ASSESSMENT OF THE IMPACT OF DEFORESTATION IN GIDAN KWANU VILLAGE OF BOSSO LOCAL GOV'T AREA NIGER STATE

BY

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A PROJECT SUBMITTED TO THE DEPARTMENT OF GEOGRAPHY/SOCIAL STUDIES NIGER STATE COLLEGE OF EDUCATION MINNA

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APPROVAL PAGE

This project work has been read and approved as meeting the requirements for the award of Nigeria certificate in education (NCE) in the Department of Geography/Social Studies Niger State College of Education, Minna.

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DEDICATION

We dedicate this project work to Almighty God and to all lecturers of Geography including the late Mallam Muye.

To the students of Geography department and also to all our parents for their continuous support and constant encouragement since the day of our birth.

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Our acknowledgement first is to the Almighty God in heaven for His love towards every one of us throughout our Nursery, Primary and Secondary School. And now at our NCE level.

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ABSTRACT

Most of the forested lands in Niger State are located in the rural areas and in these areas the level of environmental awareness is reduced as compared to the highly enlightened populace in the city centers. Therefore, the physical effects of deforestation which are mostly environmental are not foreseen by the rural dwellers. However the socio-economic effects of deforestation which affects their substance directly cannot be over emphasized. The aim of this study is to assess the impact of deforestation in Niger State and precisely Gidan Kwanu Village of Bosso Local Government Area. The objectives are to examine the causes of deforestation in the study area; to assess the effect of deforestation in the study area and to examine the socio-economic impact of deforestation in the study area. The research method employed were pictorial view, oral interview, Questionnaire and field work. The study shows that the rainfall in the study area is seriously affecting the study area via depletion of the soil and equally leaching of agricultural chemical into the underground water and streams. A critical factor that determines soil erosion by rainfall is the permeability of the soil, which indirectly influences the total amount of soil loss and the pattern of erosion on slopes of the study area. The study shows that bush burning has been principally carried out in an indiscriminate and haphazard manner by farmers in the study area to retain nutrients in the soil or regenerate grazing land. Fulani herdsmen burn the bush to facilitate the growing of new grasses which were used to feed their cattle. The study shows that forest in the study area are undergoing serious depletion as a result of firewood and agriculture among others and forests are greatly helping to reduce the amount of pollutants in the air so, the depletion of these groups of trees including economic trees are greatly increasing the risk of carbon monoxide reaching the atmosphere and this already is leading to depletion of ozone layer which in turn results to global warming. The study equally shows some soils in the study area are now suffering from dangerously low organic matter levels and could not be expected to sustain the farming systems which have been imposed upon them. The biological activities of the soil, which depends on the availability of nutrients and energy supplied by the soil organic matter and crop and livestock residues has declined correspondingly in the study area. Much of the chemical weathering that takes place in soils is the result of the activities of soil micro-organisms, this biological activity has reduced as a consequence of reduced organic matter levels and in turn soil ability to provide nutrients for growing crops has reduced in the study area. Conclusively, it could be said that the study area is a visible evidence of population pressure. The village is growing at an unprecedented rate, and the pace is accelerating. About 60% of its population growth comes from natural increase and about 40% from immigration due to the sitting of Federal University of Technology Minna permanent site and other commercial centres in the study area. Base on the above finding and conclusion, it's recommended to use appropriate crop rotation and adopt improved fallow system.

1.0 CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

According to Areola (2007), deforestation simply put is the clearing away of forests. It is the process by which an area is deprived of existing natural forest vegetation and resources. This can be brought about by systematic felling, indiscriminate logging or total clearing of existing vegetation for arable farm or industrial purposes. It usually results in destabilization of forest ecosystems and the surrounding environment. To this effect, its causes could be classified into two groups as stated below.

(a) Man

(b) Natural causes of deforestation

(a) Man

It is through the activities of structural development, logging and agriculture that deforestation is caused by man. These activities include building of roads and citing of large projects, oil exploration and solid mineral exploration.

(i) Building of Roads and Citing of Large Projects

In developing communities, social amenities such as roads, hospital, water plants etc. are regularly provided by the government and or the communities themselves. Most times without proper planning, primary forests are cleared to site such projects. In Nigeria sites presently occupied by Petrochemicals, Refineries, Fertilizer Companies and Liquefied Natural Gas Plants where sometime, naturally occurring forest ecosystems (Sada, 2008).

(ii) Mineral/Oil Exploration Activities

Mineral/Oil exploration activities in Nigeria are major causes of deforestation, especially in the Niger Delta region. Since the early 1950s when the Nigerian oil industry was developed, its activities have been responsible for crossing the deltas with oil and gas pipe lines thereby removing vegetation cover along their paths. Facilities such as oil well heads, major pipelines manifolds and flow stations have also been sited in previously forested area (Sada, 2008).

(iii) Bush Burning

Both farmers and hunters in this part of the world use fire as a tool notwithstanding the fact that it is one of the most serious agents of forest destruction especially during the dry season. Most fires are caused either deliberately or by accident and these destroy trees of all sizes including seedlings. Fire hazards are more where the herbs and fallen leaves on the forest floor become dry. Most often animal rearers burn the old grasses to encourage growth of succulent grass for pasture. It has also been suggested that grass lands were sometime forested areas on which man had deliberately set fire to catch game thereby destroying previously existing forest vegetation. Timber loggers also set fire on forest accidentally while smoking or while carrying out any fire prone activity. This most times result in ground forest fires, surface fires and eventually wild crown forest fires (Emiegbe, 2009).

(iv) Logging

The high forests are the main sources of logs in Nigeria. As cited by Kio in 2003; by the years 2005 the consumption of wood based products will be 19 million cu meters from 3 million cu meters of 1975. In order to meet this demand, timber dealers encourage unlawful and indiscriminate logging in naturally occurring forests. Depletion of unreserved forests has also resulted in the concentration of logging activities within protected forest reserves in Nigeria. for example in 1960 western Nigeria, the areas outside the forest reserves, amounted to 52 percent of

the total timber volume output, but five years later, this had fallen to just 16 percent. For the period of 1971-1975 for the whole country the long output of the unreserved forests was only 38 percent of the total. It is therefore clear that logging is one of mans activities which cause deforestation in both protected and unreserved forests in Nigeria. In the cause of solid mineral exploration large factories such as the Ajaokuta steel mill in Kogi State have occupied previously forested areas. All these contribute to further depletion of the nations forest estate which is below the international standard of 20-25 percent of the total reserved high forested areas of the country (Areola 2007).

(v) Agricultural Activities

Large scale agriculture which requires a large land capital has also consumed a large portion of forested areas in Nigeria. Mechanized farming in the middle belt was practiced by indigenous farmers, but the system of shifting cultivation is still employed to improve crop yield. This required shifting of the farm sites to virgin and uncultivated lands thereby clearing existing natural forests. Even if the best natural forest management systems available could be implemented in Nigeria, the forest reserves would not be able to meet the country's timber needs of 19 million m^3 in the year 2000.

Yields of the natural high forests are about 10-25 percent of the short-time yields from plantations (Lawtan 2003). The trend is therefore, for the clearance of primary forest for plantation development with both indigenous and exotic timber species, often to be detriment of the country's natural forests. According to Boelke and Croze (2006), the total land area planted increase with an annual average area of 26,000 ha. This implies that agricultural development is a major factor causing deforestation in Nigeria.

(b) Natural Causes of Deforestation

Natural hazards which result in deforestation include:

(i) Diseases

It is quite common to find diseased tree stands in forests. Some tropical tree disease, such as mistletoes, blister rust, blight etc all caused by fungi, and capable of destroying mature trees and subsequently large stands to cause deforestation. Insects within a forest ecosystem also play roles in causing plant disease as their day to day feeding habits make forest trees susceptible to disease infection (Sada, 2008).

(ii) Damage to Trees by Other Plants

Forest trees are damaged in various ways by other plants of the community. Whilst the superficial epiphytic flora causes little direct damage, it may reduce tree photosynthesis by cutting off the supply of light to the leaves of trees. Climbing plants such as honeysuckle Lonicera Periclymenum, Partly strangle young trees so that tree stems are distorted and sometimes the sheer weight of climbers may lay flat a young sapling thereby destroying it completely (Okafor, 2008).

(iii) Climatic Factors

Climatic factors, such as wind and temperature are also agents of deforestation. Strong winds are capable of breaking down trees on their paths in large numbers or in some cases uprooting them completely. High or very low temperatures are known to have disease causing effects on young trees. In cases of very low temperature, tree roots are frozen to deprive the shoot system of water thereby causing death. Scotching is the result of high temperature which creates a ring of burnt plant tissue round the steams of sapling at their points of contact with the soil. This could also lead to death of young trees (Okafor, 2008).

(iv) Damages to Trees by Mammals

Heavy browsing modifies the form of seedlings, and may prevent a shrub layer from development and in an old forest creates a browse line beneath which no young living tree shoot survives. Selective browsing can radically alter the proportions of different plant species present and even eradicate some. Tree bark is eaten by many groups of mammals notably rabbits, squirrels, porcupines, mouse, elk and elephants, and relatively small beavers is just as capable as the elephant of tree felling (Ovinton, 2005).

(v) Death and Decay of Trees

Trees are living things and often die naturally. Death may be premature due to root competition or lack of sufficient light or nutrients. These deficiencies predispose the plants to attack by insects of fungi which results into death and subsequent elimination of trees (Ovinton, 2005).

1.2 STATEMENT OF PROBLEM

According to Areola (2007), the effects of deforestation are most times not felt instantly by the forest ecosystem or the surrounding woodland environment. But over time, the absence of vegetation cover in a previously forested area affects both the living and non living components of that environment in the following ways. Kio (2003), stated that deforestation exposes forest soils to direct contact with the rains and this enhances the free flow of runoff which causes soil erosion. For communities whose sources of drinking water are influenced by water sheds soil erosion results in the increase of the mineral content of the surrounding water bodies and also increases turbidity. In areas where slops are step or agricultural practice is bad the land may show excessive erosion in the absence of surrounding forests. Erosion galleys eat back further into agricultural land with each rain storm and remove valuable top soil. Soils that are exposed to erosion will no doubt have lower fertility potentials as compared to more stable soils protected

by good vegetation cover. Deforestation in desert prone areas destabilizes soil and enhances the encroachment of sand upon agricultural lands. This is most times the case in Northern Nigeria where desertification is a major threat to agriculture as trees that would have been used to stabilize sand dunes are felled to be used as fuel wood. Forest areas which had been the natural habitats of some wild life for years are no longer conducive for such wild animal species to survive when deforestation takes place. Such animals end up migrating to more conducive environments. Sometimes it results in the death of such animals and subsequent extinction, as such animals are not able to adapt to their new environment. Typical examples are the migration of elephants and hippopotamus from the Niger Delta as a result of deforestation. Wood lands reduce the amount of solar energy reaching the ground, since the upper canopy reflects some incident radiation. The ratio of reflected to incident radiation is called the albedo and is usually greater in land areas without vegetation cover. This is because radiant energy is absorbed by the different plant layers in every vegetation, leaving a very small percentage to be reflected back into the atmosphere. Thus deforested areas will reflect more radiant energy into the atmosphere, which will in turn enhance global warning.

1.3 AIM AND OBJECTIVES

The aim of this study is to assess the impact of deforestation in Niger State and precisely Gidan Kwanu Village of Bosso Local Government Area. The objectives are to:

i. To examine the causes of deforestation in the study area;

ii. To assess the effect of deforestation in the study area

iii. To examine the socio-economic impact of deforestation in the study area

1.4 JUSTIFICATION

According to Lawton (2005), most of the forested lands in Nigeria are located in the rural areas and in these areas the level of environmental awareness is reduced as compared to the highly enlightened populace in the city centers. Therefore, the physical effects of deforestation which are mostly environmental are not foreseen by the rural dwellers. However the economic effects of deforestation which affects their substance directly cannot be over emphasized. It is thus very common to observe the high cost of forage crops and other forest products as deforestation results in their scarcity in communities and settlements where they used to be cheap and available. Examples of such products include tree crops like Daulium quineensis (icheku), Cola nitida (goro), Treculia African (African broad fruit) Irvingia gabonensis (Ogbono) and animals like snails, wild animals and grass-cutter to mention but a few. Subsequently, this effect stretches to the urban areas as the rural still serve as the primary source of forage crops and forest products. Deforestation has continued to reduce the total forested land area of Nigeria. Its effects are quite obvious now, that environmental awareness is gradually reaching every strata of the society. Also, from the economic point of view deforestation has created a negative impact on the average Nigerian.

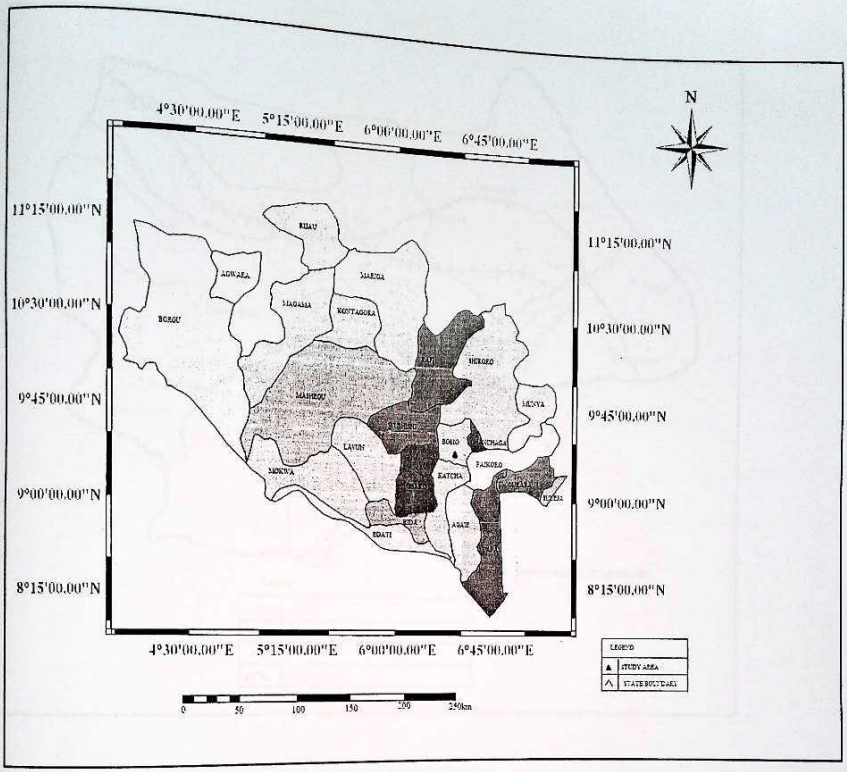
1.5 SCOPE OF THE STUDY

The scope of this study is limited to impact of deforestation in Niger State and a case study of Gidan Kwanu Village of Bosso Local Government Area and the impact assessment will includes the causes, effect and socio-economic impact of deforestation in the study area.

1.6 STUDY AREA

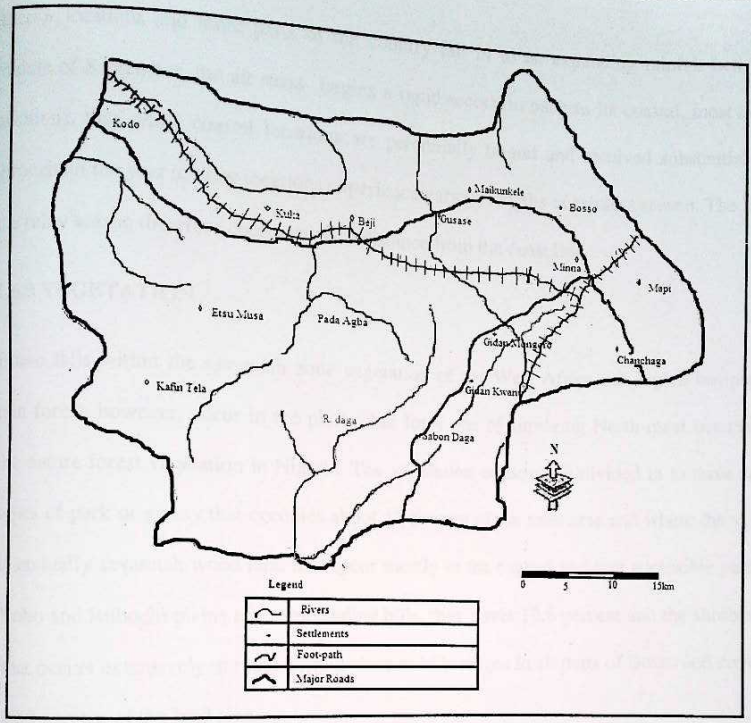
1.6.1 LOCATION

Bosso Local Government Area lies between longitude 6° 33E - longitude 6° 37E and latitude 9° 33N - latitude 9° 38N, on a geological base of undifferentiated base complex of mainly gneiss and magnetite situated at the base of prominent hills in an undulating plan. Bosso Local Government Area is situated on Niger valley. It is located in the south eastern part of Niger State with elevation in height between 100 feet (300 meters). The area geographically shares boundaries with Wushishi Local Government to the west, Chanchaga Local Government Area to the east, Shiroro Local Government Area to the north and Katcha Local Government Area to the south. It is characterized by having sedimentary rocks. Certain surrounded hill can be seen in some parts of the areas (Bosso Wikipedia, 2012).



Source: Ministry of land and Environment (2013)

Figure 1.0 Map of the Study Area



Source: Bosso Local Government Area Secretariat (2013)

Figure 1.2: Map of the study Area

1.6.2 PRECIPITATION

Rainfall occurs in Nigeria along disturbance lines in places overlaid by the warm and humid maritime air mass originating over the Atlantic Ocean in the south. Because of this, the Southern parts of the country receive more rain than the northern parts. Southern coastal areas are permanently overlaid by the humid air mass. Early in the year, the air mass beings to hurried

interior locations and more parts of the country fall in to an expanding rainfall belt. By the middle of September, the air mass begins a rapid recession back to its coastal, most southerly positions, thus while coastal locations are perennially humid and received substantial rainfall throughout the year interior locations experience various lengths of rainless season. The length of the rainy season therefore decreases with distance from the coast line.

1.6.3 VEGETATION

Bosso falls within the savannah zone vegetation of the West Africa sub-region but patches of rain forest, however, occur in the plains that form one of surviving North-most occurrences of the nature forest vegetation in Nigeria. The vegetation of Bosso is divided in to three savannah types of park or grassy that occupies about 53 percent of the total area and where the vegetation is annually savannah wood land that occur mostly in the rugged and less accessible parts on the Robo and Rubochi plains and same ending hills, they cover 12.8 percent and the shrub savannah that occurs extensively in rough terrain close to hills ridges in all parts of Bosso and covers about 12.9 percent of the land area.

1.6.4 CLIMATE OF THE STUDY AREA

Bosso has two district weather, namely the rainy season that begins around March and runs through October and the dry season which begins from October and end in March. However, within these seasons is a brief hamattan season that is occasioned by the northeast. Weather conditions in Bosso are influenced by its location within the Niger Benue through on the windward side at the climate transition zone between the essentially humid south and the sub-humid north of the country. The climatic dictates of the Bosso essentially from the south-west to

the North West due to rising elevation from the valley in the southwest the high temperatures and the relative humidity in the Niger-Benue through give Niger state a heating affect but the increasing elevation toward north. Rainfall in Bosso reflects the location on the wind ward side while the monthly rainfall distribution intensified during the month of July, August and September.

1.6.5 SOIL AND LAND TYPE

Bosso have two main types of soil, sedimentary belt in the southern and south western extremities of the area and the pre-Cambrian basement complex rock of the country which account for more than 80percent of the area.

The sedimentary formation, being part of the nupe land sandstones consists mainly of fine grained sandstones with inclusion of grits, siltstones and clay lines; and basement complex consists of wide variety of rock types which can be classified in to three broad groups. Schist, including biotite/muscoriote schist, muscorite and tale schist's with quartzite intrusive account for most of the rugged landscape in the southern parts of the Bosso. The igneous rocks made up of biotite granite, rhyolite, and syenite. The granite account for most of the rock domes and massive hills in the north-eastern and north-western parts of Bosso. The magnetite's and gneiss complex, which are metamorphic rocks consisting mostly of magnetite's, granite, gneiss and biota granite underline the site of the area. These are rocks of medium to high strength which were not expected to present serious engineering problems and the rocks of Bosso are generally quartz rich, acidic types which account for the generally sandy nature of the soil especially on the Robo and Rubochi Plains. The plains have the most fertile soils and the best agricultural lands of all plains of Bosso while the high sand content of most soils within Bosso accounts for

the relatively high erosion status. There is however, one major advantage about the type of rocks and soils found in Bosso because of the ability of construction materials in the form of building stones quartz and pistol tic gravel, building sands and earth for use as foundation materials.

1.6.6 GEOLOGY

Bosso geology consists of pre- Cambrian basement with an elevation which range between 273m to 333m in the west and 200m to 364m in the East. The landscape of the region (Bosso L.G.A) is relatively flat; this means it is located on a plain. North South direction divides the plain into two Western and Eastern part (Oyebanji 1993). Bosso L.G.A geology can, therefore, be broad Meta-sediments occurring in more than 7.5 per cent of the state Basement complex rocks occurring higher ground further away. The Niger state has proven deposits of a wide range of mineral resources including marble, tin, mica, clay, wolfromite, tantalite and talc.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 DEFORESTATION IN NIGERIA

According to Akinbami (2008), deforestation is a process where vegetation is cut down without any simultaneous replanting for economic or social reasons. Deforestation has negative implications on the environment in terms of soil erosion, loss of biodiversity ecosystems, loss of wildlife and increased desertification among many other reasons. Deforestation also has impacts on social aspects of the country, specifically regarding economic issues, agriculture, conflict and most importantly, quality of life. According to data taken over 2000 to 2005 Nigeria, located in the western region of Africa, has the largest deforestation rates in the world, having lost 55.7% of their primary forests. The annual rate of deforestation in Nigeria is 3.5%, approximately 350,000-400,000 hectares per year. The Food and Agriculture Organization of the United Nations lists the requirements of sustainable forest management as: extent of forest resources, biological diversity, forest health and vitality, productive functions of forest resources, protective functions of forest resources, socio-economic functions and a legal, policy and institutional framework. Many aspects of the outline are currently not being met and will continue to have detrimental effects if not quickly addressed (FAO, 2009).

Omofonmwan (2008), stated that a lot of damage has been done to Nigeria's land through the processes of deforestation, notably contributing to the overwhelming trend of desertification. Desertification is the encroachment of the desert on land what was once fertile. A study conducted from 1901 to 2005 gathered that there was a temperature increase in Nigeria of 1.1°C, while the global mean temperature increase was only 0.74°C. The same study also found in the

same period of time that the amount of rainfall in the country decreased by 81mm. It was noticed that both of these trends simultaneously had sharp changes in the 1970s. From 1990 to 2010 Nigeria nearly halved their amount of Forest Cover, moving from 17,234 to 9041 hectares. The combination of extremely high deforestation rates, increased temperatures and decreasing rainfall are all contributing to the desertification of the country. The carbon emissions from deforestation is also said to account for 87% of the total carbon emissions of the country. Nigeria's wide biodiversity of 899 species of birds, 274 mammals, 154 reptiles, 53 amphibians and 4,715 species of higher plants will also be strongly affected by the negative impacts of deforestation. The numbers of the rare Cross River gorilla have decreased to around 300 individuals because of poaching by locals and mass habitat destruction. Although much of the motivation of deforestation stems from economic reasons it has also lead to a lot of economic problems in an already unstable country. Along with economic issues, deforestation has made it so that the land is incapable of as much agricultural production which is part of many people's survival. Issues such as these and the subject of the environment itself has contributed to many conflicts in the country and even executions of environmental activists, such as Ken Saro-Wiwa, a Nobel Peace Prize nominee.

Much of the allowance for deforestation in Nigeria comes from their demand for fuel wood. 90% of the Nigerian population stated that they relied on kerosene as the main energy source for cooking but because it is expensive and often unavailable, 60% said they used fuel wood instead. The usage of fuel wood for cooking is higher in rural areas of the country where more of the population is concentrated. There are also incentives to people living in rural areas surrounding the process of deforestation because it is a source of income to many of them. They extremely

high levels of poverty in the country are very much connected to the issue of deforestation (Omofonmwan, 2008).

The current state of the environment and has been allowed by the State Department of Forestry who have not implemented any forest management policies in efforts to curb deforestation since the 1970s. Without any conservation efforts or education, the society is not aware of how to properly treat finite natural resources. Very few steps have been made to try to lower the deforestation rates and to stop illegal logging.

According to Odjigo (2008), any solution to the problem of deforestation in Nigeria must be an approach that incorporates and aggressively targets all aspects that are related to the problem. Teach each should include areas of energy alternatives, improved technology, forestry management, economic production, agriculture and security of the locals that are dependent on the land. Energy alternatives include hydro power, solar energy and wind energy. Solar energy is a great option for Nigeria and will have exceptional results due to its geographical location. Nigeria has already implemented windmills in some of its states but the more this approach is taken on the more energy that will be produced in an environmentally sound and efficient way. Each of these proposals are accepted globally as good alternatives to current energy production methods and have been encouraged by many environmental organizations. Improving the technology of cook stoves will be especially effective for Nigeria which currently has many households that require fuel wood for their cooking methods. In 2005 a group of countries, called the Coalition for Rainforest Nations, developed a program to reduce the rates of deforestation that contribute to CO^2 emissions. The program is designed for all developing countries with a rainforest. The developing countries receive money upon successful completion of lowering their

country's emissions. A similar concept has been designed by REDD (Reducing Emissions from Deforestation in and Forest Degradation in Developing Countries). In REDD the countries are able to receive much more money in the form of carbon credits which can be spent on more environmentally safe practices.

According to FAO (2009), deforestation all over the globe is threatening the sustainability of the environment but has had especially detrimental effects in Nigeria due to their high rates. Deforestation puts at risk all aspects of the environment, the economy and of the citizens of the country. As of 2005, Nigeria has the highest rate of deforestation in the world according to the Food and Agriculture Organization of the United Nations (FAO). Between 2000 and 2005 the country lost 55.7% of its primary forests, and the rate of forest change increased by 31.2% to 3.12% per annum. Forest has been cleared for logging, timber export, subsistence agriculture and notably the collection of wood for fuel which remains problematic in western Africa. In 2005 12.2%, the equivalent of 11,089,000 hectares had been forested in Nigeria. Between 1990 and 2000, Nigeria lost an average of 409,700 hectares of forest every year equal to an average annual deforestation rate of 2.38%. Between 1990 and 2005, in total Nigeria lost 35.7% of its forest cover, or around 6,145,000 hectares. Nigeria is home to 1417 known species of fauna and at least 4715 species of vascular plants according to figures from the World Conservation Monitoring Centre. Although national parks and reserves have increased in the country only 3.6% of Nigeria is protected under IUCN categories I-V.

2.2 CAUSES OF DEFORESTATION

As Myers pointed out, "we still have half of all tropical forests that ever existed" (Myers, 2002). The struggle to save the world's rainforests and other forests continues and there is a growing

worldwide concern about the issue. In order to save forests, we need to know why they are being destroyed. Distinguishing between the agents of deforestation and its causes is very important in order to understand the major determinants of deforestation. The agents of deforestation are those slash and burn farmers, commercial farmers, ranchers, loggers, firewood collectors, infra-structure developers and others who are cutting down the forests. Causes of deforestation are the forces that motivate the agents to clear the forests. However, most of the existing literature typically distinguishes between two levels of specific factors: direct and indirect causes of deforestation. Direct agents and causes of deforestation, also typically referred to as sources of deforestation, first level or proximate causes (Panayotou, 2000; Barbier *et al.*, 2004; Caviglia, 2009) are relatively easy to identify but the indirect causes which are usually the main divers of deforestation are the ones that cause most disagreement and the ones that are hardest to quantify (Mather, 2001; Humphreys, 2006; Sands, 2005).

Similarly, Pearce and Brown (2004) identified two main forces affecting deforestation. They are:

- Competition between humans and other species for the remaining ecological niches on land and in coastal regions. This factor is substantially demonstrated by the conversion of forest land to other uses such as agriculture, infrastructure, urban development, industry and others.

Failure in the working of the economic systems to reflect the true value of the environment. Basically, many of the functions of tropical forests are not marketed and as such are ignored in decision making. Additionally, decisions to convert tropical forests are themselves encouraged by fiscal and other incentives. The former can be regarded as the direct and latter as indirect cause of deforestation.

2.2.1 Direct causes

2.2.1.1 Expansion of farming land

About 60 per cent of the clearing of tropical moist forests is for agricultural settlement (Myers, 2004; Anon, 2001) with logging and other reasons like roads, urbanization and Fuelwood accounting for the rest (Anon, 2004b). Tropical forests are one of the last frontiers in the search for subsistence land for the most vulnerable people worldwide (Myers, 2002).

Millions of people live on the tropical forest with less than a dollar a day where a third of a billion are estimated to be foreign settlers. However, as the land degrades people are forced to migrate, exploring new forest frontiers increasing deforestation (Wilkie *et al.*, 2000; Amor, 2008; Amor and Pfaff, 2008). Deforestation is proxied by the expansion of agricultural land.

This is because agricultural land expansion is generally viewed as the main source of deforestation contributing around 60 per cent of total tropical deforestation. Shifting agriculture also called slash and burn agriculture is the clearing of forested land for raising or growing the crops until the soil is exhausted of nutrients and/or the site is overtaken by weeds and then moving on to clear more forest. It is been often reported as the main agent of deforestation. Smallholder production in deforestation and the growing number of such producers notably shifting cultivators were the main cause of deforestation.

Mostly all reports indicate shifting agriculture as responsible for about one half of tropical deforestation and some put it up to two-thirds. Shifting agriculture was greatest in Asia (about 30 per cent) but only about 15 per cent over the whole tropical world. It appears that the proportion of direct conversion of forest to agriculture is increasing and the proportion of shifting agriculture is decreasing with time.

2.2.1.2 Forest and other plantations

Plantations are a positive benefit and should assist in reducing the rate of deforestation. The fact that plantations remove the timber pressure on natural forests does not translate eventually into less, but rather into more deforestation. Indeed, it is feared that agricultural expansion which is the main cause of deforestation in the tropics might replace forestry in the remaining natural forests (Anon., 2002; Cossalter and Pye-Smith, 2003; Anon., 2005). The impact of timber plantations could thus turn out to be quite detrimental to tropical forest ecosystems (Kartodihardjo and Supriono, 2000). Tree crops and rubber in particular plays a more important role in deforestation in Indonesia than subsistence-oriented shifting cultivation (Chomitz and Griffiths, 2006). Unfortunately about one-half of the plantations in the tropics are established on native forest cleared for the purpose. Moreover plantations can promote deforestation by constructing roads that improve access of the shifting cultivators and others to the forest frontier.

2.2.1.3 Logging and fuel wood

Logging does not necessarily cause deforestation. However, logging can seriously degrade forests (Putz *et al.*, 2001). Logging in Southeast Asia is more intensive and can be quite destructive. However, logging provides access roads to follow-on settlers and log scales can help finance the cost of clearing remaining trees and preparing land for planting of crops or pasture. Logging thus catalyzes deforestation (Chomitz *et al.*, 2007).

Fuelwood gathering is often concentrated in tropical dry forests and degraded forest areas (Rowe *et al.*, 2002; Anon, 2004a). Fuelwood is not usually the major cause of deforestation in the humid tropics although it can be in some populated regions with reduced forest area such as in the Philippines, Thailand and parts of Central America. Fuelwood gathering was considered to be

the main cause of deforestation and forest degradation in El Salvador (Repetto, 2000). In the drier areas of tropics, Fuelwood gathering can be a major cause of deforestation and degradation.

2.2.1.4 Overgrazing

Overgrazing is more common in drier areas of the tropics where pastures degraded by overgrazing are subject to soil erosion. Stripping trees to provide fodder for grazing animals can also be a problem in some dry areas of the tropics but is probably not a major cause of deforestation. Clear cutting and overgrazing have turned large areas of Qinghai province in China into a desert. Overgrazing are causing large areas of grasslands north of Beijing and in Inner Mongolia and Qinghai province to turn into a desert. One man who lived in a village on the eastern edge of the Qinghai-Tibet plateau that was being swallowed up by sand told the New York Times, "The pasture here used to be so green and rich. But now the grass is disappearing and the sand is coming." Huge flocks of sheep and goats strip the land of vegetation. In Xillinggol Prefecture in Inner Mongolia, for example, the livestock population increased from 2 million in 1977 to 18 million in 2000, turning one third of the grassland area to desert. Unless something is done the entire prefecture could be uninhabitable by 2020. Overgrazing is exacerbated by sociological phenomena called "the tragedy of the common." People share land but raises animals for themselves and try to enrich them by rising as many as they can. This leads to more animals than the land can support. Grassland in Qinghai that can support 3.7 million sheep had 5.5 million sheep in 1997. Animals remove the vegetation and winds finished the job by blowing away the top soil, transforming grasslands into desert. When a herder was asked why he was grazing goats next to a sign that said "Protect vegetation, no grazing," he said, "The lands are too infertile to grow crops—herding is the only way for us to survive." (Hays, 2008).

2.2.1.5 Fires

Fires are a major tool used in clearing the forest for shifting and permanent agriculture and for developing pastures. Fire is a good servant but has a poor master. Fire used responsibly can be a valuable tool in agricultural and forest management but if abused it can be a significant cause of deforestation (Repetto, 2008; Rowe *et al.*, 2002). Based on the data available from 118 countries representing 65 per cent of the global forest area, an average of 19.8 million hectares or one per cent of all forests were reported to be significantly affected each year by forest fires (Anon., 2010). Deforestation due to road pavements in Brazil had also lead to higher incidences of forest fires (Carvalho *et al.*, 2001; Nepstad *et al.*, 2001).

2.2.1.6 Mining

Mining is very intensive and very destructive (Mather, 1991; Sands, 2005). The area of land involved is quite small and it is not seen as a major cause of primary deforestation. Mining is a lucrative activity promoting development booms which may attract population growth with consequent deforestation. The deforestation rate due to mining activities in Guyana from 2000 to 2008 increased 2.77 times according to an assessment by the World Wildlife Fund-Guianas (Staff, 2010). Similarly, in the Philippines, mining, along with logging, has been among the forces behind the country's loss of forest cover: from 17 million hectares in 1934 to just three million in 2003 or an 82 per cent decline (Docena, 2010). Nearly 2,000 hectares of tropical forest in the Municipality of Coahuayana in the State of Michoacán (south-western Mexico) will completely be destroyed by mining iron minerals planned by the Italo-Argentine mining company TERNIUM (Anonymous, 2008). Similarly, Nyamagari hills in Orissa India currently threatened by Vedanta Aluminum Corporation's plan to start bauxite mining will destroy 750 hectares of reserved forest (Griffiths and Hirvelä, 2008).

Massive and unchecked mining of coal, iron ore and bauxite in Jharkhand, India has caused large scale deforestation and created a huge water scarcity (Anon., 2011b). In return for US$3.8 billion of investment, the agreements between the State government of Jharkhand, India and mining companies, there will be a massive land acquisition which will deforest no less than 57,000 hectares of forest and displace 9,615 families, many of them located in legally protected Scheduled Areas set aside for indigenous peoples in the State (Mullick and Griffiths, 2007). Moreover, Roads constructed to support the mining operations will open up the area to shifting agriculturists, permanent farmers, ranchers, land speculators and infrastructure developers. For instance the core of Brazil's Amazon development strategy were infra-structure development projects such as roads providing access to frontier regions, mining area and large hydroelectric reservoirs (Carvalho *et al.*, 2002, 2004). The construction of roads, railways, bridges, and airports opens up the land to development and brings increasing numbers of peoples to the forest frontier. If wood is used as fuel in mining operations and it is sources from plantations established for the purpose, it can cause serious deforestation in the region. On the other hand, mining can be labour intensive and take labour away from clearing forest.

2.2.1.7 Urbanization/industrialization and infra-structure

Expanding cities and towns require land to establish the infrastructures necessary to support growing population which is done by clearing the forests (Mather, 2001; Sands, 2005). Tropical forests are a major target of infra-structure developments for oil exploitation, logging concessions or hydropower dam construction which inevitably conveys the expansion of the road network and the construction of roads in pristine areas (Kaimowitz and Angelsen, 2008). The construction of roads, railways, bridges, and airports opens up the land to development and brings increasing numbers of people to the forest frontier. Whether supported or not by the

governmental programmes, these settlers have usually colonized the forest by using logging trails or new roads to access the forest for subsistence land (Wilkie *et al.*, 2000; Amor, 2008; Amor and Pfaff, 2008). The development of these infrastructure projects are of worldwide concern, since tropical forest clearing accounts for roughly 20 per cent of anthropogenic carbon emissions destroying globally significant carbon sinks (Anon, 2001c) and around 21 per cent of tropical forests have been lost worldwide since 1980 (Bawa *et al.*, 2004).

2.2.1.8 Air pollution

Air pollution is associated with degradation of some European and North American forests. The syndrome is called "Waldsterben" or forest death. In 1982, eight per cent of all West German trees exhibited damage that rose to about 52 per cent by 1987 (Raloff, 2009) and half of the trees reported dying of Waldsterben in the Alps (Lean, 2000). High elevation forests show the earliest damage including forests in the north-east and central United States.

2.2.1.9 Wars and role of the military

It is well established that military operations caused deforestation during the Vietnam War and elsewhere (Mather, 2001; Sands, 2005). More recently, linkages have been documented between the civil war in Myanmar and the timber trade between Myanmar and Thailand. Myanmar regime sells timber to the Thais to finance its civil war against the Karen hill tribe. Forest destruction in El Salvador has resulted from war. Apart from military involvements in wars, the role of military in deforestation has been documented in Southeast Asia and South America (Sands, 2005). The authors also observed that role of powerful military in Brazilian politics are a major cause of Amazonian forest destruction.

2.2.1.10 Tourism

National parks and sanctuaries beyond doubt protect the forests, but uncautioned and improper opening of these areas to the public for tourism is damaging. Unfortunately, the national governments of tropical and sub-tropical countries adopt tourism for easy way of making money sacrificing the stringent management strategies. Further, many companies and resorts who advertise themselves as eco-tourist establishments are in fact exploiting the forests for profit. In Cape Tribulation, Australia, for example, the rain forest is being threatened by excessive tourism (Colchester and Lohmann, 2003). Similarly, in the Terai Duars of eastern India foothill Himalaya, eco-tourism is encouraged and we fear this is being done without developing adequate management plans. For instance, the Chilapatta Reserve Forest in this area is opened for eco-tourism for its ancient ruins deep in the forest and a tree species *Myristica longifolia* that exudes a blood like sap when injured. The site has become a popular eco-tourist destination because of the ruins and for this blood exuding tree. In the whole forest only eight individuals were found but two of the trees in the near vicinity of the ruins completely dried away due to repeated injuries caused to the plants by the curious tourists (Shukla, 2010). In fact, in the name of eco-tourism, infra-structure development is taking place mostly be the private players in these wilderness areas which are further detrimental in terms of attracting peoples other than tourists also, causing deforestation especially deep in the forest.

2.2.2 Indirect causes

The World Rainforest Movement's 'Emergency Call to Action for the forests and their Peoples' asserts that "deforestation is the inevitable result of the current social and economic policies being carried out in the name of development" (Anon, 2000d). It is in the name of development

that irrational and unscrupulous logging, cash crops, cattle ranching, large dams, colonisation schemes, the dispossession of peasants and indigenous peoples and promotion of tourism is carried out. Harrison Ngau, an indigenous tribesman from Sarawak, Malaysia and winner of the Goldman Environment Award in 1990 puts the cause of tropical deforestation like this, "the roots of the problem of deforestation and waste of resources are located in the industrialized countries where most of our resources such as tropical timber end up. The rich nations with one quarter of the world's population consume four fifth of the world's resources. It is the throw away culture of the industrialized countries now advertised in and forced on to the Third World countries that is leading to the throwing away of the world. Such so-called progress leads to destruction and despair" (Anon, 2000d). Such a development leads to overconsumption which is the basic underlying cause of deforestation.

2.2.2.1 Colonialism

Erstwhile colonies of the colonial powers like Britain, France, Spain or Portugal are now the Third World Countries or the developing nations mostly have the tropical rainforests except Australia and Hawaii were exploited for their natural resources and their indigenous people's rights destroyed by the colonial powers. All these countries have indigenous populations who had their own system of land management and/or ownership in place for thousands of years before the intervention of colonists from rich industrialized nations. Colonialism turned previously self-sufficient economies into zones of agriculture export production. This process continues even today in different form of exploitation and the situation is worsening (Colchester and Lohmann, 2003).

2.2.2.2 Exploitation by industrialized countries

Wealthy countries or the erstwhile colonial powers having deficit of their own natural resources are mainly sustaining on the resources of the financially poorer countries those are generally natural resource rich. Twenty per cent of the world's population is using 80 per cent of the world's resources. Unfortunately also the governments of these poor resource rich countries had generally adopted the same growth-syndrome as their western neighbours or their erstwhile colonial master giving emphasis on maximizing exports, revenues and exploiting their rich natural resources unsustainably for short-term gains. Moreover, corruption in government, the military and economic powers is well known. The problem is further worsened by the low price of the most Third World exports being realized in the international market (Colchester and Lohmann, 2003).

2.2.2.3 The debt burden

Pursuing the guided development agenda, the financially poorer countries are on a heavy international debt and now feeling the urgency of repaying these huge debts due to escalating interest rates. Such a situation compels these debt ridden poorer countries to exploit their rich natural resources including their forests partly to earn foreign exchange for servicing their debts. For instance, construction of roads for logging operations in some South-east Asian countries was funded by Japanese aid which allowed the Japanese timber companies to exploit the forests of these countries. Understandably, these timber companies profitably exploited the forests while the South-east Asian countries were left owing Japan money for construction of their roads (Colchester and Lohmann, 2003).

2.2.2.4 Overpopulation and poverty

The role of population in deforestation is a contentious issue (Colchester and Lohmann, 2003; Sands, 2005). The impact of population density on deforestation has been a subject of controversy. Poverty and overpopulation are believed to be the main causes of forest loss according to the international agencies such as FAO and intergovernmental bodies. It is generally believed by these organizations that they can solve the problem by encouraging development and trying to reduce population growth. Conversely, the World Rainforest Movement and many other NGOs hold unrestrained development and the excessive consumption habits of rich industrialized countries directly responsible for most forest loss. However there is good evidence that rapid population growth is a major indirect and over-arching cause of deforestation. More people require more food and space which requires more land for agriculture and habitation. This in turn results in more clearing of forests. Arguably increasing population is the biggest challenge of all to achieve sustainable management of human life support systems and controlling population growth is perhaps the best single thing that can be done to promote sustainability. Overpopulation is not a problem exclusive to Third World countries. An individual in an industrialized country is likely to consume in the order of sixty times as much of the world's resources as a person in a poor country. The growing population in rich industrialized nations are therefore responsible for much of the exploitation of the earth and there is a clear link between the overconsumption in rich countries and deforestation in the tropics (Colchester and Lohmann, 2003). Poverty and overpopulation are inextricably linked. Poverty, while undeniably responsible for much of the damage to rainforests, has to a large extent been brought about by the greed of the rich industrialized nations and the Third World elites who seek to emulate them.

Development is often regarded as the solution to world poverty, seldom helps those whose need is greatest. Thus, it is often the cause rather than the cure for poverty. The claim that overpopulation is the cause of deforestation is used by many governments and aid agencies as an excuse for inaction. In tropical countries, pressure from human settlement comes about more from inequitable land distribution than from population pressure. Generally, most of the land is owned by small but powerful elite which displaces poor farmers into rainforest areas. So long as these elites maintain their grip on power, lasting land reform will be difficult to achieve (Colchester and Lohmann, 2003) and deforestation continues unabated.

Therefore poverty is well considered to be an important underlying cause of forest conversion by small-scale farmers and naturally forest-dense areas are frequently associated with high levels of poverty (Chomitz *et al.*, 2007). The population also often lacks the finance necessary for investments to maintain the quality of soil or increase yields on the existing cleared land (Purnamasari, 2010). Deforestation is affected mainly by the uneven distribution of wealth. Shifting cultivators at the forest frontier are among the poorest and most marginalized sections of the population. They usually own no land and have little capital. Consequently they have no option but to clear the virgin forest. Deforestation including clearing for agricultural activities is often the only option available for the livelihoods of farmers living in forested areas (Angelsen, 2009).

2.2.2.5 Transmigration and colonisation schemes

Transmigration of people to the forest frontier whether forced or voluntary due to development policy or dislocation from war is the major indirect cause of deforestation (Colchester and Lohmann, 2003; Sands, 2005). Moreover, governments and international aid agencies earlier believed that by encouraging colonisation and transmigration schemes into rainforest areas could

alleviate poverty of the areas in the financially poorer countries. Such schemes have miserably failed but hurted the indigenous people and the environment. In Indonesia, the *Transmigrasi* Program of 1974 had caused annual deforestation of two lakh hectares (Colchester and Lohmann, 2003). Dispossessed and landless people bring increased population pressure to the forest frontier. Further, new migrants in the area increase demand for food and other agricultural products which can induce the farmers at the forest frontier to increase their agricultural production by expanding agricultural land by clearing the forests (Levang, 2002). Moreover, the new migrants may not care for conservation of the forests in their new home which further accelerates deforestation of the area.

2.2.2.6 Land rights, land tenure and inequitable land distribution and resources

Cultivators at the forest frontier often do not hold titles to land (absence of property rights) and are displaced by others who gain tenure over the land they occupy (Deacon, 2009; Sands, 2005). This means they have to clear more forest to survive. Poorly defined tenure is generally bad for people and forests (Chomitz *et al.*, 2007). In many countries government have nominal control of forests but are too weak to effectively regulate their use. This can lead to a tragedy of the commons where forest resources are degraded. In frontier areas deforestation is a common practice and legalized way of declaring claim to land and securing tenure (Schneider, 2005).

2.2.2.7 Economic causes - development/land conversion value, fiscal policies, markets and consumerism

The relationship between development and deforestation is complex and dynamic (Humphreys, 2006; Sands, 2005). One point of view is that development will increase land productivity and thereby reduce the need to clear forests to meet food requirements. Another is that development will produce further capital and incentive to expand and clear more forest. The former may be

the case when constrained by a fixed food demand. The latter may be the case when food demand may not be satisfied owing to a continuing export market and rising internal population with rising levels of consumption. Profits from deforestation vary from less than a dollar to thousand dollars per hectare depending on location, technologies and land use systems (Chomitz *et al.*, 2007). It is also argued by the workers that richer farmers were better able to finance deforestation while a poor farmer can't afford to clear much forest. Conversely, through transfers, stronger credit markets and better opportunities for off-season employment can increase income as well as deforestation by small land holders. Moreover, land offering higher rents encourage quicker deforestation. Higher prices for crops and lower prices for farm inputs also spur faster deforestation (Chomitz *et al.*, 2007). Wage increase can also stimulate deforestation (Barbier and Cox, 2004). Technological innovations make farming more profitable either prompting the expansion of farms into forest or attract new farmers to forest frontiers (Angelsen and Kaimowitz, 2001; Angelsen, 2006). Even when the increase in commodity price is only temporary, it tends to raise expectation about future prices, increasing the expected probability from land clearance and conversion to agriculture (Angelsen, 2005; Sunderlin *et al.*, 2000). Many development policies have failed because they have supported either wittingly or unwittingly the development of those who already have land, power, influence and political clout. This further alienates the rural poor and puts the pressure back on the forests.

Poor farm households or commercial loggers have little incentive to care about the environmental effects of their actions. Such unaccounted costs give rise to economic failures such as local market failures, policy failures and global appropriation failures (Panayotou, 2000). Market fails due to unregulated market economy which does not produce an optimal outcome. Prices generated by such market does not reflect the true social costs and benefits from resource

competitive. Alternatively, if the national governments value the environmental benefits, it could apply a tax or disincentives to clear. However, even though maintenance of the environmental services is essential for sustained economic development, deforesting nations usually have more immediate goals and are unprepared to take this step.

2.2.2.9 Corruption and political cause

The FAO identified forest crime and corruption as one of the main causes of deforestation in its 2001 report and warned that immediate attention has to be given to illegal activities and corruption in the world's forests in many countries (Anon., 2001b). Illegal forest practices may include the approval of illegal contracts with private enterprises by forestry officers, illegal sale of harvesting permits, under-declaring volumes cut in public forest, underpricing of wood in concessions, harvesting of protected trees by commercial corporations, smuggling of forest products across borders and allowing illegal logging, processing forest raw materials without a license (Contreras-Hermosilla, 2000; 2001).

2.3 EFFECT OF DEFORESTATION AND OVEREXPLOITATION OF VEGETATION

The destruction of forests is caused for the most part by land clearance for agricultural purposes. "Both slash-and-burn agriculture, when land is not allowed to lie fallow as long as traditional practices dictated, and permanent clearing for modern farms, are taking a toll" (FAO, 2003). Shifting cultivation entails "cutting trees and shrubs and tall grasses, burning the litter, growing crops for 2 to 5 years on the cleared land, and then allowing the natural cover to return to regenerate the soil the fallow period may last any time from 5 to 15 years, depending on the soil and type of vegetation" (FAO, 2003). Such operations are estimated to have contributed some 60 percent of the expansion of farmland between 1973 and 1998. The removal of vegetation cover

starts or accelerates soil erosion under rain and wind action, and "burning for weed control encourages leaching and soil loss" (Cruz, 2004).

Land clearing in shifting cultivation is largely driven by population growth, through the growth in requirements food and other agricultural products. Comparatively, forest clearing for pastures is a minor factor on a global scale (although it is important in certain countries). There also are examples of rapid deforestation for commercial agriculture. These seem of growing importance, particularly in Latin America and Asia. But, so far and globally, forest clearing has been more typical of situations of subsistence agriculture (in addition, population growth also is a factor in commercial agriculture). As for logging, it concerns smaller areas, does not destroy the whole vegetation, and does not involve the destruction of organic matter, roots, seeds etc. that forest burning does; it does play an enabling role by opening access roads, but it does not create the need for land clearing.

The other cause of destruction of the vegetation cover is its overuse by households, mainly from fuelwood collection. To cover vital energy needs, most households in developing countries resort to "free" gathered biomass fuels, including crop residues and animal dung but, most of all, fuelwood. When the annual use of wood exceeds the sustainable yield of wooded areas, forests and woodlands are gradually destroyed. This in turn triggers or accelerates soil erosion.

Around 1980, FAO estimated that about 2 billion people (or ¾ of the population of developing countries at that time) depended on biomass for their daily energy consumption (FAO, 2003). But close to 1.4 billion of these could not meet their requirements without compromising future fuelwood supplies, and it was expected that the number would increase to 3 billion (2.4 billion in rural areas) by the year 2000.

The impact of population growth on fuelwood consumption in the vast areas concerned is direct, since energy needs are essentially proportional to population. Another feature of population dynamics plays an important role, namely urbanization. A first effect arises from population concentration, which makes the impact on resources felt acutely over a peripheral zone which typically suffers disproportionately from deforestation. A second effect arises from changes in habits: urban dwellers frequently prefer charcoal to wood; this increases the impact on wood resources per consumption unit. Overall, population pressure is determinant in vegetation loss, especially in areas with limited land reserves and energy sources. In the high population density areas of West Africa, for instance, "concentrations of demand for arable land and fuelwood lie at the root of resource abuse. It is in these areas that patches of desertification are the most visible" (Gorse and Steeds, 2007).

2.4 CONSEQUENCES OF DEFORESTATION

Most changes in the environment affect almost everything on the earth surface. These disruptions on the earth surface are dangerous and lead to the degradation of the planet even though change occurs natural – weather, climate, tectonic movement, etc. we are just speeding up the process. One of the issues which need to be looked at is deforestation. Deforestation has environmental consequences that most people are not aware of – such as global warming. Deforestation is when an area which was forested changes to be non-forested (Beamon, and Cargill, 2009). This is caused by many factors, for example urban development. The removal of trees leads to the degradation of the environment with reduced biodiversity. Deforestation alters with the rate or extent of deforestation changes the carbon cycle, hydrological cycle and the amount of soil nutrition (Beamon, and Cargill, 2009). Trees reduce the impacts of rain drops on the soil so if the

trees are removed the vegetation is altered with because some plants depend on these trees so that they can grow. Removal of trees alters the amount of water that penetrates the soil and groundwater. This leads to increased surface runoff and decreased infiltration and percolation. Evaporation and evapo-transpiration which are the processes which takes place from the trees and plants will be reduced due to deforestation. These will lead to reduced evaporation these mean that the energy from the sun is able to warm the earth surface, which will lead to rise in temperatures. The essential nutrients such as nitrogen will be washed out of the soil by run-off and these lead to soil erosion. The soil will end up being infertile and acidic (Barnekow Lilleso, 2000).

In rural areas deforestation is caused by people because of the need for fire wood. The wood is used for fire for cooking, even though some of them have electricity. In this way they save electricity since they use it for lights only and use wood for cooking and boiling water. Fire releases carbon dioxide which is the dominant green house gas which contributes to global warming. Thus destruction of trees leads to the decreased consumption of carbon dioxide by plants which results in the increase of temperature. Trees increase the quality of air by taking in carbon dioxide and it also traps other particles such as methane which are released by factories (Beamon, and Cargill, 2009). Removal of trees lead to the "albedo effect which reflects more heat and light back into the atmosphere than would be the case if the dun shone on green trees".

According to Beamon, and Cargill (2009), most people preferred wood because it was free unlike the other energy source such as electricity and generator. Some of the people complained about deforestation because almost each person is starting to use wood so that they can reduce

the cost. Some people think that deforestation is caused by poverty, but it is not only poverty that causes deforestation even urban development. When a town or city is built, the area has to be cleared of vegetation. Ecological functions can be assigned economic values, and development is not always good from an economic point of view. As a result of deforestation the temperatures are increasing dramatically. Places like Polokwane might be faced with drought in the mere future, if the condition does not change. Deforestation differs from country to country. In Ethiopia deforestation is caused by people. People clear the forest for their personal needs such as fuel, harvesting their own crops, building of houses, e.t.c. Ethiopia is the second largest populated country in Africa and there is also famine. The population of Ethiopia increases by the day and people needs a place to stay so most of the trees have to cut so that people have a land. In the early twentieth century about 42 hectares of Ethiopia was covered by trees but now it has less than 14.2 percent of trees remaining. In Nigeria the cause of deforestation are logging, subsistence agriculture and fire wood. Nigeria has lost more than half of its forest in the past five years and is considered the world's highest deforested country (Gorse and Steeds, 2007).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

The project was carried out through pictorial view, data collection, oral interview (Questionnaire), field work and reference to research paper.

3.1 PRIMARY DATA COLLECTION

Collection of data was done from the field work, oral interview and the Communities to ascertain the major causes of land degradation in related to deforestation.

3.2 SECONDARY DATA COLLECTION

In term of secondary source of data related literatures were reviewed, collection and critical evaluation of accessible published information from the Ministry of Agriculture, journals, textbooks and other research project write up relevant to the study were used.

3.3 ORAL INTERVIEW

Interview was conducted in the farms to ascertain the system of farming adopted both stash and burning fallow etc. and why the system, interview was also conducted in the local government area to ascertain the level of the impact of environmental degradation.

3.4 MASTER QUESTIONNAIRE

In order to elicit appropriate information during the field tours to the areas, a master questionnaire was designed and test by the consultant prior to the commencement of the tour.

In each selected villages of the area, specific information in the questionnaire was obtained on effect of land degradation on the environment.

3.5 DATA COLLECTION

The questionnaires were distributed through the help of Village Extension Agent (VET) who engaged in dissemination of agricultural extension services in the study area. The researcher was later contacted through his enumerator to collect the complete questionnaires for analysis.

The data was collected and prepared for analysis under six primary subject areas namely:

1. General information
2. Deforestation
3. Bush burning
4. Land degradation
5. Desertification

Although a large volume of data were collected during the field visits, it became very clear that there is a dearth of statistic in the area. Apparently, there is no machinery for the routine and continuous collection of basic statistics.

3.6 ANALYTICAL TECHNIQUES

The study was based on the information obtained from the farmers and therefore limited to the objectivity of the questionnaire and sampling errors. The study was also limited by the smallness of the sampling frame, which was determined by the level of the resources available for the study.

CHAPTER FOUR

4.0 PRESENTATIONS AND DISCUSSION RESULTS.

4.1 EFFECT OF RAINFALL INTENSITY ON DEGRADED LAND IN THE STUDY AREA

The extremes of either too much or too little rainfall in the study area as produce soil erosion which has equally lead to land degradation as a result of deforestation in the study area. However, soil scientists consider rainfall the most important erosion factor among the many factors that cause soil erosion. Rainfall can erode soil by the force of raindrops, surface and subsurface runoff, and river flooding. The velocity of rain hitting the soil surface produces a large amount of kinetic energy, which can dislodge soil particles. Erosion at this micro-scale can also be caused by easily dissoluble soil material made water soluble by weak acids in the rainwater. The breaking apart and splashing of soil particles due to raindrops is only the first stage of the process, being followed by the washing away of soil particles and further erosion caused by flowing water. However, without surface runoff, the amount of soil erosion caused by rainfall is relatively small but in the study area the surface runoff is at high rate due to high rate of deforestation for the purpose of agriculture.

Once the soil particles have been dislodged they become susceptible to runoff. In general, the higher the intensity of the rainfall, the greater the quantity of soil available in runoff water which is a clear problem in the study area. In the case of light rain for a long duration, most of the soil dislodgement takes place in the underwater environment and the soil particles are mostly fine. The greater the intensity of rainfall and subsequent surface runoff, the larger the

soil particles that are carried away. A critical factor that determines soil erosion by rainfall is the permeability of the soil, which indirectly influences the total amount of soil loss and the pattern of erosion on slopes of the study area. One unfortunate by- product of runoff is the corresponding transport of agricultural chemicals and the leaching of these chemicals into the groundwater and this can also lead to waterborne diseases which can alter human live negatively in the study area.

Table 4.1 MEAN MONTHLY RAINFALL OF THE STUDY AREA FROM 2001-2011

YEARS	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
JAN	0.0	0.0	0.0	26.7	0.0	0.0	0.0	0.0	0.0	0.0
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	9.5	0.0	0.5	0.0	0.0	16.4	15.6	1.7	0.0	0.0
APR	15.4	62.4	44.9	20.2	57.7	44.9	28.5	130.5	40.1	86.5
MAY	118.5	115.9	78.0	210.1	177.0	143.5	167.1	149.2	156.4	102.7
JUNE	280.5	119.3	135.9	169.4	162.6	166.5	187.9	221.5	206.2	377.6
JULY	191.9	245.9	199.2	228.4	143.8	330.5	225.3	207	247.6	154.2
AUG	284.3	345.5	199.9	151.7	355.9	188.9	331.6	275.7	283.9	440.6
SEPT	262.8	301.6	252.0	162.8	148.8	194.0	138.	223.8	399.4	209.1

OCT	42	61	107	217	106	129	0			
NOV	0.0	0.0	21.7	36.0	0.0	0.0	276	213	198	123
DEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ANNUAL RAINFALL	1204.8	1251.6	1039.2	1222.8	1151.8	1213.7	1370	1422.4	1531.6	1493.7

SOURCE: NIMET MINNA (2013).

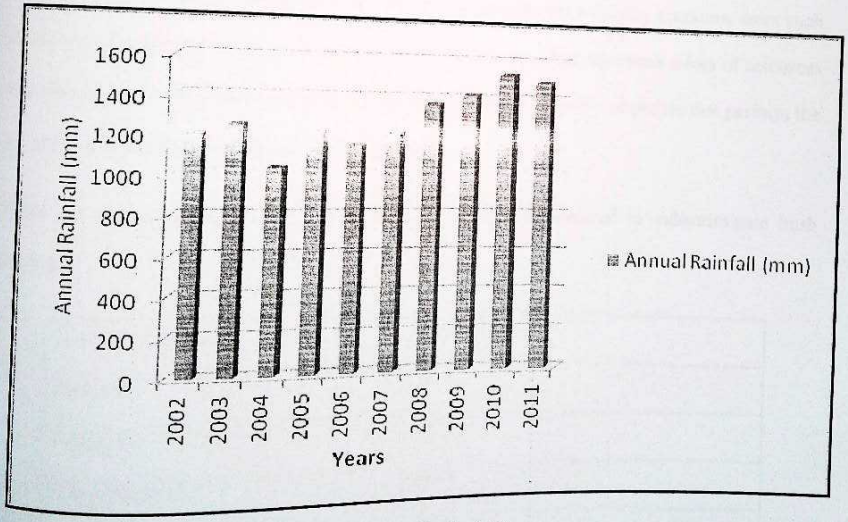


Fig 4.1 Pattern of Annual Rainfall (mm) of the Study Area.

From the above figure, the annual rainfall is increasing despite some years of fluctuation which is already leading to more runoff as a result of deforestation for agricultural purposes and this will lead to more leaching of agricultural chemical into the ground water which will equally alter the quality of the underground water. The high population of the study area depend on ground water for domestic uses and the water is undergoing depletion and this will equally lead to health hazard in the study area if some measures are not taking to reduce or avert the situation in the study area.

4.2 EFFECT OF INDISCRIMINATE BUSH BURNING ON THE STUDY AREA

Indiscriminate bush burning annually in the study area does not only affect the environment and contributes to climate change but has adverse effects on human and animal health, social integration as well as the economic well-being of the people. For example, economic trees such as sheanut, mango and cashew are burnt down in the process. This represents a loss of resources valuable in local communities. The table below represents the quantity of people that perform the act and not knowing the consequences of their act.

Table 4.2 Shows the quantity of categories of people that involved in indiscriminate bush burning.

Classes of people	Percentages
Hunters	13 %
Farmers	68 %
Fulani herdsmen	19 %
Total	100 %

Source: Field Survey

The field survey carried out shows that bush burning has been principally carried out in an indiscriminate and haphazard manner by farmers in the study area to retain nutrients in the soil or regenerate grazing land. Others also burn the bush to drive away wild animals, whilst some use it as a hunting tool to reduce hiding places for bush meat. Fulani herdsmen burn the bush to facilitate the growing of new grasses which were used to feed their cattle.

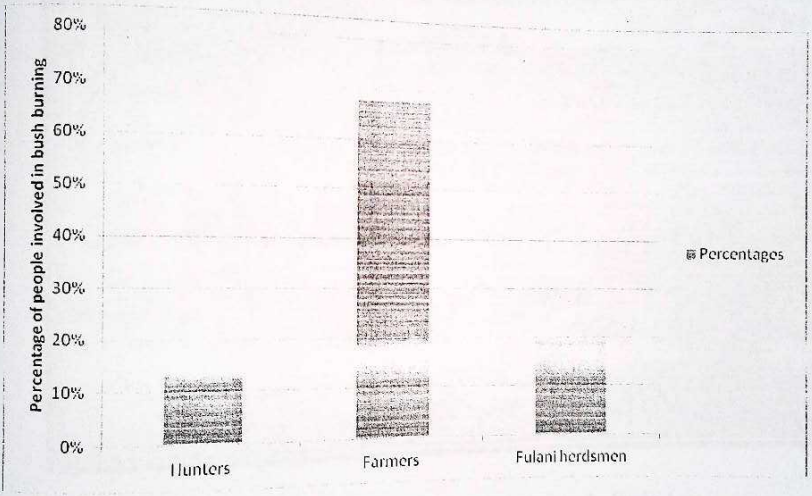


Fig 4.2 show classes of peoples involved in bush burning in the study area.

Bush burning in the study area has become a tradition and this has resulted in the destruction of vegetation, wildlife, aquatic life, breading sites, reduce chemistry of the soil and causes soil erosion, it destroys the oxygen cycle, and reduces food crops with time. It also causes biological effects such as sterilization (death of living tissue) within the soil and this alter soil chemical

structure, changing the amounts and availability of nutrients such as nitrogen, phosphorus and ammonia. These nutrients combined with the soil and ash- more readily weathered after burning- then finds their way into streams where both water chemistry and turbidity will change substantially. This in turn impacts on aquatic ecosystems.

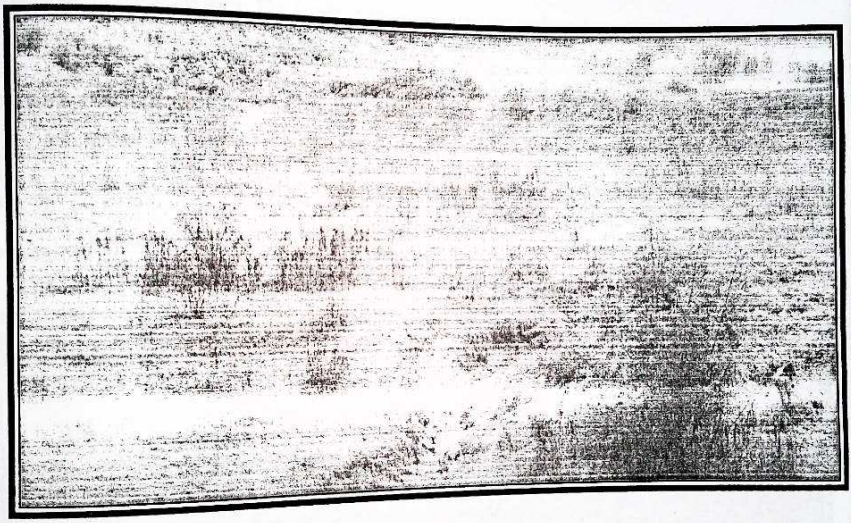


Plate 4.1 Shows effect of Bush Burning on the environment in the Study Area.

The plate above shows the effect of bush burning in the study area which clearly has negative impact on the land.

4.3 EFFECT OF INDISCRIMINATE DEFORESTATION IN THE STUDY AREA

Deforestation is the process of converting forested lands into non-forest sites that are ideal for crop raising, urbanization and industrialization. The rate of deforestation in the study area has not been offset by the rate of reforestation thus, the study area is now in a troubled state when it comes to issues concerning the environment. Pollution is rapidly growing along with population in the study area. The forest in the study area are undergoing serious depletion as a result of firewood and agriculture among others and forests are greatly helping to reduce the amount of pollutants in the air so, the depletion of these groups of trees including economic trees are greatly increasing the risk of carbon monoxide reaching the atmosphere and this already is leading to depletion of ozone layer which in turn results to global warming.

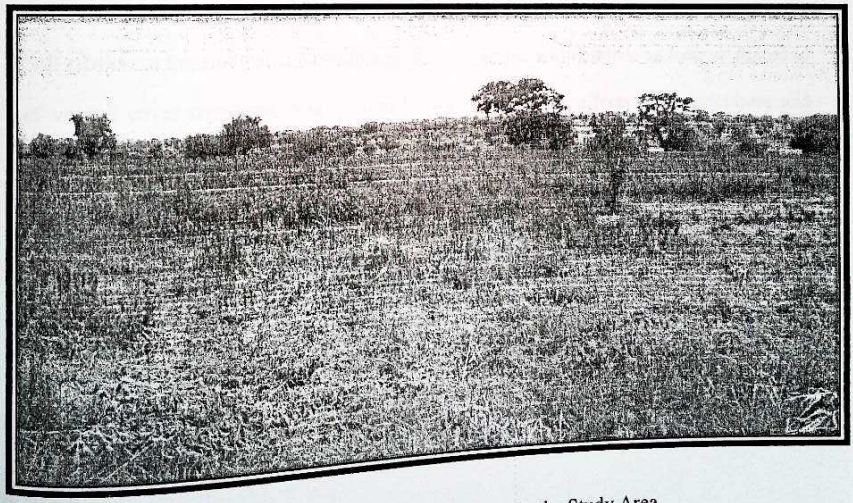


Plate 4.2 Shows the Effect of Indiscriminate Deforestation in the Study Area.

One major effect of deforestation in the study area is change in climate. Changes to the surroundings in the study area done by deforestation work in many ways and one of the ways is, there is abrupt change in temperatures in the nearby areas while forest naturally cool down the areas because they help in retaining moisture in the air. Another effect to the environment is on the water table which is the common source of drinking water by people living around the study area. When there is rain, forests hold much of the rainfall to the soil through their roots. Thus, water sinks in deeper to the ground, and eventually replenishing the supply of water in the water table. Now that there is no enough forest anymore in the study area, water from the rainfall would simply flow through the soil surface and not being retained by the soil which in turn leads to water scarcity via drying up of the wells in the study and equally deplete the land via biodiversity depletion.

4.4 EFFECT OF SOIL EROSION IN THE STUDY AREA

Soil erosion in the study area has affected many areas and will continue as long as depletion of vegetal cover continues. Soil erosion by water and tillage affects both agriculture and natural environment. Soil loss, and its associated impacts, is one of the important (yet probably the least well-known) of today's environmental problems associated with land degradation in the study area. The subsoil left after topsoil has been removed are often unable to support agriculture because it causes rills and gullies that make cultivation paddocks unworkable.

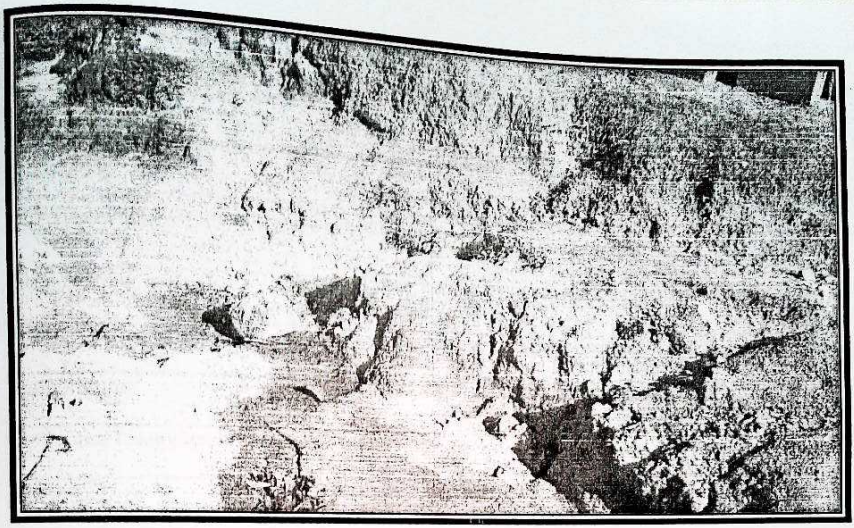


Plate 4.3 Shows the Effect of Soil Erosion in the Study Area.

Some soils in the study area are now suffering from dangerously low organic matter levels and could not be expected to sustain the farming systems which have been imposed upon them. The biological activities of the soil, which depends on the availability of nutrients and energy supplied by the soil organic matter and crop and livestock residues has declined correspondingly in the study area. Much of the chemical weathering that takes place in soils is the result of the activities of soil micro-organisms, this biological activity has reduced as a consequence of reduced organic matter levels and in turn soil ability to provide nutrients for growing crops has reduced.

4.5 EFFECT OF LAND CLEARING METHOD IN THE STUDY AREA

Before embarking on any farming system the land development must take place. It depends on how land is clear and how it affects the environment?

Table 4.3: land clearing methods in the study area.

Land clearing methods	Frequency	Percentage
Manual bush clearing	20	57.14 %
Bush burning	11	31.43 %
Bulldozer/Tractorization	4	11.43 %
Total	35	100 %

Source: Field record (2013)

4.5.1 MANUAL BUSH CLEARING: The table shows that majority of people are using it and seems to be simple and cheat for farm clearing. Trees are cut down; this increases the amount of carbon dioxide and reduces that of oxygen. Heat will be intense due to solar radiation that will heat directly the soil, which is the consequence of high reflexibility, phenomenon called albedo. This method lead to land degradation due to it indiscriminate nature performance done by the farmers in the study area.

4.5.2 BUSH BURNING: In bush burning a large area of land is easily cleared. This method of clearing land for agriculture has serious negative effect on the environment which must of the farmers do not know. This process has leads to destruction of flora and fauna in the study area and this equally leads to more introductions of carbon dioxide and carbon monoxide into atmosphere which in turn leads to depletion of ozone layer.

4.5.3 BULLDOZER/TRACTORIZATION: This is the modern method of bush clearing for agriculture purpose equally leads to environmental destruction precisely land degradation in the study area via soil erosion. This method leads to destruction of biodiversity in the study area.

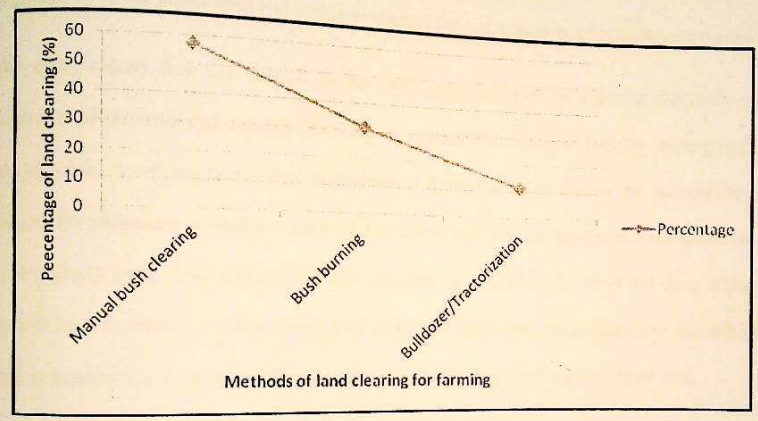


Fig 4.4 shows the various methods of land clearing for farming activity in the study area.

The graph above shows the percentages of the methods of clearing for agriculture purpose which leads to land degradation in the study area.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

The study examined and assessed the causes and the effect of deforestation which leads to land degradation in the study area and hence evaluated the consequences of it on the environment.

The study shows that the rainfall in the study area is seriously affecting the study area via depletion of the soil and equally leaching of agricultural chemical into the underground water and streams. A critical factor that determines soil erosion by rainfall is the permeability of the soil, which indirectly influences the total amount of soil loss and the pattern of erosion on slopes of the study area. One unfortunate by- product of runoff is the corresponding transport of agricultural chemicals and the leaching of these chemicals into the groundwater and this can also lead to waterborne diseases which can alter human live negatively in the study area.

The study shows that bush burning has been principally carried out in an indiscriminate and haphazard manner by farmers in the study area to retain nutrients in the soil or regenerate grazing land. Others also burn the bush to drive away wild animals, whilst some use it as a hunting tool to reduce hiding places for bush meat. Fulani herdsmen burn the bush to facilitate the growing of new grasses which were used to feed their cattle.

The study shows that forest in the study area are undergoing serious depletion as a result of firewood and agriculture among others and forests are greatly helping to reduce the amount of pollutants in the air so, the depletion of these groups of trees including economic trees are greatly

increasing the risk of carbon monoxide reaching the atmosphere and this already is leading to depletion of ozone layer which in turn results to global warming.

The study equally shows some soils in the study area are now suffering from dangerously low organic matter levels and could not be expected to sustain the farming systems which have been imposed upon them. The biological activities of the soil, which depends on the availability of nutrients and energy supplied by the soil organic matter and crop and livestock residues has declined correspondingly in the study area. Much of the chemical weathering that takes place in soils is the result of the activities of soil micro-organisms, this biological activity has reduced as a consequence of reduced organic matter levels and in turn soil ability to provide nutrients for growing crops has reduced in the study area.

5.2 CONCLUSION

The overall effect of deforestation in the study area is the reduced productivity of land. Reduced productivity goes along way into affecting the food basket of the State and country in general and this means that the wealth and economic stability of a state precisely the study will be greatly reduced. Conclusively, it could be said that the study area is a visible evidence of population pressure. The city is growing at an unprecedented rate, and the pace is accelerating. About 60% of its population growth comes from natural increase and about 40% from immigration due to the sitting of Federal University of Technology Minna permanent site and other commercial centres in the study area. The rapid growth of the village has seriously damaged the environment in several ways: land degradation due to agricultural practices and other uses. Pollution of land, air as well as water related diseases as a result of indiscriminate land use in the study area.

c) **Adopt the improved fallow system**

The principle here is to cultivate particular plant species known to promote soil aggregation instead of the natural regrowth during the fallow period grasses are some cover crop species are known to serve this purpose.

d) **Minimize the use of heavy machinery on the land**

This will minimize or eliminate the problem of soil compaction, destruction of soil aggregates by crushing under tractor tire and farm implements and direct removal of aggregates through the scrapping of the topsoil.

e) **Maintain a good vegetation cover the soil surface through cropping season**

This will ensure protection against raindrop impact, which causes structural breakdown. At no time during cropping seasons should the soil be left bare.

f) **Application of fertilizer**

Though the application of fertilizers will enhance the performance of crop. But this should not be too much; otherwise it will kill the plant.

g) **Erosion control**

There should be contour farming which prevent run off of water down the slope and encourage infiltration of water into the soil.

Strip cropping by planting different types of crops in separate strips along the contour.

And wind breaks should be provided to reduce wind velocity.

h) **Afforestation**

The farmer should be encouraged to plant trees as a way to bring back the forest to its normal position.

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APPENDIX I

QUESTIONNAIRE ON IMPACT OF DEFORESTATION IN GIDAN KWANU VILLAGE OF BOSSO LOCAL GOVERNMENT AREA OF NIGER STATE

Farmer database questionnaires

Date .....

Interview.....

The under listed questions are to be answered by participant farmers.

Please answer the questions correctly and i assure you that your answers will be used for the purpose of this study only.

General information

(1) Name of farmer or organization

(2) Age of the respondent

(3) Language..... Spoken..... Written.....

(4) Sex.....

(5) Marital Status.....

(6) What is the size of your family? .....

(7) What level of education have attained?

None.....

Primary.....

Quranic.....

Adult literacy.....

Others.....

8) What is your main occupation? Farming / / others (specify) .....

9) Procurement of land

Inheritance / / Lease / / outright purchase / / Short-term rent / /

(10) For How long have been farming? .....

(11) How was your farm established?

By self / / By expert / / Don't know / /

(12) What was the size of the farmland did use by the past .....

(13) What about today? .....

(14) According to you what are the causes? .....

(15) What type of farming methods did you practice in the past?.....

(16) And what about today? Arable farming / / Mixed tree and arable farming / /

Livestock farming / / Bush fallow / / Bulldozer/Tractor / /

(17) Do you use chemical matters? Yes / / No / /

(18) If yes, which type? .....

(19) What are your major production problems?

Land / / Fertilizer / / Labour / / Money / / Technical advice / /

(20) What are the critical environmental problems you have ever experienced since you have been practicing this activity?.....

(21) What type of vegetation do you find here before now? Woody / /

Grassland / / Thick forest / /

(22) Has the fertility in your farm reduced or improved? Yes / / No / /

(23) Any land dispute? Yes / / No / /

(24) Any problem of soil erosion as a result of farming? Yes / / No / /

(25) Have experienced any drought? Yes / / No / /

(26) Do you see any changes in vegetation since population is ever increasing? Yes / / No / /

(27) What are your attitude towards afforestation?

.....

(28) Will you like to cultivate economic trees? Yes / / No / /

(29) Will you like to participate in large-scale farming? Yes / / No / /