction. It changes the earth's surface structure (i.e., the aerodynamics system of the area). This has led to serious environmental degradation, ranging from hazards related to settlement and agricultural production [Olanrewaju et al 2000].

Deforestation according to Shaba (2001) "increases atmospheric carbon dioxide (CO_2) with subsequent rise in global temperature. It causes regional decrease in rainfall, increasing soil erosion and decline in its fertility. It distorts the ecological balance".

Makanjuola, (2000) maintained that, "deforestation reduces the level of oxygen in the atmosphere, causing chronic hypo-oxygenation of red blood cells of human body". Significantly, deforestation disrupts watersheds, causing erosion, siltation and flooding of streams.

It is a true saying that land use conversion can set off series of changes in the environment and each change is likely to trigger additional changes. For instance, a grass-land or forest can be turned into farm lands, thus it leads to deforestation possibly causing erosion, flooding and eventual loss of trees, animals and even lives and property.

2.5 NEED FOR SUSTAINABLE AGRICULTURE

Land is very important as number one resource-base of any nation. The use to which it is put also necessitates proper and better management for future benefit. Agriculture being the oldest use to which land is put, needs to be put to the highest and best use. Sustainable Agriculture is a veritable option that ensures that while we utilize the resources avail us by land, we equally can caution against hazardous effects those agricultural activities can have on the environment.

Sustainability has been defined by many authors and scholars who have interest in achieving favourable agricultural yield and habitable environment. According to Cunningham (2003), "sustainability is seen as meeting the needs of the present generation without compromising the future generation to meet their own needs" He stressed further in this context of sustainability that agriculture can be made

compatible with sustainable ecology and social system. Sustainable agriculture or regenerative farming both aim at producing food and fiber on a sustainable basis and repairs damages caused by destructive practices.

The word sustainability is somehow controversial in nature as many have argued and questioned the workability of the concept. Jules (2004) maintained that "ecologist regard sustainability of any sort impossible in the long run because of the limits it imposes on non-renewable resources and capacity of the biosphere to absorbs our waste". He went on to say that sustainable agriculture is summed up in the term 'sustainable development'. Furthermore, those two concepts are fundamental to the sustainable use and management of earth's natural resources. First, the basic needs of humanity – food, clothing, shelter and jobs, must be met. This involves paying attention to the largely unmet needs of world's poor, as a world in which poverty is evident will always be prone to ecological and other catastrophes. Secondly, the limits to development are not absolute but are imposed by the present state of technology and social organization. This impact on the environmental resources and on the biosphere's ability to absorb the effect of human activities.

Moreover, in recent times it is evident that technology and social organization can improve to make way for a new era of environmentally sensitive economic growth. In fact, this process of change is under-way in the field of agricultural development, in which transition towards sustainable agriculture is improving food production. This is particularly for the poor, as well as protecting the environment. Furthermore,

Ibrahim (2001) describes sustainability as "not a fixed state of harmony, but a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development, and institutional changes are made consistent with future as well as present need". This goes to the point that ultimate need to harness our natural resources and ensuring better means of getting desired result. Surely no matter the orientation and application used in exploitation of natural resources, it should be directed towards a change which will be consistent with the need of the present and future generation.

Cunningham (2003) maintained that "the goal of sustainable agriculture is to maintain the level of agricultural production needed to feed the human population. This should be done in a way not to ruin any part of the supporting system or degrading the environment". Therefore he enunciated the following points as the advantages of sustainable agriculture:

i. Ecosystem can dispose waste and replenish nutrients by recycling all elements (i.e. soil health and stability).

ii Ecosystems can use sunlight as their source of energy (wind and solar energy can be employed for any farming task).

iii. The size of consumer population is maintained such that overgrazing does not occur (ie protecting forest areas, recognizing their benefits on human population).

iv Biodiversity is maintained (by crop rotation, crop combination and mixing agro

forestry and livestock, providing buffer against economic and biological risks), and to make agriculture sustainable will depend on controlling erosion, overgrazing, deforestation and salinization.

2.5.1 Procedure in Ensuring Sustainable Agriculture

Cunningham (2003), pointed out the following procedures to ensuring sustainable agriculture:

i. There should be management of topography, through contour plowing (ie plowing across the surfaces rather than up and down).

ii. Ensuring strip farming practice (i.e. planting different kinds of crops in alternating strip along the contour). This entails that when one crop is harvested, the other; yet to be harvested protects the soil and keep water from running down the slope.

iii. Planting of crops that grow for more that two years (like tea and coffee), thereby creating forest or grassland to protect certain unstable soils on sloping site or water courses.

iv. Provision of ground cover. Annual rows of crops such as corn or beans generally caused the highest erosion rate because they leave soil bare for much of the year. The easiest way is to provide cover for the soil, is to leave the residue on the land after harvest. They not only cover the surface to break erosion effects of wind and water, it reduces evaporation and soil temperature in hot climate. It also protects ground organisms that help to aerate and rebuild soil. Therefore, cover crops like

alfalfa or clover can be planted immediately after harvest to hold and protect soil.

v. There should be reduction in tillage. This involves minimum tilling of the soil, in other words, reducing the number of times a farmer disturbs the soil by plowing and cultivation.

vi. There should be forest management. The available forests left "untouched" should be protected from undue encroachment and afforestation should be encouraged.

In view of these, no matter the type of agriculture, conventional or unconventional, they cannot be phased out of human existence. The option then is to imbibe holistically the concept of sustainable agriculture which guarantees cautious usage of land resources for the present and assures continuous availability for the future.

2.5.2 Impact of Sustainable Agriculture

Despite the past improvement in food production, the most difficult challenges are just beginning. The world population will eventually reach 8-13 billion people by mid 21st century. Even at the lowest estimate, the current inequitable access and right to resources will still call for agricultural production increase substantially, if the current level of nutrition is to be maintained. Without considerable growth in agriculture, the prospects of many people in poor countries and regions of the world are bleak. According to Jules (2004) "since the mid 20th century agricultural development policies have been remarkably successful at emphasizing external inputs as means to increase food production. This has produced remarkable growth

in global consumption of pesticides, inorganic fertilizer, animal feeds stuffs and tractors and other machinery. The external inputs have however replaced natural control processes and resources rendering them vulnerable. Pesticides have replaced biological, cultural and mechanical methods for controlling pests, weeds and diseases. Farmers have substituted inorganic fertilizers for livestock manure and nitrogen-fixing crops. Information for management decision comes from input suppliers and researchers rather than local source. Fossil fuel has replaced locally generated sources".

Jules, (2004), also maintained that "the specialization of agricultural production and associated decline of mixed farming has also contributed to these situations. What were once valued internal sources have become waste products. The basic challenges for sustainable agriculture are to make better use of these internal resources. This can be done by minimizing the external resources more effectively or by combination of both".

In conclusion, sustainable agriculture strives for the integrated use of a wide range of nutrients, soil and waste management technology. It aims for increased linkages and flows between them. By-products or wastes from one component or enterprise become input to another. As natural processes increasingly replace external inputs, so the impact on the environment is reduced.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

In the gathering of data, two distinct but interrelated approaches were used; the quantitative and the qualitative approaches. A study that contains only qualitative data or solely quantitative data misses the rich texture of interpretation that an integrated approach makes [Nsofor, 2007]. Both the Primary and Secondary sources f data were used to collect information.

3.2 DATA TYPES AND SOURCES

a. Primary Data Source

The researcher employed the following processes in data collection and gathering procedure;

3.2.1 Reconnaissance Survey: this was the first trip the researcher made in order to collect first hand information in the study area. This visit made it possible for the researcher to interact with the residents of the area and to appraise the viability of the data gathering option, that is, the questionnaire structure among others. This visit was quite productive as the researcher was able to identify the core farmers and the nature of agricultural practice in the area.

3.2.2 Land Use Survey: The researcher was mindful of the terrain and the land use types in the study area. Certainly, other land use types like residential usage, commercial usage, among others were noticed but more attention was drawn on

agricultural land use; which was observed to have shared dominance in the area. This survey further entails knowing the total land cover of each of these land usages, identify the nature of agriculture and types of farming system prominent in the area.

i. Questionnaire Administration: after carrying out the initial surveys in the area, it was time to administer the questionnaire; having got to know the terrain and the social organization of people in the study area. The questionnaire had a wide scope in terms of the information it seeks to gather. The three broad areas of the questionnaire are socio-economic structure of the people, the nature and types of agriculture in the area and the activities that induces changes in the environment (see Appendix I).

ii. Interview Method: Oral interview came about in the course of administering the questionnaire. This option was viable to cater for specific questions that relevant to the study which was not included in the questionnaire but found to be useful for the research and for those who cannot read or write. For instance, this aspect helped in identifying the actual nature of involvements of the two genders in agriculture. The females were prominent in milking the cow and harvesting while the male were observed to graze the cattle and clear the farmlands for cultivation. This information was gotten via oral interview while on the field.

b. Secondary Data: The secondary data were collected from the following sources:

3.2.3 Remote Sensing Data: A SPOT of the study area was downloaded from

Global Land Cover Facility website (www.landcover.org) to analyse the land use types and the nature of agricultural practices in the area. The image had already been geo-referenced by EROS Data Centre of the United States Geological Survey before being downloaded for this research project. The image was processed using IDRISI software.

3.2.4 Topographic and administrative maps: the topographical map was referenced in the initial chapter of this research and so was the administrative map showing the areas surrounding Zungeru/Wushishi and its location in the overall Niger state administrative block. This information is pertinent to the research because of the need to establish the actual locational characteristics for the study area. The maps were gotten from the Zungeru/Wushishi Local Government Authority.

3.2.5 Library Research: The necessary information needed for the study was mainly sourced from textbooks, magazines, newspapers, journals, articles and thesis. These helped to review literatures especially on the effect of agricultural land use in other environmental settings. The effect of deforestation and eventually, the remedy to such problems were reviewed. This is important because the environmental effect of these problems cannot easily be quantified, but only some of these materials helped to bring home the intention of the researcher.

However, not all the material read was actually quoted. Those not quoted were use for more knowledge on the study. The authors used and their works were referenced

accordingly.

3.3 SAMPLE POPULATION, SIZE AND METHOD

The sample populace for the research was restricted mainly to the farmers, residents around farm sheds, villagers and farm workers. This population segmentation was quite possible owing to the initial surveys carried out on the study area before questionnaires were administered. The copies of questionnaires (Appendix I) distributed were 100 and only 80 were returned. The method adopted in the questionnaire administration was that of random sampling technique. This technique ensures a relatively balanced sampling method where all identified sample populace is represented in the survey.

3.4 DATA ANALYSIS TECHNIQUE

Two main categories of data were collected for this research and that implies two different analyses were carried out.

3.4.1 Questionnaire Analysis: after the questionnaires were administered, data were analyzed using a software called Statistical Package for Social Sciences, *SPSS*. This software is an analytical package with an interface similar to that of Microsoft Excel but well suited for carrying out complex Analysis of Variance, ANOVA, regression, correlation, T test, among others. The reason for adopting the usage of this software is as result of its accuracy in measuring correlation; which forms the bulk of analysis for this research. For instance, the researcher was able to effectively ascertain how notable agricultural practices impact on the environment of the study area. The

correlation was further buttressed by a Pearson Chi-Square test which showed more statistical evidence on the relationship between notable agricultural practices and the observed impact on the study area. Where necessary, tables and graph were used to further buttress the results.

3.4.2 Remote Sensing Data Analysis: the remote sensing data used was basically the Zungeru spot image which was processed using ***IDRISI Andes 15*** software. The composite bands 1, 2, and 3 were processed to give a picture of the land use cover in the area and a Normalized Difference Vegetation Index, NDVI test was further conducted to ascertain the level of vegetal cover and agricultural land usage in the area.

This remote sensing data was used to differentiate the difference line use cover in categories: Such as Vegetated Area, River, Farmland/Cultivated Area, Settlement, Pond/Dam, Well and Fadama and Sand.

All the above in different colours.

CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

This research seeks to identify the environmental impact of agricultural activities in the study area, hence, two set of data were utilized. These are satellite imagery and questionnaires applied to a population sampled in the area. These sets of data provide us different aspects of information with a view to ascertaining the actual impact of agricultural activities in the area.

Zungeru Spot Image

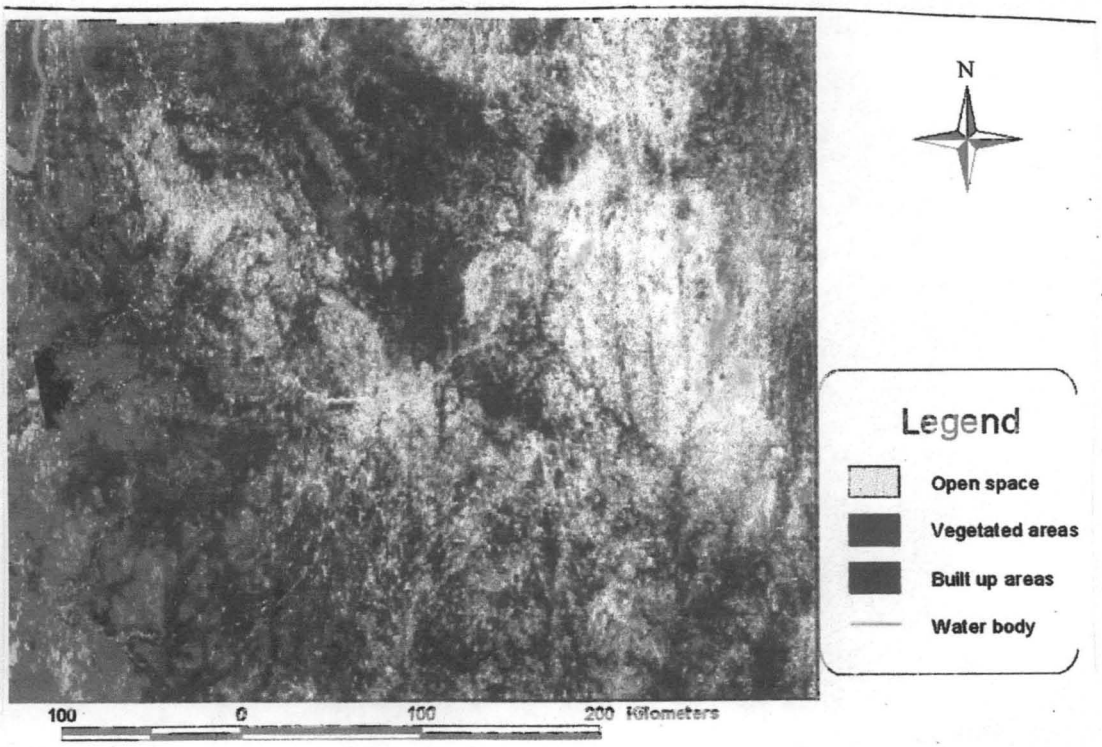


Figure 4.1 Colour Composite Bands 1, 2, and 3 of the Image of the Study Area after processing

This spot-image revolves on the combination of bans I, II, III of spot-image of the study area which are the different colours that differentiate various land-cover categories.

Categories of Land Cover

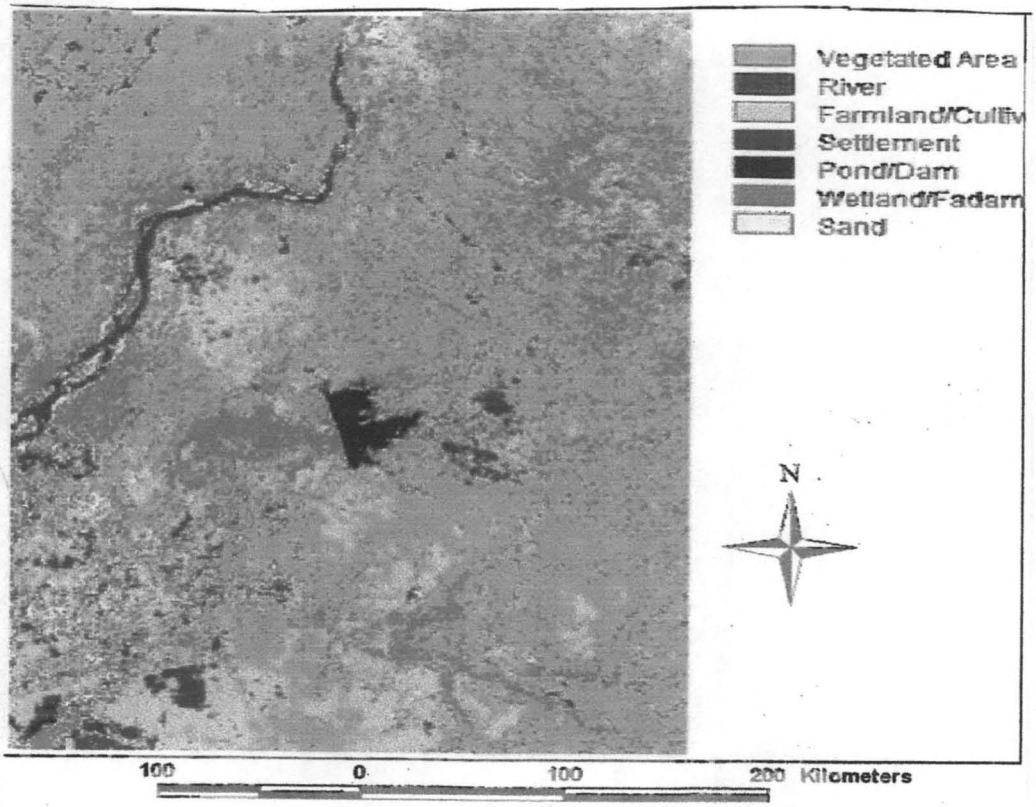


Figure 4.2 Processed Image showing the Agricultural Land Use in the Area.

This image was processed from the composite colour banks of one to three into various land cover types as seen above.

Land use Categorization per Hectares

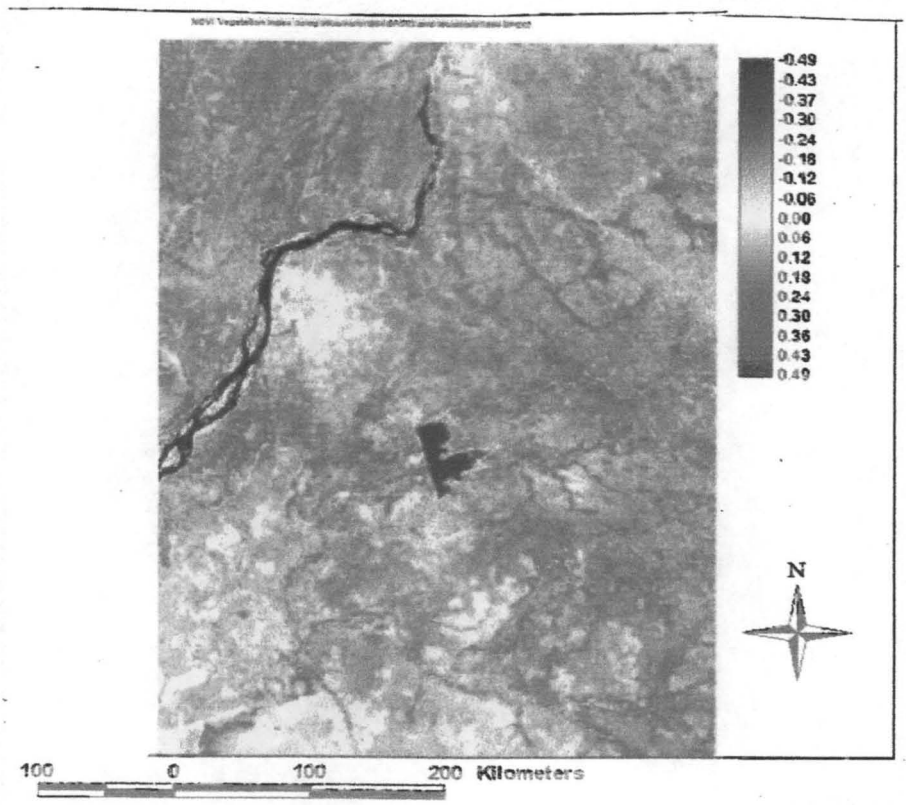


Figure 4.3 **Normalized Difference Vegetation Index (NDVI) Image of the Study Area.**
***Source*: (www.landcover.org)**

The above is used to express the difference between the near infra red and red bans of 3 and 4 which was normalized by the sum of those bans.

4.2 CATEGORISATION LANDUSE COVER IN HECTARES AND PERCENTAGES

Table 4.1 shows the landuse categories such as vegetated area, river, farm land, settlement, Pond/dam, wetland/fadama and sand. Their various proposition in hectares and percentages were also shown.

Table 4.1: Land Use Categorization in Percentage

Category	Land cover types	Proposition in hectares	% in Hectare
1	Vegetated Area	24.4	26.9%.
2	River	9.1	14.2%
3	Farmland/cultivated area	12.7	16.5%
4	Settlement	4.6	5.7&
5	Pond/Dam	3	4.7%
6	Wetland /Fadama	41	13.2%
7	Sand	13.1	18.8%

4.3 GENDER INVOLVEMENT IN AGRICULTURE IN THE STUDY AAREA

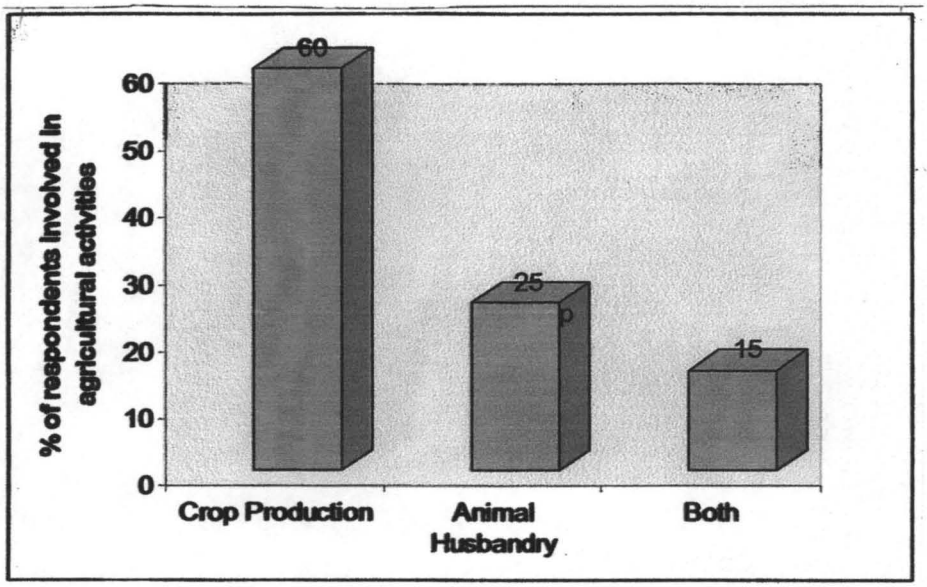
Table 4.2 specify the level of involvement of two different gender groups (male and female) in the agricultural activities (animal husbandry and crop production). This was analyzed in percentage involving them separately and collectively in the two different agricultural activities in the study area.

Table 4.2 Gender participation in agriculture in the study area.

Gender	Animal Husbandry	Crop Production	Both	Total
Male	45%	35%	20%	100
Female	46%	32%	22%	100

Source: Field Work 2008

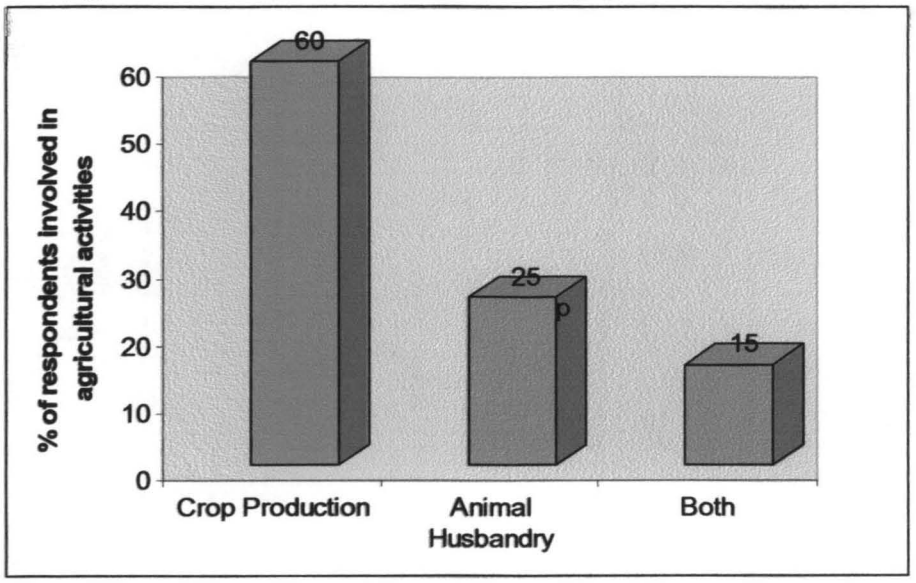
Figure 4.4 Agricultural Activities engaged in the Study Area



***Source*: Field Survey, 2008**

Figure 4.4 explains the various agricultural activities e.g. crop production and animal husbandry and the number of respondents that are involved in this agricultural activity.

Figure 4.4 Agricultural activities engaged in the study Area



Source: Field Study 2008

Figure 4.4 explains the various agricultural activities e.g. crop production and animal husbandry and the number of respondents that are involved in this agricultural activity.

4.4 MAJOR CROPS CULTIVATED IN THE STUDY AREA

Table 4.3 shows the various crop types cultivated in the study area such as Yam, Maize Sorghum and Mixed Cropping and the number of respondents in percentage.

Table 4.3 Crop Types cultivated major crop types cultivated in the area of study

Crop type	No of Respondents	Percentage %
Yam	30	40
Maize	25	35
Sorghum	20	30
Mixed Cropping	10	15
Total	80	100

Source: Field Study 2008

4.5 METHODS APPLIED IN CLEARING FARMLAND

Table 4.4 shows the various methods applied in clearing farm land such as mechanical, manual, bush-burning, chemical and combination of various methods and the number of respondents in percentage.

Table 4.4 Inputs applied on farm land Methods applied in clearing farm land

Method	No of Respondents	Percentage
Mechanical	03	5
Manual	42	45
Burning	20	28
Chemical	10	14
Combined Method	05	8
Total	80	100

Source: Field Study 2008

4.6 TYPES OF INPUTS APPLIED ON FARMLAND

Table 4.5 shows the various inputs applied to boast yield such as fertilizer, animal manure), campus manure, chemicals (herbicides/pesticides) and combination of input and number and percentage of respondents.

Table 4.5 Inputs applied on Farm land Type of input applied on farm

Type	No of Respondents	Percentage %
Fertilizer	40	45
Animal manure	-	-
Compost manure	-	-
Chemicals Herbicides/pesticides	18	35
Combination of Input	4	20
Total	80	100

Source: Field Study 2008

4.7 NOTABLE AGRICULTURAL PRACTICES AND OBSERVE CHANGES IN THE STUDY AREA

Table 4.6 shows a cross tabulation between notable agricultural practice and observed changes in the study area.

Table 4.6 Shows a cross tabulation between notable agricultural practices and observed changes on the study area.

Practices	Induced Changes observed			Total
	Crop Loss	Trees Loss	Wildlife Disappearing	
Manual Clearance	13	12	10	35
	44.8%	36.4%	55.6%	43.8%
Bush-burning	16	21	8	45
	55.2%	63.6%	44.4%	56.3%
Total	**29**	**33**	**18**	**80**
	100%	**100%**	**100%**	**100%**

***Source*:** Field Survey, 2008.

Table 4.7 Chi-square Tests

Table 4.7 shows the Chi-Square result of analysed relationship between agricultural practices and observed changes on the study area.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Sq	1.765	2	.414
Likelihood Ratio	1.766	2	.413
Linear-by-Linear Association	.290	1	.590
N of Valid Cases	80		

Source: Field Study 2008

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter, having carefully analyzed the results in the penultimate chapter, presents the conclusion and recommendations for the research.

5.2 DISCUSSION

5.2.1 ZUNGERU SPOT IMAGE

In 4.2, the general classification of the agricultural land use of the study area, a combination of bands 1, 2, and 3 of Spot image of the study area was used. On the image, the water reflectance was absorbed and it appeared blue and the built up areas (settlement) appeared in magenta. Vegetation appeared in red and the open spaces/bare land appeared relatively whitish. Consequently, the following features were identified on the satellite image of the study area and confirmed to be true during field study

i. **Water Bodies**:- The spectral reflectance of water made it most distinctive in the near-infrared wavelength. Thus the application of band 3 which is in the near-infrared region has made the delineation of water bodies easy due to the absorption properties of water. Consequently, in the study area, around Wushishi, one major river, River Kaduna flows from north to southeastward direction with tributaries and Wushishi dam is noticeable in the southern part of the study area.

ii. **Built up Areas**:- Clusters of settlements are noticeable on the image, some

around the vegetated areas, along the river course which buttresses the sedentric-agrarian lifestyle of the residents of the area. While carrying out the field study, it was observed that many of the farmers tend to live close to their farmlands.

iii. **Open Spaces/Bare Grounds:-** Open spaces are noticeable in the various parts of the study area as depicted whitish on the satellite image. Existence of these open spaces/bare grounds was corroborated during the field work.

iv. **Vegetation and Cultivations.** A vast proportion of the image is covered with vegetation and cultivated areas. The band 2 of the image depicts the reflectance of the green areas in colour red.

After careful study on determining the environmental impact of agricultural activities on the study area the following deductions were made:

Noticeable agricultural land uses in the area are identified in earlier part of this chapter and they include vegetated area, wetland/Fadama area, farmland/cultivable area, settlement, pond/dam, river and sandy area.

That agriculture ranked highest among other occupations engaged in by residents of Zungeru. As clearly shown by the NDVI analysis carried out, areas from 0.06 to 0.49 indicated a high level of vegetal cover while the expanse covered by Farmland/Cultivated areas is 24.3 hectares. These buttress the fact due to the availability of cultivable lands, residents do engage in farming.

That the more the pressure of population, the more the increase in agricultural

practice, hence, more likely encroachment on the natural environment. Crop production is said to be dominant on the list of farming systems in the area and this has been largely helped with the availability of major dam, river and tributaries in the area. These ensure that even during the dry season, some cultivation can still be practiced. Crops commonly grown in the area are yam, maize, sorghum and around the wetlands rice and sugar cane are grown.

The observed agricultural practices which have consequential effects on the environment are manual bush clearing (use of cutlass and hoe) and bush burning. The test carried out to ascertain the true impact on the environment shows a significant relationship between the agricultural practices and their impacts on the environment. The observed impacts are those on crops, trees and wild life disappearance. In fact, the most severe has been one caused by bush burning.

5.2.2 AGRICULTURAL LAND USE OF THE STUDY AREA

A composite analysis carried out on the image gives more clarity on the land use noticeable in the study area. These include vegetated area, River, Farmland/cultivated area, settlement, wetland/Fadama area, pond/dam and Sandy area. A discussion on each of the observed land use types will be attempted.

Vegetated area: the analysis carried out was carefully defined to show areas of thick and scattered vegetation from those of 'organized' green cover (farm land/cultivated area). The result as shown in figure 4.2 and table 4.1 reveals that a vast expanse of 24.3 hectares of land in the study area is covered by vegetation, which is 26.9% of

the whole area. This vegetation provides grazing land for cattle in the area and also dry woods for locals who use them for cooking as observed while carrying out this study:-

River: noticeable among the water bodies are river Kaduna and Wushishi dam in the study area. River Kaduna which flows southward from the Kaduna area passes through Wushishi town provides a source of domestic water for residents and also a source of irrigation for farmers in the area. The river and its tributaries are estimated to cover 9.1 hectares of land of the study area, covering 14.2% of the area.

Farm land/cultivated area: the image classification shows a significant 3.5 hectares of land in the study area is cultivated being 14.2% of the whole area. This buttresses the fact that agriculture constitutes one of the major occupations for residents of Zungeru area. Noticeable cultivation is seen along river Kaduna and partly around the Wushishi dam which attest to the fact that irrigation farming is practiced in the area.

Settlement: clusters of settlements are noticed all over the area accounting for 4.6 hectares of land covering 5.7% of the area. Noticeable patterns are settlements around the water bodies and those around the farm lands. While carrying out the field study, it was observed that during the dry season, especially around November – March, cultivation of crops is still being done around the water bodies (the river and dam). The need to ensure proximity and efficient monitoring of farm lands explain settlement around the farms which again attest to the agrarian lifestyle of

residents of this area.

Wetland/Fadama area: patches of wetland are seen majorly along the river Kaduna, Wushishi dam and other minor rivers tributaries. Crops grown in this area are rice, sugar cane and sorghum. The wetland provides a relative all year planting ground for farmers in the area. While on the field study, significant cultivation activity was observed along river Kaduna and Wushishi dam around November.

Pond/dam: the availability of Wushishi dam provides for light fishing activity but more significant is the use of the dam by locals for domestic and farming purposes (irrigation). The noticeable farming around the Wushishi dam is largely facilitated by the presence Sandy area: observed mainly along the river Kaduna course and around the settlement area. Collected in the river channel and sometimes gathered by erosion, sand has become a major constituent for man's built environment. Construction of physical infrastructures as roads, schools, hospitals and even settlements has been made possible by the availability of sand and other construction materials. This covered 3 hectares, represent 4.7% of the total area. Sand – the sand available in the area, covered 13.1 hectares, represent 18.8% of the sand covered in the whole land area.

5.2.3 Normalized Difference Vegetation Index (NDVI)

The Normalized Difference Vegetation Index (NDVI) is expressed as the difference between the near infrared and red bands and normalized by the sum of those bands. Figure 4.3 is the NDVI extracted from bands 3 and 4 of the spot image of the study area. The measurement from -0.49 to -0.12 shows the high level of water body in the area while figures from -0.12 to 0.00 depicts bare land. Figures from 0.06 to 0.49

indicate a high vegetation belt in the area. The vegetation belt here so defined is inclusive of the actual vegetation earlier discussed and the farmland/cultivation areas. The fact that agricultural activities enjoy a great deal of dominance has again been corroborated by this index analysis.

However, having established therefore from these analysis that agricultural land use tends to have a larger proportion above all other land use in the area. The next analysis will then show the nature of agricultural practices and the consequent impact on the area.

5.2.4 QUESTIONNAIRE DATA

i. ***Nature of Agricultural Practice in the Area:*** This set of data provides more insight into the socio-economic life of people in this area and more particularly about the nature of agricultural activities and clues into the impact of these activities on the area.

The Table 4.2 shows the level of involvement of the two different genders in agricultural activities in the study area. On the whole, the male still shows dominance in both the animal husbandry (45%) and crop production (35%) but not so well in terms of combining both practices (12%). The female however were able to combine the two practices more than their male counterpart with a record of 22%; 46% were recorded for their participation in animal husbandry and 32% for their involvement in crop production. From my observations while on the field, the female involvement in animal husbandry was noticeable in the areas of milking and feeding in the ranch. While their involvement in crop production was more

pronounced in harvesting and bush clearing (Picking felled woods and dry weeds). The males were doing basically the hard task of the farming activities with many farmers interviewed involved in grazing the cattle and tilling the ground for crop production.

While Figure 4.4 shows the observed crop production that form the bulk of agricultural practice in the area of study. 60% of the respondent engaged in crop production,25% involved in animal husbandry and about 15% combined the two farming system. The dominance of crop production is not farfetched owing to earlier observations made from the satellite imagery. It has been established that a vast hectares of land in the study area is cultivated and even during the dry season cropping still takes place thanks to the rivers and the dam in the area.

In Table 4.3, the major crops grown in the area include yam, maize and sorghum; others are rice and sugar cane. Yam gulps about 40% of the crop production, maize 35% while sorghum has a share of 30% of the entire crop production in the area and those that engaged in mixed cropping forms another 15%.

Also, in Table 4.4, show how the farmers deploy different methods in clearing their farm lands. From field studies carried out, it reveals that about 45% of the farmers still adopt the cutlass and hoe farm clearance method (manual), some 28% engaged in bush burning while another 14% utilizes sprayed chemicals to clear their farm lands. Only a hand full 5% of the farmers use machines to clear their farm while another 8% says they employ combination of the methods to ensure farm clearance.

In Table 4.5 shows the various inputs applied on farm land, 70% of the farmers do use fertilizers to improve their crop yield, 24% admits to utilizing chemicals as herbicides and pesticides to check weed and pest invasion on their farms while another 6% says they combine any of the inputs to enhance yield on their farm.

5.2.5 NOTABLE AGRICULTURAL PRACTICES AND OBSERVED IMPACT ON THE STUDY AREA

In tables 4.6 and 4.7, the core of this research is to identify the impact of agricultural practices on the study area. In achieving this, two variables on the questionnaire were analysed; notable practices and impact on the area.

The variable on notable practices was defined as manual bush clearance and bush burning while those of impact identified by respondents are crop loss, economic trees and wild life disappearance. The analysis was based on cross tabulation of the two variables and consequently chi-square test was carried out to ascertain the actual impact of the variables under consideration. The Cross tabs procedure forms two-way and multiway tables and provides a variety of tests and measures of association for two-way tables. The structure of the table and whether categories are ordered determine what test or measure to use. From the table, impact of manual bush clearance on crop loss is estimated at 44.8%, on tree loss at 36.4% and on wild life disappearance at 55.6%. The induce changes of bush burning on crop loss is estimated at 55.2%, on tree loss at 63.6% and on wild life disappearance at 44.4%.

The induce changes observed from bush burning tends to be severe on both crop and tree loss; the reason cannot be far-fetched from the fact that bush burning tends to spread much faster than manual bush clearance would have. Nonetheless, a

tree loss; the reason cannot be far-fetched from the fact that bush burning tends to spread much faster than manual bush clearance would have. Nonetheless, a conclusion cannot be fully drawn yet from the cross tabulation which is why a chi-square test was further conducted to ascertain the veracity of this outcome. From the Pearson Chi-square analysis, a table value of 1.765 was obtained under 2 as degree of freedom and an asymptotic significance of 0.414 was obtained. Using the 0.05 level of significance to test the strength of the relationship between the variables under consideration, it can be deduced that there is a significant relationship between agricultural practices and observed impacts on the study area. The asymptotic significance of 0.414 is greater than the scaled significance level of 0.05 which implies a significant relationship between the variables tested. Hence, it is appropriate at this juncture to say that in the case of Zungeru, agricultural practices as manual bush clearance and burning have had remarkable changes on crop, tree loss and wild life disappearance.

5.3 SUMMARY

After careful study on determining the environmental changes of agricultural activities on the study area, the following deductions were made:

Noticeable land types cover types in the area were identified in earlier part of this work and they include vegetated area, having the highest percentage coverage of about 26.9% of the total land area. Wetland/Fadama covered 13.2% of the total land area, while farmland/cultivated area covered 16.5% of the total land area.

Settlement, represents 5.7% of the study area, while Pond/Dam covered 4.7%, River represent a portion of 14.2% and sandy area covered 18.8% of the total land area in the study area.

That agriculture ranked highest among other occupations engaged in by residents of Zungeru. As clearly shown by the NDVI analysis carried out, areas from 0.06 to 0.49 indicated a high level of vegetal cover while the expanse covered by Farmland/Cultivated areas has a percentage of 16.5%. These buttress the fact due to the availability of cultivatable lands, residents do engage in farming.

That the more the pressure of population, the more the increase in agricultural practice, hence, more likely encroachment on the natural environment, crop production is said to be dominant on the list of farming systems in the area and this has been largely helped with the availability of major dam, river and tributaries in the area. These ensure that even during the dry season, some cultivation can still be practiced. Crops commonly grown in the area are yam, maize, sorghum and around the wetlands rice and sugarcane are grown.

The observed agricultural practices which have consequential effects on the environment are manual bush clearing (use of cutlass and how) and bush burning. The test carried out to ascertain the true changes on the environment shows a significant relationship between the agricultural practices and their changes on the environment. The observed changes are those on crops, trees and wild life disappearance. In fact, the most severe has been one caused by bush burning.

5.4 CONCLUSION

Agriculture is key to man's survival (Shaba, 2007). In Zungeru its dominant practice attest to this claim. Increasing use of land for agriculture contributes to the unabated encroachment on the natural environment which consequently is inimical to the survival of man and his cohabitants. This study focused on examining the impact of agricultural activities on the environment and a nexus was established. The spate of farmland clearance with implements as cutlass and hoe and bush burning has left its impacts on the environment. What is important however that in as much as it is important to carry out agricultural activities we must equally be conscious of the changes it will have on the environment. The consciousness so define implies sustainable development which encourages present development with the future in focus. In other words, while we explore the cultivable lands we should bear in mind its likely consequences and guard against it.

In the case of Zungeru, deforestation as pointed out in the study is pronounced and urgent action must be taken to check this trend.

5.5 RECOMMENDATIONS

The study has been important having identified the challenges and problems faced in the study area to make recommendations and possible ways to handle them.

Land use plan should be encouraged in our localities. This plan identifies areas that can be used for farming and at such it reduces the incidences of encroachment into areas that are marked as reserves.

There should be sufficient awareness on the need for farmers to desist from bush

REFERENCES

Arosany, G. T. (2000) Environmental Costs of the Nigeria Board Transport System. In Contemporary Issues in Environmental Studies. Haytee Press & Publishing Co. Ltd., Ilorin., Kwara State.

Baba, J. M. (1994) "Sustainable Development and the Nigeria Environment". NUJ, New Series, Vol. I.

Baba, J. M. (2000) Environmental Politics and Policy. PGD Environmental Management, Geography Department, Federal University of Technology Minna.

Baba, J. M. (2007) Demographic Strategic Regional Development for M. Tech. Environmental Management, Federal University of Technology Minna.

Botkin, D. B. and **Keller, E. A.**(2003) Environmental science. John Willey and Sons Inc. Publishers U.S.A.

Boserup, E. (1965) The Conditions of Agricultural Growth – The Economics of Agrian Change under Population Pressure. Geo – Allen and Unurin Publishers Ltd. London.

Calheriros, D. F. (2000) Journal of Applied Ecology. British Ecological Society; Center for Agricultural Research in Pantanal.

Clayton, A. (1992) Cities and Environmental Science. A Global Concern. Seventh Edition. McGraw Hill Publishers U.S.A

Clayton, A. (1992) "Cities and Environment is Urban Living Sustainable?" The Planner JRTP, Vol. 78. No. 21 of Pg. 9 – 11.

Clive, H. (2004) Challenges of Agriculture. Microsoft Encarta.

Cunningham, S. (2003) Environmental Science. A Global Concern Seventh Edition. McGraw Hill Publishers, New York.

Emman, I. C. (1995) Environmental Sciences. A Planner's View. Mishbet Publishers, Nigeria Ltd. Lagos.

Emman, I. C. (1989) Land Information Management. First Edition, Oxford University Press.

Erhlieh, P. R. (1977) Population Resource Environment. W.H Freeman and Co Publishers Francisco.

Ibrahim S. M. (2001) Timber Harvesting and Loss of Flora Species. P.GD Thesis, Department of Geography, Federal University of Technology, Minna.

John, R. (2004) Population Pressure. Microsoft Encarta, Premiun Suite.

Jules, V. (2004) Environment and Agriculture, Microsoft Encarta Premiun Suite.

Lester, B. (2004) The Population Challenges. Microsoft Encarta Premiun Suite Reference Library 1993 – 2004 Microsoft Corporation.

Makanjuola, A. B. (2000) Environmental Changes and Health Implications. In Contemporary Issues in Environmental Studies. Haytee Press & Publishing Co. Ltd., Ilorin, Kwara State.

Malthus, T. (1830) An Essay on the Principles of Population. Flew Anthony Ed. Pengum Books, Microsoft Encarta 2007.

Minna Area SPOT (2001) Global Land Cover Facility Website (www.landcover.org).

Nsofor, G. N. (2007) Introduction to a Scientific Approach to Geography. Lecture Note for M.Tech Prpgramme, Federal University of Technology Minna.

Ogunbodede, E. F. (2000) Landuse Planning and Management. A Contemporary Environmental Issue. Department of Geography. Ondo State University.

Olanrewaju, R. M. & Ogunleye-Adetona, C. I. (2000) Women in Environmental Degradation. A Contemporary Issue in Environmental Studies. Department of Geography, University of Ilorin. Haytee Press Ltd Kwara.

Olorunfemi, J. F. and **Jimoh, H. I.** (2000) Anthropogenic Activities and Environment. A Contemporary Issue in Environmental Studies. Department of Geography, University of Illorin, Haytee Press Ltd Kwara State.

Sada, P. O. (1988) Development and Environment: A Conceptual Framework for Environmental Management. Evan Publishers, Ibadan.

Shaba, A. H. (2007) Land Management and Geographic Information;System; Its pertinence and Use. Paper Presented on one day workshop of CPC, organized by the Nigerian Institute of Estate Surveyors and Valuers Niger State Branch.

Sogo-Tem, J. S. (2000) "Environment and Economic Growth". In Contemporary Issues in Environmental Studies, Department of Economics, University of Ilorin.

APPENDIX

QUESTIONNAIRE ADMINISTRATION

Federal University of Technology, Minna, Niger State, Environment Management, Geography Department.

Topic: Environmental Effects of Agriculture in Zungeru Town.

Name: _____

Sex: _____

Age: _____

1. Are you engaged in any of agricultural activity? (a) Yes (b) No

2. If yes, what type Agricultural activity?
   (a) Animal Husbandry (b) Crop Production (c) Both

3. Give an estimation in hectares of the Land you cultivate.
   (a) 1 – 5 (b) 5 – 10 (c) above 10

4. What type of the crops do you cultivate?
   (a) Sorghum (b) Maize (c) Yam (d) Others Specify

5. Which among these crops mentioned above does very well in the area specify.
   a.
   b.
   c.

6. Have you noticed any decrease in yield of crops cultivated in the past five (5) years? (a) Yes (b) No

7. If yes give further details.

S/No.	Crops Type	Date of Decrease	Causes	Remedy Applied
1.	Yam			
2.	Rice			
3.	Maize			
4.	Sorghum			

8. What clearing method do you employ?
   (a) Mechanical (b) Manual (c) Burning (d) Chemical

9. What Procedure do you use in tilling the land?
   (a) Tractor (b) Hoe (c) Others, specify

10. What types of input to increase yield do you apply?
    (a) Fertilizer (b) Animal Manure (c) Compost Manure
    (d) Chemicals (Pesticide and Herbicides)

11. Is there any irrigation activity in the area? (a) Yes (b) No

12. If yes, what type of cropping method do they use
    (a) Annual Cropping (b) Multi-cropping

13. What are the problems of Agriculture in the Area. List in order of severity.
    a.
    b.
    c.

14. Proffer some solutions to the problems mentioned.
    a.
    b.
    c.

15. Has your farm been growing in size or been reducing?
    (a) Growing (b) Reducing

16. What are the factors responsible?
    a.
    b.
    c.
    d.

17. Have population increase any affect on plot of land previously cultivated? (a) Yes (b) No

18. What source of energy do you use at home?
    (a) Kerosene (b) Gas (c) Firewood (d) Charcoal

19. Do you buy wood? (a) Yes (b) No

20. Do you plant Trees? (a) Yes (b) No

21. If yes, how many trees do you plant annually?
    (a) More than two (2) (b) One (c) Nil

22. How many forest reserves do you have in this local government?
    (a) One (b) Two (2) Reserves (c) Nil

23. If yes, what measures are used to protect the forest?
    a.
    b.
    c.

24. Are you aware that activities of deforestation have negative consequences on the environment? (a) Yes (b) No

25. Do you think deforestation coned be reduced in the area?
    (a) Yes (b) No

26. How can deforestation be best checked?
    (a) Afforestation (b) Awareness (c) Game Reserve

27. How best do you think government can check the rate of deforestation in the area?
(a) Legislation (b) Creation Forest Reserve
(c) Provision of Alternative Energy

28. Have you noticed any changes in vegetable through farming practices? (a) Yes (b) no

29. If yes, indicate any change by ticking these items appropriately.
(a) Economic trees disappearing (b) Farm lands Degraded
(c) Wildlife Disappearing (d) Water sources drying up
(e) All of the above (f) If any other change, indicate

_____

_____

_____

30. Have there been any incident of bush fire in the area?
(a) Yes (b) No

31. If yes, what was the resultant effect?

a.

b.

c.

d.

e.