DESCRIPTIVE ANALYSIS OF FUELWOOD EXPLOITATION IN RAFI LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA

BY

ABUBAKAR, GARBA MAGAJI
M.TECH/SSSE/2007/1603

DEPARTMENT OF GEOGRAPH FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

APRIL 2010

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

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DECLARATION

I, Abubakar Garba Magaji, hereby declare that this research project has been a personal academic undertaking, solely carried out under the supervision of Prof.G.N. Nsofor of the department of Geography, Federal University of Technology, Minna.

Credit has been given to writers whose works have been cited or referred to in the Thesis.

..... 10/05/2010.

Abubakar Garba Magaji Date

CERTIFICATION

This Thesis titled: **Descriptive Analysis of Fuelwood Exploitation in Rafi Local Government Area of Niger State, Nigeria by: Abubakar, Garba Magaji** (M.Tech/SSSE/2007/1603) meets the regulations governing the award of the degree of Master of Technology (M.Tech) of the Federal University of Technology, Minna and is approved for its contribution to scientific knowledge and literary presentation.

Prof. G. N. Nsofor 10/5/13
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Name of Head of Department Signature & Date

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ABSTRACT

A descriptive analysis of fuelwood exploitation study was conducted in 2009 covering the administrative wards in Rafi local government of Niger state. The aim and objectives of the study were to identify sources, extent, consequences and suggests possible solution to mitigate the effects of fuelwood exploitation in Rafi Local Government Area. Data were collected through accidental sample technique from the sampled population using structured questionnaire and personal observation. The data were analyzed using descriptive statistics technique (proportion or percentage) of the respondents and the results presented in tables. The results showed that the major source of fuelwood collection included own land, private land, roadside and state forest. It also revealed that fuelwood users obtained their fuelwood through purchase and self-cutting in the study area. The findings further revealed extent of fuelwood exploitation through long distances covered by the respondents to collect fuelwood and the high dependence on fuelwood as their main source of energy. The consequences of fuelwood exploitation found in Rafi Local Government include: vegetation depletion, destruction of biodiversity and soil erosion, exposure of the environment to weather elements leading to leaching, increase in evaporation which may lead to ecological imbalance in the area. Intervention measures to improve efficiency and sustainable exploitation of fuelwood were recommended such as provision of affordable alternative energy sources, public enlightenment, awareness, community participation in decision making on the consequences of fuelwood exploitation and the need for sustainable use of forest resources. There is also the need for proper implementation of government policies that would lead to efficient use of the natural resources for sustainable development.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Exploitation of natural resources is an essential condition of the human existence. Throughout history, humans have manipulated natural resources to produce the materials they needed to sustain growing human populations. This refers primarily to food production, but many other entities from the natural environment have been extracted. The unsustainable exploitation of the natural resources results into deforestation, destruction of wetlands, desertification, Soil erosion, declining oil and mineral supplies, coastal degradation, overfishing, groundwater contamination and depletion, surface water shortages, Ozone depletion. At the grassroots community level, many resources are still perceived as "free" and "without limit." There is lack of public awareness of the potential scarcity of the resources involved. Partly resulting from this lack of knowledge or awareness, and hence high pressure, resources are being liquidated for immediate economic gain rather than being managed sustainably.

Fuelwood exploitation is the cutting down of trees and the burning of trees for an alternative source of energy. And also, one of the cheapest and reliable sources of energy for domestic use in rural areas as well as in urban areas. It is one of the factors that can lead to deforestation. Deforestation can be defined as an act leading to removal or destruction of forest vegetation (trees, shrubs, herbs, woody climbers, thorns, etc) especially with unaccompanied deliberate efforts at its replacement. Land degradation may be defined as the loss of utility or potential utility through the reduction of or damage to physical, social, cultural or economic features, and/or reduction of ecosystem diversity. There may be a single cause or a complex mix of causes, which may either be biogeophysical ('natural') or socioeconomic ('human'). And it is quite possible that cause(s) may be indirect, perhaps cumulative and difficult to identify. A major challenge is to learn how interactions between development and environment can be better managed to increase prospects for ecologically and socially sustainable improvements to human well-being.

Demand for fuelwood in general terms is more than the supply in some countries located in semi-arid region. Approximately 80% of the total energy used for domestic needs per annum in rural areas in Nigeria, Kenya, Zambia, Zimbabwe, Senegal, Ivory Coast and Namibia are sourced from charcoal and firewood (Fuwape 1993).

In order to avoid further environmental and ecological degradation that scarcity of fuel-wood may cause, it is necessary to consider methods of alleviating the current fuel-wood crisis. Growing more trees may solve the problem of acute scarcity and deficit supply of wood. The concept of growing high-yield multipurpose plantation trees under short rotation and intensive culture (SRIC) has been introduced in semi-arid of some African countries (Hansen, A.J 1991). Such multi-purpose trees, in addition to providing fuel-wood and also be a sources of forage for livestock, silkworms, herbal medicine, gums, dyes and vegetable oil. The selection of SRIC energy plantation tree species depends on the ease of tree propagation, initial growth, biomass yield, ability of the trees to coppice after harvest and good wood combustion characteristics (Lucas, E.B and Fuwape, A.J 1982). Some of the suggested tree species for fuel-wood plantation are: *Acacia auricliformis Casuarina equisetifolia, Gliricidia Sepium, Gmelina arborea, Sesbania grandifolia* for humid areas and *Acacia* species. *Albizia lebbeck, Azadirachta indica, Cajanus cajan, Cassia siamea* and *Encalyptus* species for arid and semi arid regions (Ayensua et al 1981).

The most striking feature of the African energy situation is over consumption of low grade traditional energy source (fuel wood, charcoal and non-woody biomass), and on the other hand under consumption of highly quality modern fuels (coal, electricity, gas). The interactions of social, economic, cultural and political factors are main forces that drive people to fire wood activities. In rural areas, deforestation is caused by rural people because of the need for fire wood to meet their daily domestic and commercial demand. There is often a tendency for marginalized rural groups to be blamed for environmental degradation, as they have little public voice and their interactions with the environment are more obvious, compared, for instance, with an urban consumer of fuelwood. The main culprits of desertification are failure of the market to reward restraint in firewood extraction, institutional failure to manage forests sustainably, and lack of livelihood alternatives. Most of the industries, wood energy is consumed by small scale industries

which include food processing industries, service sectors such as brewing, fire smoking, salt production, baking, restaurants, schools, hospitals, and agro-processing industries such as tobacco curing, tea lime, smith, laundries, pottery and ceramics. These industrial and domestic activities result into environmental hazards. The industries and domestic activities, which rely upon wood energy, provide employment and income for rural people particularly during off-season in agricultural production (Monela and Kihiyo 1999).

The population change in the continent of Africa seems to be the centre of prevailing development challenges. This is applicable to the countries in which Nigeria is not excluded. Furthermore, due to the anticipated steady increase in population and it is expected that actual consumption of fuelwood and charcoal would continue to rise (Monela and Kihiyo, 1999). Commercial fuelwood exploitation such as charcoal requires large volume of wood, which in turn depletes tree stock causing deforestation. Little is known about the extent of deforestation due to urban charcoal and fuelwood use; neither are social and economic pattern, which determine the fuelwood exploitation or the policy options available to mitigate the problem.

The massive demand for cheap source of energy for domestic and commercial use in Africa which Nigeria is not exempted from as well as the study area, which if not checked would have far reaching consequences on man and the environment.

Therefore, there is the need to study the environmental consequences of fuelwood exploitation in Rafi Local Government Area of Niger state.

1.2 Statement of Research Problem

Fuelwood exploitation in Rafi Local government of Niger state has been on the increase as a result of man's multiple desire to meet his need. In the absence of cheap and readily available alternative source of energy for domestic use, tree cutting (felling) to provide fuelwood for domestic and even commercial activities such as cooking and baking are increasing on daily basis.

The accessibility of major roads in Rafi Local Government Area has not only encouraged population growth and residential expansion, but also commercial activities. This expansion results in rapid rate at which these environmental resources (fuelwood) are depleted in the quest to satisfying human needs. The needs for cheap sources of energy have led to massive exploitation of natural resources (fuelwood) for commercial purposes. If this trend is not checked it is feared that it will lead to deforestation. Deforestation may invariably result in ecological disaster such as land degradation, soil erosion, drought, desertification, climate change and biodiversity loss and this would not only affect the environment but also affect man.

It is inview of the above that this research seeks to study the sources fuelwood, extent fuelwood and environmental consequences resulting from fuelwood exploitation in Rafi Local Government Area of Niger State.

1.3 Aim and Objectives

The aim of this research work is to study the sources of Fuelwood, extent of fuelwood and environmental consequences of fuel wood exploitation in Rafi Local Government area of Niger State.

The objectives are:

1. To identify the sources of fuelwood in Rafi Local Government Area.
2. To identify the extent of fuelwood exploitation in Rafi Local Government Area.
3. To assess the environmental consequences of fuelwood exploitation in Rafi Local Government Area.
4. To propose possible interventions that can be carried out in order to sustain the supply of fuelwood and to mitigate the adverse effects of its exploitation in Rafi Local Government Area.

1.4 Scope of the Study

The scope of this research is specifically based on the "fuelwood exploitation" in Rafi Local Government Area of Niger State. This study will cover the identification of sources, extent and the environmental consequences of the fuelwood exploitation in selected wards within the study area. The research would recommend possible interventions that can be carried out in order to sustain the supply of fuelwood so as to mitigate its adverse effects in the study area.

1.5 Justification of the Study

Rafi Local Government Area is as old as the state itself. The Local Government Area was created on the 1st April 1976. The major towns in the Local Government includes: Kagara, Tegina, Pandogari, Yalwa, Yakila, Kusherki.

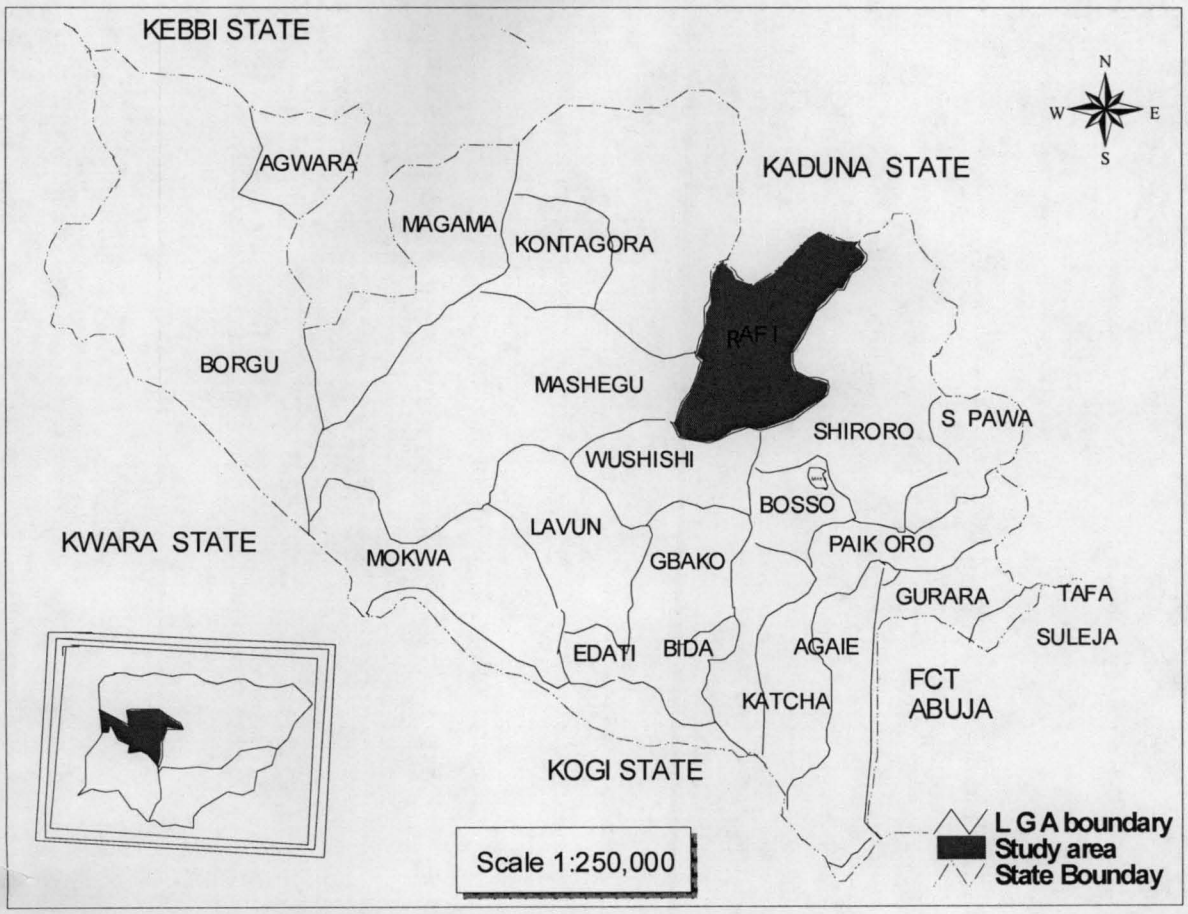
The Lagos – Kano express (trunk A) road passes through Tegina, Kagara,Pandogari and Kusherki while Minna express way joins Lagos - Kano road at Tegina and it cuts across Garon Gabas and Yakila towns. This has influenced the rate of trade as well as the residential growth. The expansion of these towns results in more pressure on the available natural resources. The pursuit of satisfying human needs, has led to the over exploitation of natural resources which on the long run is bound to have great consequences on the environment. Therefore, information (data) on sources, extent and effects of firewood exploitation in the study area is important for the sustainable utilization of resources and development.

However, research information is lacking on the environmental consequences of fuelwood exploitation in the study area. Therefore, there is the need to carry out this research to fill the information gap. This research work would pave way or basis upon which further research in related fields can be conducted in future in the study area.

1.6 Description of the Study Area

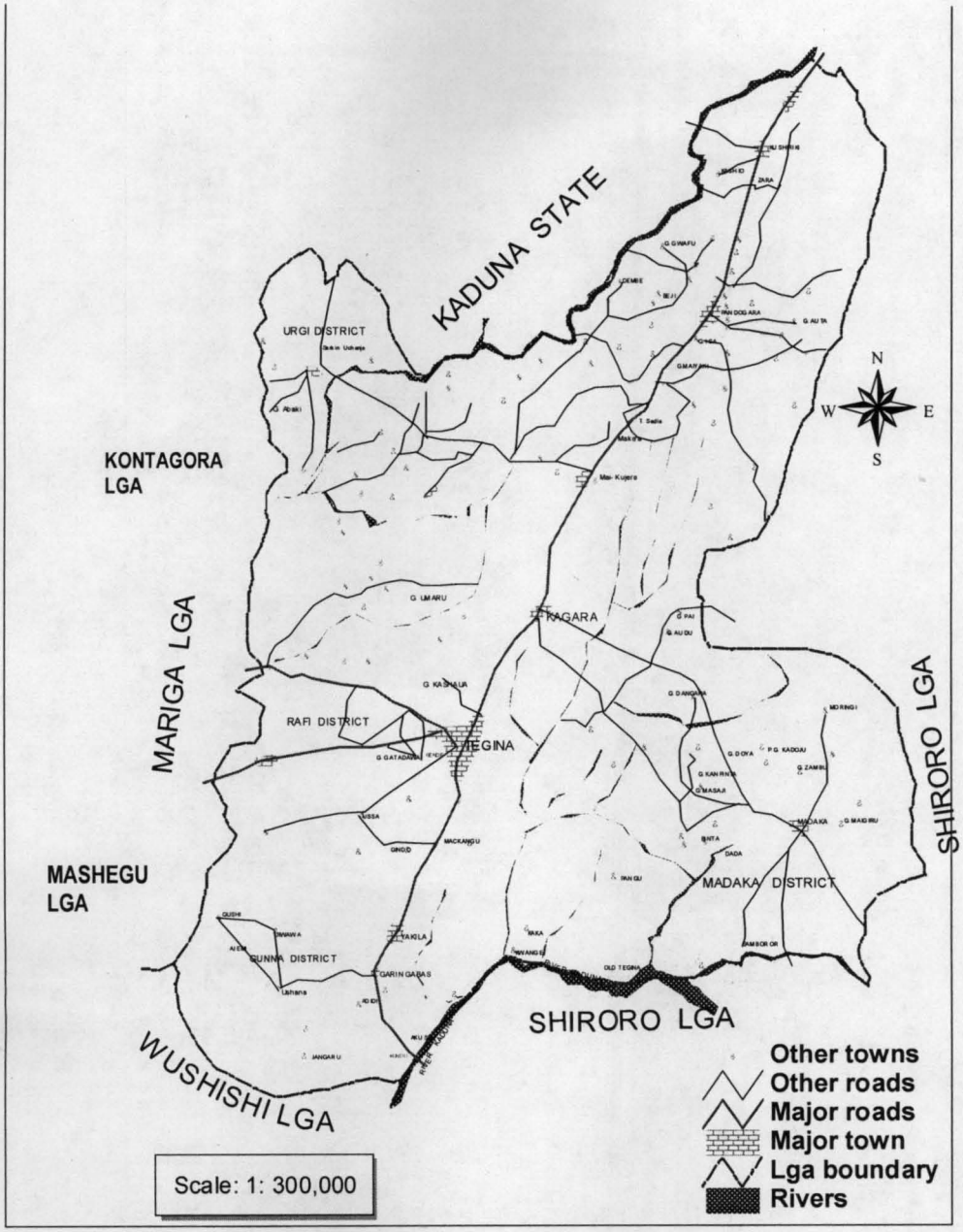
1.6.1 **Location**

Rafi Local Government Area is as old as the state itself and was created on the 1st April 1976.Rafi Local Government Area has its headquarters at Kagara. It is located within latitude $9^0$11N and 9^0 30N, and longitude $5^0$20E and $6^0$15E. The study area covers a land mass area of 6,606.14km^2. The Local Government Area shares boundary with Kaduna state on the northern part, to north-east by Shiroro L.G.A, to the south –east by Wushishi L.G.A, West by Mashegu andNorth – West by Mariga L.G.A. (See fig1.1). The study area consists of six districts; Kagara, Gunna,Madaka, Kusherki, Kongoma and Uregi district (See fig 1.1 and fig 1.2).



Source: DataNET Catograhic Consult. Minna

Fig 1.1 Map of Niger State Showing Rafi Local Government Area



Source: DataNET catographic consult.Minna

Fig.1. 2 Map of Rafi LGA showing Towns & Roads

1.6.2 Population

The population of Rafi Local Government is not evenly distributed; there are areas of high, moderate and low population. The uneven distribution is due to factors like climate, fertile soils, natural attachment/historical factors, administrative headquarters, employment

opportunities, presence of minerals resources, industries, social amenities and infrastructures, commercial activities and migration. The population of the entire Local Government Area based on the National Population and Household Census of 2006 had a population of 181,929 people.

1.6.3 Climate

Rafi local Government Area is situated within Sudan savanna of northern Nigeria, as such shares the climatic characteristic of the savanna region. The mean annual rainfall is about 1100mm with the highest monthly record received between July and September. There is a long period of little or no rainfall (i.e. dry season of 4-8 months). The temperature is high throughout the year ($21^{oc} - 33^{oc}$). The mean maximum monthly temperature is 30^0c and the mean minimum temperature is about 25^0c in September. The relative humidity is low (20-40%) in January and (50-60%) in July. The area is influenced by N.E trade wind, which brings cool and dry harmattan wind in dry season and S.W monsoon wind, which brings a warm wet wind in rainy season (Maxlocks, 1980).

1.6.4 Geology

Rafi Local Government Area lies on the geological base of undifferentiated basement complex rocks of mainly Igneous, metamorphic and sedimentary within the high plains of Hausa land whose average elevation stand at 750m above sea level. The soils are laterite and ferruginous tropical soils with abundant lithosol and raw minerals on the interfluves. The laterite soils are associated with Guinea savanna. The soils are heavily leached due to rainfall and usually reddish in colour due to presences of iron. They are also sticky when wet and hard when dry. There are also minor occurrences of hydromorphic soils and weakly developed soils of alluvial deposits on the valley and rivers (Maxlock, 1980).

1.6.5 Hydrology

The local government area is well drained with most rivers being tributaries of river Kaduna. The major rivers are River Kaduna, River Mariga, River Ushafa, River Uregi,

River Gogin Gunna, River Kyaruma, River Kushaki, River Gora, River Raba etc. There are minor rivers and streams that exist within the study area. The regime of the rivers is influenced by the rainfall, geology and relief; as such most of the rivers are seasonal.

1.6.6 Vegetation

The vegetation presently is a mixture of natural and cultural vegetation due to prolonged human interference. However, where the natural vegetation exists it is dominated by what Charter, J. (1970) referred to as the "mixed leguminous wooded savannah" labeled as northern guinea and southern guinea savanna (Keay, 1953). The types of vegetation is determined by the relative proportion of different plant life forms-trees, shrubs and herbs. The vegetation is characterized by tall and short trees with broad leaves, thorn and thick barks. The local government area has characteristics of northern guinea-savanna woodland as a result of prolonged human interference.

The common plant species found in the study area include: *Butryospernum, Lophira alata, Acacia, Isorberlina Doka, Bur kea Africa, Terminalia Govcoscenaces, Afzelia Africa ptenocarpus erinaceous*. Along the forest fringes in the local government area there are plant species like *Khaya Senegalese, Chlorrphara ecelsa, Invengia gabonnesi, mansonia etc.*

1.6.7 Land Use

Over 90% of the land is used for agriculture. The main type of agriculture practiced in the area is subsistence agriculture. Subsistence agriculture is a system whereby area of farmland is cultivated using simple implements to produce crops for the farmer's house need. Due to the small size of farm land under cultivation, the farmer hardly produces enough for sale. The staple crops grown are millet, sorghum and maize except along some river valleys where vegetables are cultivated by the Hausa migrants. Rice is also cultivated in small quantity at subsistence level.

The Fulani nomads as well as sedentary populace of the Kamuku, Pangu Ingwai,Ura and Bassa natives, uncontrollably carries out livestock grazing in the area. The animals reared include; cattle, sheep and goats.

1.7 **Organisation of the Thesis**

The thesis is organized into five chapters. Chapter one comprises the introductory part of the thesis. Chapter two comprises the literature review on related topics. Chapter three comprised the methodology used in data collection and analysis. Chapter four contains presentations of result. Finally, chapter five consists of the results, discussion, recommendation and conclusions.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

Fuelwood exploitation is the cutting down of trees and the burning of trees for an alternative source of energy. The aim of this research work is to study the environmental consequences of fuelwood exploitation in Rafi Local Government area of Niger State. Fuelwood is one of the cheapest and reliable sources of energy for domestic use in some rural areas as well as in urban areas. Fuelwood is one of the factors that can lead to deforestation. Fuelwood cutters often target dead trees for their daily collection.

With the growing population, demand for firewood would continue to rise under conditions of declining income. This has become necessary for us to determine the sources, the extent of fuelwood exploitation and the environmental consequences in other to achieve sustainable resource exploitation.

In Nigeria today a large population resides and works in rural areas. These rural dwellers are a major contributor to forest depletion. It has the greatest concentration of poverty, landless workers, small tenant farmers, small farm owners, the rural unemployed, and the poor of the poor in the nation. As a result of the poverty level in these areas, biodiversity provides for 90% of their needs, a fact that plays a major role in the destruction and depletion of native flora and fauna (Rodriquez, 2002). One major way the rural dwellers affect the biosphere is through the use of firewood as the major source of household energy. About 95% of these dwellers use firewood, as they cannot afford fossil fuel. The demand for firewood has recently increased since the introduction of the Structural Adjustment Programme (SAP) in July 1986(Nathaniel, 2003).

The earth and the lives of everything that depends on it – from the smallest bacteria to the largest sea creatures – rest on delicate matter and that is balanced. A single, seemingly

harmless disturbance in this balance has consequences that are both beneficial and disadvantageous. One of these is deforestation. Many researchers have carried out research work on this topic at different geographical locations of the world.

Deforestation as indicated by Nathalie (2003) has always been a practice of many developing communities and has contributed greatly to civilization, as we know. Unfortunately much of the negative effects of deforestation are caused by greed, bad agricultural practices and government policies.

The significant role forest plays in our daily lives cannot be overestimated. Other than for their beauty, forest is highly responsible in keeping and sustaining global ecosystem. Infact, as pointed out by Nathaniel (2003), "much of the quality of life we enjoy, we owe to the forest". It is also the home of more than half of all creatures and organisms in this planet. From food to life-saving medicines, forests give mankind a variety of gifts that contribute much to our quality of life.

Consciousness of the problems of global deforestation began in the 1980s. Tariq (1989) noted that in 1988, scientists found the first strong evidence that depletion of the protective zone layer has already occurred over the northern Hemisphere. This has partly been linked to deforestation.

In Western and Central Africa, much of tropical humid forests have already undergone substantial commercial harvesting. The total volume of firewood exploited annually in the sub-region is more than 200 million. According to Food and Agricultural Organization report, nearly 90% is consumed as fuelwood and charcoal, and only 2% as industrial round wood. However, of great concern is the rate at which deforestation is occurring. Currently, about 12 million hectares (ha) of forest are cleared annually (Joselyn, 2001). Tariq (1989) outlined that almost all of this deforestation occurs in the moist forests and open woodlands of the tropics as a result of agriculture or harvesting fuel wood. In addition to

this deforestation, about 4.4 million ha of the tropical forest are selectively logged every year.

There are two major environmental problems with firewood cutting and burning. These are 'where the wood comes from' and 'what happens to it when it is burnt'. The large-scale removal of firewood directly degrades wildlife habitat. In eastern Australia the bulk of the wood comes from slower growing woodlands and dry forests, inland of the Great Dividing Range and in the drier Midlands of Tasmania (Trail, 1991).

2.2 Fuelwood Exploitation Scenarios in Niger State

Musa (2002) studied the impact of deforestation in Bobi grazing reserve in Mariga LGA of Niger State. His objectives were to assess the impact of increased agricultural and livestock production, to provide guidelines for maximum utilization of natural resources in the area and to recommend possible ways of checking or ameliorating the problems. He used questionnaires distributed to sample population of farmers, nomads and other stakeholders. The analysis was done using frequency/percentages of responses. The findings indicated massive deforestation in the area resulting from population pressure, forest clearing for agriculture, logging, fuelwood consumption, bush burning and over grazing. The effects include poor soil fertility, soil erosion and loss of forest resources. He recommended among others a massive awareness drive to improvement in farming methods and land management as well as reforestation and use of alternative energy source to minimize fuel wood exploitation.

Sulaiman (2002) studied the availability, utilization and consequences of fuel wood exploitation in Ushafa area of Suleja, FCT. The objectives were to determine the extent of deforestation in the area, to examine the consumption/ utilization pattern, the consequences as well as to examine the alternative energy sources available. He used a combination of questionnaires, oral interviews and discussion with sampled population as a primary source of data using simple proportion and percentages in analyzing his data. The result indicated massive deforestation in the area from fuelwood as the dominant source of energy in the

area. The consequences are that of soil erosion, deforestation and gradual loss of cultivable lands. The study recommended public awareness of the danger of deforestation, encouraging the use of alternative fuel sources as well as for the government to live up to its responsibilities so as to control deforestation.

Jaagi (2002) studied deforestation and its consequences in Mokwa LGA of Niger state. The objectives of the study were the causes and consequences of deforestation in the area with a view to recommending ways of controlling the problem. He relied on questionnaires and oral interview with sample population of farmers and other stake holders including records of logging from 1998 to 2002 from the zonal forestry office as sources of his primary data. He attributed the causes to logging, shifting cultivation practices by local farmers, rural energy needs through fuelwood, over grazing, wild fire and bush burning. He also found out the consequences of deforestation in the area to include flooding along the riverbanks, loss of Biodiversity, reduction in soil fertility and increase in evapo-transpiration rate. He recommended improvement in the system of farming, reforestation and legislation against unnecessary deforestation.

Adamu (2006) conducted a study in Bosso Local Government Area. Questionnaire method was used to collect data. The data were analyzed using proportions or percentage of respondents to the questionnaires and presented in tables. . A total of 250questionnaires were distributed within five wards in the Local Government Area. The aim of the research work was to study the environmental consequences of deforestation in Bosso L.G.A. in Niger state. Specifically, the objectives of the study were to study the extent and level of deforestation in Bosso L.G.A. He also identified the causes of deforestation in Bosso L.G.A. He found out that (89.7%) used fuelwood/charcoal, 7.3% used kerosene while 1.5% used gas and electricity. It also revealed that the community obtained their fuelwood from market constituting 46.4%, near by bush 14.3%, and distance forest 33.9%. The overwhelming majority (51.5%) preferred using fuelwood because it is very cheap and substantial proportion believed that it is the only source readily available to them.

2.3 Fuelwood exploitation in Nigeria

Umeh (1989) explained that the Nigerian forests have witnessed wanton destruction. He attributed the causes to over-cutting, over grazing, bush fires and other abuses that it can no longer adequately provide the much-deserved goods and services. He also revealed that Nigeria, which hitherto used to be an exporter of timber, is now increasing her importation of forest products.

Busuma (2008) Borno state which is located in the desert region of the north-eastern part of Nigeria, borders around the Sahel savannah vegetation. The state is believed to be naturally affected by deforestation because it experiences less rainfall, high temperature and sparsely covered by vegetation due to its geographical location. The human factors also contribute immensely to deforestation in Borno state. Studies show that 84% of the populace rely solely on firewood for cooking. This observation also reveals that 57% of the total population have been using firewood for over 10 decades which is an indication that the activity of deforestation has been taking place for a long time. The study also revealed that timber exploitation, mostly from the high forest covering about 12.41 million hectares of the country's 91.1 million hectares of land space i.e. about 13.5% can disrupt forest stability and its ecosystem. The disturbance is not only in terms of its inability to regenerate through natural processes, but some species of flora and fauna are endangered".

The record of forestry research institute shows that at least 62 species, which constitute about 7% of the total number of species in Nigeria are endangered. The seriousness of this development is that timber species which form the base of the country's economy may soon be extinct. Thus, necessitating importation and loss of hard currency. Similar danger of extinction is faced by wildlife for which the forest provides natural habitat probably the clearest indication of danger wildlife faces is that even the Savannah environment which has given them some cover is disappearing and giving way to desert or new desert conditions.

Ayuba (2003) stated that forest reserves in Borno State are numerous and of varying sizes. A total of 83 consolidated forest reserves exist in the state making up a total land area of

3.5 - 4.0 square kilometres. The Sambiza forest reserve, being the largest forest reserve, has a total land area of 51839km. However, because of poor management, these reserves have suffered increasing degradation in the last three decades due to indiscriminate bush burning, empowerment by farmers, pastoralists and poaching of animals.

Ujah (1982) asserted that the adverse effects of deforestation is already measurable in the form of increased light intensity, soil and air temperature, and decrease in soil moisture and atmospheric relative humidity in Nigeria.

The effects of deforestation on atmospheric condition on a global scale are still a matter of speculation.

2.4 Global Situation on Fuelwood Exploitation

Driscoll (2001) conducted a study in Armidele Australia, Using a telemarketing company; he obtained 415 successful interviews with people who use firewood from all states except the Northern Territory. The aim of the research was to identify the sources of fuelwood and who uses them. Using telephone interview the results indicated that about half the people who use firewood buy it and 60% comes from small suppliers, people without established premises. This has some important implications on how to regulate the commercial side of the fuelwood equation. The half who do not buy fuelwood, collect it themselves. Three quarters of these people collect fallen timber; while 18% collect dead standing timber and only 6% cut live trees to burn. This is an important thing to consider if you are trying to establish how sustainable a local firewood supply might be. He also said that 80% of fuelwood that is collected comes from private property.

However, the rate of deforestation is even much more acute in some countries, Cote d'ivore and Nigeria annually lose about 52 percent of their forest while in Costa Rica, Sri Lanka, and Salvador the rates are 3.6%, 3.5% and 3.2% respectively. Depending on its rate of loss; each of these countries could lose all its forest sooner than was forecast if no conservation steps is taken (Tariq, 1989).

On the causes of fuelwood exploitation, many researches have been made. Poverty seems to be the prominent factor compelling people to engage in firewood exploitation. Most of the fuelwood is locally exploited by traditional mode which is often inefficient. The causes seem to be similar though with some variations over time and space. However, most of the families use fuel wood to meet their energy needs for cooking. Some ten to twenty years ago, fuel wood came from dead trees or branches, while today the use of 'live' trees has been observed. This is often due to logging linked to deforestation practices. Over the past twelve years, the exploitation of fuelwood has proved to be more lucrative than traditional agricultural activities or cattle rearing.

Dickson (2001) studied fuel wood use in Armidale Australia (New Wales). He used interview method to collect data. The aims were to identify fuelwood collections, fuelwood consumed and wood smoke pollution problem in Armidale. He found out that Fuelwood collection and use in the Armidale region is controversial on two counts. First, the amount of fuelwood consumed has depleted accessible stands of certain eucalyptus communities of dead wood, with unknown but potentially significant impacts on ecosystem integrity. Second, the woodsmoke pollution problem in Armidale in winter has unknown but potentially significant impacts on human health and morbidity. Some 70% of Armidale households used firewood at home. Almost all (96%) wood users (n = 480) burnt wood for space heating, mostly over the 5-month period from May to September. Age of dwelling was the most important determinant of fuelwood use. It also revealed that 45% of respondents considered it cheaper than other forms of energy. The second most desirable feature of fuelwood was amenity and lifestyle. Other reasons included enjoyment and recreational value of collecting and handling wood, the exercise associated with splitting and carrying wood and the sense of self-reliance or ownership of the resource. Few respondents offered reasons for disliking fuelwood. Five preferred gas or electricity and two stressed the health problem of interior woodsmoke. The research also revealed that just over half of residences burnt wood delivered by fuel wood merchants who provided only 76.5% of advertised deliveries. The research revealed that 55% of fuelwood-using residences in Armidale purchased wood from merchants, 36% collected their own, 7% obtained offcuts from the sawmill and 2% were provided wood by family or friends. The vast majority of the potential fuelwood resource (27.669 Mt or 87%) occurred on private

property. Of those who thought wood availability had declined, most were concerned about resource depletion and increasing scarcity. Of those who thought wood availability was static or increasing, most said that wood was in ready supply, that there was plenty of wood on their land or in some areas, or that there was much dead fallen timber on the ground or lots of old dead trees. Those concerned about fuelwood supplies had been working in the industry significantly longer than those who were unconcerned.

Deforestation may not be completely viewed as negative in totality. Nathalie (2003) identified some of positive consequences. Depending on the need of the social group concerned, deforestation has made it possible for communities to be built. Forest makes way for fuel energy source, residential houses, office buildings and factories. Governments are able to build roads to make trade and transport easier and therefore more convenient to residents.

Tariq (1989) observed that deforestation rate might change because population and economic activities are growing rapidly in many countries, and both market forces and government policies can either promote or restrain deforestation. Growing population could lead to more deforestation because of the need to grow more food. Economic development is frequently accompanied by an increase in the amount of food each person consumes possibly requiring the clearance of even more land. On the other hand, economic development also permits greater investment in agriculture, with higher yields per hectare the same amount of food would be grown on a smaller area of land, thereby reducing deforestation rate and off setting the effects of growing population.

According to Driscoll (2000) most firewood (84%) for private use or sale is collected from private property; 9.5 per cent comes from State forests; with 3% collected from roadsides, and 3.8% from other sources.

The combination of a high proportion of firewood collected from private land and the high proportion being taken by individuals and small time operators makes the firewood industry very difficult to regulate. Therefore changes in people's perceptions and behaviour about using firewood are critical to establishing a sustainable firewood industry.

Rodriquez (2002) conducted a study in the dry forest of northwestern Peru and revealed that the estimated per capita income in 2000 was less than US$0.80 per day. The poorest 25% of agro-pastoralists have a per capita income of US$0.23 per day. Although almost 95% of families own goats, livelihoods are diverse. In four out of the six localities, firewood extraction provides more income than livestock and cheese production. About 2000 kg/month/household was used for domestic use, representing 60% of total fuelwood extraction. This figure is three-times the domestic firewood consumption rate typical in other similar parts of the world, and is probably inflated because householders do not want to admit to over-exploitation of firewood for commercial gain. Because an unknown proportion of the firewood reported as being for domestic consumption is probably sold for income, the total rates of extraction need to be considered. Domestic and commercial extraction combined averages 3400 kg/month/household. Much is sold to nearby villages, but a significant proportion is consumed as charcoal in the coastal cities and the dry forest supplies 34% of the charcoal consumed in Lima.

The principal reason for desertification is not goats, but the overexploitation of the forest for firewood and charcoal. If agro-pastoralists can find alternatives to firewood extraction to supplement their income, then they might be encouraged to manage the forests more sustainably. Ironically, goats and goat products might provide their best livelihood alternatives, and, therefore, the best hope for alleviating further environmental damage.

Generally there is a negative correlation between income derived from firewood extraction and income derived from goat production, and a particularly strong negative correlation between the extraction of fuelwood and the production of goat cheese. He proposed that finding profitable alternatives to fuelwood extraction, desertification might be reduced by

reducing the need for fuelwood for cooking in households and restaurants. High-efficiency stoves and bio-digester systems need to be further investigated. Both agro-pastoralists and urban consumers of charcoal have an interest in the preservation of the forest. Awareness campaigns to publicize the link between deforestation and the charcoal industry might persuade urban dwellers to buy charcoal from forests managed sustainably. At the same time, agro-pastoralists need to be supported in efforts to diversify livelihoods away from fuelwood extraction and to preserve forest resources to sustain future livestock and cheese production. The main culprits of desertification are failure of the market to reward restraint in firewood extraction, institutional failure to manage forests sustainably, and lack of livelihood alternatives. Solutions can only be found by treating goat-keepers as partners in resource management and in the socioeconomic development of the region. And the sustainable policy decided upon might well involve goats.

Chettri (2007) conducted study on the fuelwood value assessment in Western Sikkim, India in the Himalayas. Local people's preference scores for firewood species were studied through pair-wise ranking tools of Participatory Rural Appraisal technique from Yuksam-Dzongri trekking trail, Sikkim, India. A wide variety of plant species used as firewood was enlisted. These woody tree species with potential firewood use value were analysed for their Firewood Value Index (FVI) considering energy value, density, moisture content and ash content. He found out that, 76% of the total resources needs are derived from natural forests because of their free and easy access and simplicity in use. He also observed that these resources were vulnerable to deterioration due to selective use, over exploitation and bad management practices. About 43% of Sikkim's total geographical area is under forest cover, of which 34% is dense forest. Majority of the rural people in Sikkim depend on forests for fuelwood, fodder and timber, and utilization of resources by selection of species with preference is widely practiced fuelwood and fodder collection, interior forest grazing and leaf litter collection are common resource-use practices among the different ethnic groups as well to tourism services providers. Therefore, it is important to understand the basis of firewood preference for reducing threats to high value firewood species and address this with better management approaches.

It was observed that almost all the wood attributes were significantly related to people's scores. The energy value was significantly and positively related to the people's scores and FVI (0.671, $P < 0.01$), and negatively to ash content (–0.628, $P < 0.01$). It was noted that the moisture content of these species was significantly and negatively related to FVI (–0.651, $P < 0.01$), but not with the people's scores (–0.247, not significant). Other relationships such as density and energy (0.664, $P < 0.01$); biomass ash ratio and people's score (0.605, $P < 0.01$) and biomass ash ratio and energy (0.705, $P < 0.01$) were also significant. The correlations also support the relationship between the FVI and energy value (0.741, $P < 0.01$), density (0.483, $P < 0.05$), ash content (–0.776, $P < 0.01$) and moisture content (–0.651, $P < 0.01$). These analyses revealed that there are strong relationships between the wood attributes and FVI as well as with people's score, assuring that local preferences do have implications on the quality of firewood species.

However, it also revealed that moisture content is of least importance with respect to people's choice. Communities look for higher energy value as a key factor (0.671, $P < 0.05$) followed by density (0.458, not significant) and ash content (–0.280, not significant). This is an interesting reflection showed by the people on their basis of preferences.

In general, for ideal fuelwood, species with high heat of combustion or energy, high wood density, low ash content and low moisture content are the most desirable. The two major observations were recorded in this context. People do prefer species that are of high energy value, but at the same time they also consider availability. It was also observed that people's preferences were based on quality wood (high energy content, high density, low ash content and low moisture content), but they also consider woods which are easy to cut and yield less smoke on burning. As local knowledge by pairwise ranking was found applicable for a gross idea on firewood values for most of the resources utilization, serious attention should be given to know the depth of local knowledge to improvise high potential firewood species by farming or *in situ* conservation. His findings suggested that local knowledge and constituent properties of species should be the basis for *in situ* conservation and cultivation of high-value firewood species to meet the present and future demands.

Tariq (1989) observed that deforestation rate might change because population and economic activities are growing rapidly in many countries, and both market forces and

government policies can either promote or restrain deforestation. Growing population could lead to more deforestation because of the need to grow more food. Economic development is frequently accompanied by an increase in the amount of food each person consumes possibly requiring the clearance of even more land. On the other hand, economic development also permits greater investment in agriculture, with higher yields per hectares the same amount of food that would be grown on a smaller area of land, thereby reducing deforestation rate and off-setting the effects of growing population.

Unfortunately, the negative consequences of deforestation far out weigh the positive consequences.

Baland and others (2002) conducted a survey on the determinants of firewood collection in Nepal, as a major cause of deforestation. Interview method was used to collect data. This survey covered 274 wards, of which 215 are rural area. Only data for the rural wards were used, involving 2713 Households who were interviewed concerning their production and consumption activities for the year 1995-96. The research focused only on villages in the rural area as it is there that firewood collection is more likely to be important than in urban areas. Nearly one third of the households do not collect firewood at all. On the average, a household collects 5.8 *bharis* or bundles of firewood a month. Each *bhari* takes a significant amount of time to collect fuel wood, slightly more than 5 hours on average per household. Across villages, the village average time required to collect a *bhari* varies a lot as its standard deviation is equal to 2.5. Within villages also, collection time varies across households, with an average standard deviation of 1.8 hours per *bhari* suggesting a significant extent of economic heterogeneity within villages. Households mention adults as the principal collectors of firewood, and females somewhat more important than males in this respect (average number of adults collecting per household is 1.56, and of female adults is 0.94, so that female collection time represents 60% of the adult collection time within households; 77% of the households collected firewood from a government or a community forest, with the remaining households collecting either from their own lands or other sources (such as from roadsides). Fuelwood is the dominant source of energy for cooking and heating for 73% of the households: Importantly, households in the sample make very little use of firewood substitutes, as less than 3% of the household use kerosene, electricity or gas as the primary source of cooking or heating fuel. H e also found out that

the education levels are low: 70% of household heads have no education. The majority of households (65%) are engaged in self-employed agricultural activities and livestock rearing, and another 16% of them work as agricultural wage-earners. Household size has a strong, positive and declining impact on the amounts of firewood collected. The results indicate a significant and positive effect associated with average village consumption: richer villages tend to collect more firewood. He also found out that the overall impact of inequality, either through collective action or aggregation effects, is negligible. If all intra-village inequality in living standards were to be eliminated, then (ignoring potential general equilibrium effects on prices and wages) village collections would rise by only 14%. In particular, rising per capita consumption and population levels tend to raise fuelwood collections by a substantial amount, with an aggregate elasticity close to unity. Counteracting this is the role of primary education which raises the implicit cost of collecting firewood by offering better educated household members more lucrative occupations that reduce their dependence on the forest.

Pitt (1985) estimates demand for alternative fuels using household level data for Indonesia, where fuel markets are relatively well developed. He found negative income elasticity for the demand of firewood, but a strong and positive elasiticity for charcoal. He also found little substitution effects between kerosene and fuelwood, particularly in rural areas, which leads him to question the distributive impact of kerosene subsidies that would disproportionately favour urban households. Note that his analysis is not based on the opportunity cost of collection, but on observed fuelwood prices, in a context where markets for fuelwood, charcoal and kerosene are well-developed.

Whitney (1987) has analysed the impact of both overall population growth and urban and rural growth on fuelwood demands and deforestation in the Sudan between 1960 and 1980, using data from a national energy assessment and UNDP and World Bank data on energy consumption. Whitney observed that it had been economically more rational for Sudan to mine its forest resources than to spend its limited hard currency importing fossil fuels. He cited deforestation as most severe in the Central Region. According to his analysis, the amount of deforestation due to household fuelwood consumption increased over three times (from 7,500 km2 per annum to 28,000 km2 per annum) between 1960 and 1980 due

primarily to population growth. The increased use of wood for charcoal by the growing rural population was a major factor driving deforestation since per capita use of wood for charcoal increased alongside population growth in rural areas. In contrast, in growing urban areas per capita charcoal use actually declined during the period since some urban dwellers converted to fossil fuels. Whitney concluded that in the future, use of charcoal and fuelwood in rural areas would be the primary causes of deforestation in the Sudan. In the absence of large-scale conversion to fossil fuels, he recommended improving charcoal wood-burning stoves, development of more efficient charcoal, increasing the use of kerosene, and reducing the demand for fuelwood through pricing policies.

Thapa (1992) made an analysis of household level data from 300 households in one hill village of Nepal to explore how socio-economic and cultural factors could affect responses to rapid population growth and environmental degradation. She used regression analysis to estimate the impact of socio-economic status, family size, education and caste (Brahmin/Chetri versus artisan) on out-migration, contraceptive use, and chemical fertilizer use and fuelwood consumption. The results indicated that artisan caste and larger household size was associated with more out-migration. Higher socio-economic status was associated with increased use of fertilizer (agricultural intensification) and contraceptive use. Middle-income households had the highest demand for fuelwood and, by implication, more deforestation. A negative relationship between family size and per capita fuelwood consumption was found, although overall demand and thus deforestation increased with family size. And concluded that socio-economic status and caste affiliation could have significant impacts on the relationship between population pressure and deforestation.

Kumar and Hotchkiss (1988) carried out a regression analysis of household survey data from 120 households in Nepal during 1982-1983 to test the hypotheses that deforestation reduced agricultural output, household income from agriculture, and nutrition by increasing the time women must spend collecting forest products, including fuelwood. Deforestation was measured in terms of fuelwood collection time, with greater times associated with higher levels of deforestation. The authors used regression analysis to estimate the impact of female time allocation, agricultural production and nutrition on deforestation/fuelwood collection time. The results indicated that increased

deforestation/fuelwood collection time was significantly associated with decreased farm labor by women and decreased time spent in food preparation. They concluded that deforestation had negative effects on agricultural production and income as well as household nutrition.

Hammer (1977) conducted a study concerning the energy situation in Bara, a town in Kordofan with about 9000 inhabitants. Bara was chosen as a study object because the area was suffering from land degradation, and Hammer Digernes was of the opinion that one of the main factors leading to that situation was the people's cutting of the woody vegetation to meet their energy demands. Interview method was used to collect data. Percentages were used for comparism. After interviews with women in 10% of Bara's households the total yearly consumption of wood for fuel was calculated. The roundwood consumption was 0.8 cubic metres per person per year as fuelwood and 4.9 cubic metres per person per year as charcoal. He concluded that Bara had a total yearly consumption of 4.1 tons roundwood or 857 kilos wood per person.

Dove (1988) conducted a survey on the fuelwood supply and demand in rural households: the Punjab, NWFP, and Baluchistan. He used interview method to collect data. The analysis is based on interviews with 607 households in 41 villages in the Punjab (districts, Attock, Chakwal, Rawalpindi, Khushab, Sialkot, Gujrat, Jhelum), NWFP (districts, Kohat, Kara,) and Baluchistan (districts Jffarabad, Tamboo). The villages were selected as being representative of their respective areas, based on a prior survey of major ecological, economic, and social variables of 111 villages in the same districts. The research findings revealed that 70% of the farmers surveyed gather fuelwood regularly, 23% gather it on seasonal basis, and 7% do not gather fuelwood at all. And also most of the fuel is from farmer's own land. The findings also revealed that 66% of the farmers surveyed find it difficult to gather fuelwood. The difficulty is greatest among farmers with medium-sized holdings, among tenants, self-cultivators and among farmers with completely irrigated lands. 32% of the farmers surveyed regularly purchased fuelwood. It also revealed that the most frequent purchasers are farmers that are self-cultivators with small holdings. It also revealed that only 7% of the farmers have ever sold fuelwood, and that the most frequent sellers are farmers that are landlords, and have large holdings. The result also revealed that

91% of farmers who want to plant trees say that they will use some or all of them for fuelwood and 81% of the farmers who want to plant trees for two or more purposes in addition to fuelwood.

Masoud (1991) conducted study on the fuelwood use in Zanzibar town. The aim focuses on fuelwood in Zanzibar town and the implications for forestry policy. The objectives were to assess the present consumption patterns of woodfuel and non-wood fuel in the town by households and woodfuel by institutions. To examine the causes of the demand, the sources of the supply and their implications. To predict the future demand for woodfuel in the town in light of the current trends. The main data collection technique used was interviewing based upon questionnaires. A total of 152 households (representing 1276 persons) were interviewed. Of the 152 interviews, 107 were conducted with women and 45 with men. Results of the study indicated that fuelwood (firewood and charcoal) is the principal urban energy source, for both the household and institutional sectors. Of the total fuel energy used by these sectors, 69 percent comes from firewood. The household sector accounts for nearly 86 percent of the total firewood consumption by weight. Charcoal accounts for an estimated 18 percent of the total cooking fuel consumption. Firewood is the principal cooking fuel used by most low- and middle-income households, and by 22 percent of the high-income families. Charcoal is used as the main cooking fuel in 44 percent of the high-income, 32 percent of the middle-income, and 10 percent of the low-income groups. Electricity is the main cooking fuel used by 33 percent of the high-income groups and to some extent (9 percent) by the middle-income class. These findings support the first proposition.

The result also revealed that 79 percent purchased their cooking fuel, whereas 21 percent gathered their fuels (firewood and coconut residues) from the urban fringes and rural areas. The annual rate of increase of firewood prices was 37 percent whereas minimum wages increased at 22.6 percent. From this data, real income appears to be either stagnant or most probably decreasing. As the household size increases by one person, per capital fuel consumption decreases by 0.482 GJ/annum. These findings suggest that from the household economic point of view, large families are more efficient in energy use than small families. It was also observed that most fuelwood in Zanzibar town comes from

natural vegetation in the coral rag areas, where shifting cultivation dominates. In some areas, farmers reported that, over the past twenty years, the fallow period has been reduced from 20 - 25 years to 2 - 4 years.

Richard and Daniel (1977) discusses the possible increase of atmospheric carbon dioxide content by up to 10% and consequent increase in global temperatures through the greenhouse effect as a likely result of removal of the tropical rain forest. The second major impact is the effects of wood smoke pollution on human health. Wood smoke contains a diverse range of cancer-causing chemicals and is a major source of small particle emissions. Pollution causes a range of heart-lung illnesses and cancer. Wood smoke is a major air pollutant in cities and country towns in southern Australia. Many of which are perceived to have clean air. However, wood smoke causes some of the nation's worst winter air pollution in towns such as Launceston in Tasmania and Armidale in New South Wales

The next chapter presents the methodology used to collect data for the study as well as the analyses used.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter shows the procedure used for the data collection and the types of data collected for the research work. It also shows the sampling techniques used and how the data collected were processed, prosecuted, analyzed and interpreted to achieve the stated aim and objectives of the research work.

The aim and objectives of this research work were to study the environmental consequences of fuelwood exploitation in Rafi Local Government Area. Fuelwood is one of the cheapest and reliable sources of energy for domestic use in rural areas as well as in the urban areas. It has become necessary to determine the sources, collectors and users of fuelwood, and also try to determine the extent of firewood exploitation and environmental consequences so as to achieve sustainable resource exploitation.

3.2 Sources of Data

The major sources of data used for this research work were the primary sources and the secondary sources.

The primary source of data was the prepared questionnaires administered to the sampled population by the researcher and his assistant to fasten the work. Where the sampled populations are literate, the questionnaires were self-administered and the responses collected later. In the case where the sampled populations are illiterate (uneducated), the researcher and his assistant asked the respondents questions from the questionnaires and the responses recorded.

The secondary sources of data used were the relevant literatures.

3.3 Reconnaissance Survey

The reconnaissance survey was carried out by the researcher before embarking on the real collection of the primary data for this research work and direct personal observation was made in the study area to familiarize ourselves with the environment and the scope of the research work.

3.4 Sample Techniques

To achieve the objectives of this research, accidental sampling technique was used .The researcher recognized and made use of the administrative division of the LGA into eleven (11) wards. These are;

i) Kagara Gari
ii) Kakuri
iii) Kongoma North
iv) Kongoma West
v) Kusherki North
vi) Kusherki South
vii) Kundu
viii) Sabondari
ix) Tegina Gari
x) Tegina West
xi) Yakila

However, in each of the eleven (11) wards selected respondents were classed into the following order;

i. Collectors
ii. Users

3.5 Field Encounters

However, where the respondents are not literate, the researcher and his assistant would interpret the questionnaires in the local language of the respondents (Kumuku, Pangu, Ingwai and Hausa) and the responses would be recorded in English.

Pre-testing of the questionnaire was done in order to verify if the questions could be understood and to check if they address matters under investigation or study. The pilot testing was done to a sample five people involved in firewood activities. The questionnaire is attached as Appendix 1.

The questionnaire was aimed at collecting information on fuelwood activities in Rafi Local Government Area from more than one person that could be analyzed statistically.

A total of 275 copies of the questionnaires were distributed in eleven (11) sampled wards or clusters on the basis of 25 questionnaires per ward.

Table 3.1 **Distributions Of Questionaires To Wards And Responses Received.**

S\no	Wards	Questionnaires distributed	Responses received	Questionaires not received	Percentage returned (%)
1	Kagara Gari	25	23	02	93.3
2	Kakuri	25	25	0	100
3	Kongoma Central	25	24	01	96.6
4	Kongoma West	25	21	04	86.6
5	Kusherki North	25	23	02	93.3
6	Kusherki South	25	25	0	100
7	Kundu	25	25	0	100
8	Sabondari	25	24	01	96.6
9	Tegina Gari	25	25	0	100
10	Tegina	25	25	0	100
11	Yakila	25	22	03	100
	TOTAL	275	262	13	95.3

Source: Field work, 2009

Table3. 1 shows the distribution of questionnaires sampled by wards in Rafi local government Area, and the responses received in each ward. From the table it is seen that out of the 275 questionnaires distributed. A total of 262 (95.3%) were returned. This implies that a great majority of the sampled population (95.3%) responded and hence, the analysis of the data centered on these responses.

3.6 Data Analysis and Interpretation

The data analysis and interpretation of this research were done using descriptive statistics techniques (simple proportion and percentages). Quantitative data collected were summarised to ensure that they can be in the form suitable for achieving the aim and

objectives of the research work. This was done while ensuring that the original meaning of the statements of the respondents are maintained.

The responses of respondents were analysed to achieve the objectives of the study. The percentages and proportions of the responses were calculated to determine the sources of fuelwood, extent of fuelwood exploitation and environmental consequences of fuelwood exploitation in Rafi Local Government Area. The next chapter shows the calculations of percentages, proportions and analysis of the data collected.

CHAPTER FOUR

RESULTS

Introduction

This chapter presents results of data collected from the sampled administered questionnaires in Rafi Local Government Area. The results are presented in tables below. The aim and objectives of this research work were to identify the sources of fuelwood, extent of fuelwood exploitation, environmental consequences of fuelwood exploitation and suggestions on possible intervention to mitigate the adverse effects of fuelwood exploitation in Rafi Local Government Area.

4.1 **Age Distribution of Respondents:** The section shows age categories of the respondents in the study area. Table 4.1 summarises the results obtained from the question: What is your age?

Table 4.1: **Age Distribution of Respondents**

Age group	Frequency	Percentage (%)
10 - 20 years	50	18.2
21-30 years	123	44.7
31- 40 years	69	25.1
41 years and above	20	7.3
Questionnaires not returned	13	4.7
Total	275	100%

Source: Author's Field work, 2009.

4.2 **Occupational Distribution of Respondents:** The section shows the types of economic activities engaged by the respondents in the study area. Table 4.2 summarises the results obtained from the question: What is your occupation?

Table 4.2: **Occupational Distribution of Respondent**

Occupation	**Frequency**	**Percentage (%)**
Public servant	45	16
Farmer\livestock rearing	120	65
Traders	37	10
Others	31	13
Total	262	100

Source: Author's Field work, 2009.

4.3 **Sources of energy used for domestic activities:** The section shows the types of energy use for domestic activities by the respondents. Table 4.3 summarises the results obtained from the question: What is the main source of energy use at home?

Table 4.3 **Sources of Energy Used for Domestic Activities**

Energy source	**Frequency**	**Percentage (%)**
Fuelwood	225	85.9
Kerosene	25	9.5
Electricity	10	3.8
Others (specify)	2	0.8
Total	262	100

Source: Author's Field work, 2009.

4.4 **Types of Farming System Engaged By Respondents:** The section shows the type of framing system practice by the respondent in study area. Table 4.4 summarises the results obtained from the question: What Type of Farming system do you practice?

Table 4.4: **Type of Farming system Engaged by Respondents**

Types	**Frequency**	**Percentage (%)**
Crop farming	75	53.4
Animal Rearing	25	31.5
Mixed farming	20	15.1
Others	0	0
Total	120	100

Source: Author's Field work, 2009.

4.5 **Duration of Farming Activities in the Area:** The section shows the numbers of years the farmland has been put under cultivation by the respondents. Table 4.5 summarises the results obtained from the question: How many years have you been working on this farmland?

Table 4.5: **Duration of Farming Activities in the Area**

Duration (years)	**Frequency**	**Percentage (%)**
1-3	010	2.7
4-6	015	5.5
7-9	25	13.7
12 and above	50	78.1
Total	120	100

Source: Author's Field work, 2009.

4.6 **Method of Farm Clearance**: The section shows the method used by the respondents in farm clearance. Table 4.6 summarises the results obtained from the question: Which method of land clearance do you use?

Table 4.6: M**ethod of Land Clearance**

Methods	**Frequency**	**Percentage (%)**
Mechanized	12	15.1
Slash and burn	35	27.4
Cutting and burning	58	45.2
Others	15	12.3
Total	120	100

Source: Author's Field work, 2009.

Plate I: Cleared new Farm (Tegina)

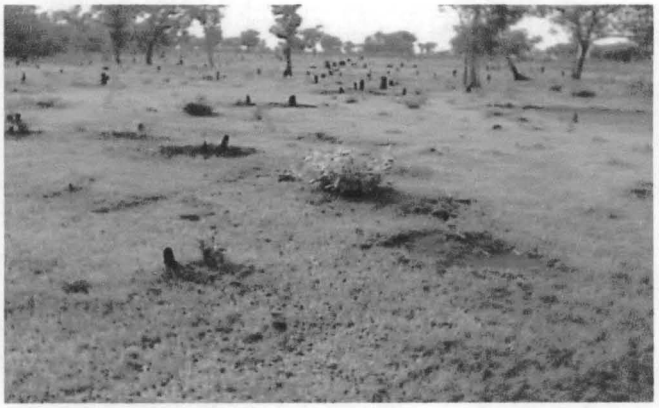


Plate II: Farmland (Kumanu)

4.7: **Type of Implement Employed In Farming:** The section shows the types of farming equipments used by the respondents in the study area. Table 4.7 summarises the results obtained from the question: What Type of farm implement used by the farmers?

Table 4.7**: Type of Farm implement Employed in Farming**

Type	**Frequency**	**Percentage (%)**
Modern farm tools	15	12.5
Simple farm tools	75	62.5
Animals	30	25
Others	0	0
Total	120	100

Source: Author's Field work, 2009

4.8 **Farmland sizes:** The section shows the farmland sizes owned by individual respondents in the study area. Table 4.8 summarises the results obtained from the question: What is the size of your farm land?

Table 4.8: **Size Farm Land**

Size	**Frequency**	**Percentage (%)**
1-5 hectare	64	53.3
6-10 hectares	38	31.7
11-15 hectares	16	13.3
16 and above hectares	02	2.7
Total	120	100

Source: Author's Field work, 2009.

Plate III: Gunna,s Farm (Kundu)

Table 4.9: **Experiences of environmental problems on farms:** the section shows whether the respondent have experienced any environmental problem. Table 4.9 summarises the results obtained from the question: Do you experience any environmental problem in your farmland?

Table 4.9 **Experience of Environmental Problem on Farmland**

Option	**Frequency**	**Percentage (%)**
Yes	112	97.3
No	08	2.7
Total	120	100

Source: Author's Field work, 2009.

4.10: **Types of environmental problems experience by the farmers:** The section shows the types of environmental problems experienced by the respondent in the study area. Table summarises the results obtained from the question: If Yes, Which Environmental Problem Do You Experience?

Table 4.10: **Types of Environmental Problem Experienced by the Farmer**

Environmental Problems	**Responses (Frequency)**	**Percentage (%)**
Vegetation depletion	54	48.2
Soil erosion	23	20.5
Reduction in Biodiversity	5	4.5
All of the above	20	17.9
Others (specify)	10	8.9
Total	112	100

Source: Author's Field work, 2009.

4.11: **Causes of Reduction in Farm Yield:** The section shows some reasons why respondent experienced low farm yield. Table summarises the results obtained from the question: What is the cause of reduction in your farm yield?

Table 4.11 **Cause of Reduction in Farm Yield**

Environmental Problems	Responses (Frequency)	Percentage (%)
Vegetation depletion	23	19.2
Soil erosion	18	15
Reduction in Biodiversity	5	4.2
All of the above	22	18.3
Others (specify)	52	43.3
Total	120	100

Source: Author's Field work, 2009.

4.12: **Possible remedies on environmental problems:** The section show some possible solutions to environmental problems by the farmer (respondents). Table 4.12 summarises the results obtained from the question: What do you think is the possible solution?

Table 4.12: **Possible Remedies on Environmental Problem**

Possible solution	**Responses (Frequencies)**	**Percentage (%)**
Reforestation	11	9.2
Fertilizer application	65	54.2
Crop rotation	9	7.5
Herbicides and insecticides	7	5.8
Others (specify)	28	23.3
Total	120	100

Source: Author's Field work, 2009.

4.13: **Sources of Fuelwood collected:** The section shows sources (places) where fuelwood are collected. Table 4.13 summarises the results obtained from the question: Where do you collect your Fuelwood?

Table 4.13 **Sources of Fuelwood Collected**

Source	**Frequency**	**Percentage (%)**
Roadside	25	19.1
Own land	46	35.1
Private land	40	30.5
State forest	20	15.3
Others	0	0
Total	131	100

Source: Author's Field work, 2009.

Plate IV: Fuelwood collectors

Plate V: Truck Tegina-Kagara

4.14: **Distance covered by Fuelwood collectors:** The section shows the distance covered by the respondents before they get to fuelwood places. Table 4.14 summarises the results obtained from the question: How far is the Fuelwood cut?

Table 4.14: **Distance Covered by Fuelwood Collectors**

Distance (KM)	**Frequency**	**Percentage (%)**
1-3	10	7.6
4-6	25	19.1
7-9	56	42.8
10 and above	40	30.5
Total	131	100

Source: Author's Field work, 2009.

4.15 **Reasons for Collection of Fuelwood:** The section shows reason on why the respondents are engaged in fuelwood activities in the study area. Table 4.15 summarises the results obtained from the question: Why Do Collect Fuelwood?

Table 4.15 **Reason for Collection of Fuelwood**

Purposes	**Responses (frequencies)**	**Percentage (%)**
Domestic use	50	38.2
Commercial use	35	26.7
Domestic/commercial use	46	35.1
Total	131	100

Source: Author's Field work, 2009.

Plate VI Fuelwood trader (T/ Kadai)

Plate VII: Fuelwood (Kwanan – Kumanu)

4.16 **The Rate of Collecting or Felling Trees:** The section shows the rate (frequency) of fuelwood collection by individual respondent in the study area. Table 4.16 summarises the results obtained from the question: How Often Do You Log or Fell Trees (collect)?

Table 4.16 **Rate of Collecting or Felling Trees**

Option	**Frequency**	**Percentage (%)**
Every day	30	22.9
Once a week	20	15.3
Twice a week	35	26.7
Monthly	8	6.1
Others	38	29
Total	131	131

Source: Author's Field work, 2009.

4.17 **Replanting of Trees by Fuelwood Collectors (Loggers):** The section shows whether the respondents replace tree cut in the study area. Table 4.17 summarises the results obtained from the question: Do you replant trees where you felled them?

Table 4.17: **Replanting of Trees by Fuelwood Collectors (Loggers)**

Option	**Frequency**	**Percentage (%)**
Yes	0	0
No	131	100
Total	131	100

Source: Author's Field work, 2009.

4.18: **Awareness of the Effects of Fuelwood Collection on the Environment**: The section shows whether the respondents are aware of the effect of fuelwood activities on the environment. Table 4.18 summarises the results obtained from the question: Are you aware of the effects of Fuelwood collection (Logging) on the environment?

Table 4.18 **Awareness of the Effect of Fuelwood Collection on the Environment**

Options	**Frequency**	**Percentage (%)**
Yes	115	87.8
No	16	12.2
Total	131	100

Source: Author's Field work, 2009.

4.19: **The Environmental Changes Experienced By Respondents:** The section shows the environmental changes experienced by the respondents in the study area. Table 4.19 summarises the results obtained from the question: Do You Experience Any Change in your environment?

Table 4.19: **Environmental Changes Experienced by Respondents**

Environmental changes	**Responses**	**Percentages (%)**
Depletion of tree species	101	78.9
Soil erosion	8	6.3
Reduction in biodiversity	6	4.7
All of the above	10	7.8
Others (specify)	3	2.3
Total	128	100

Source: Author's Field work, 2009.

4.20: **Method of Obtaining the Fuelwood:** The section shows how the respondents obtain their fuelwood in the study area. Table 4.20 summarises the results obtained from the question: How Do You Obtain Your Fuelwood?

Table 4.20: **Method of Obtaining the Fuelwood**

Energy source	**Frequency**	**Percentage (%)**
Purchase	38	29.0
Self-cutting	93	71.0
Total	131	100

Source: Author's Field work, 2009.

4.21: **Quantity of fuel-wood used for domestic purposes daily:** The section shows the daily estimates of fuelwood used by an individual for domestic activities. Table 4.21 summarises the results obtained from the question: What Is the Quantity of Fuelwood You Use for Domestic Purposes Daily?

Table 4.21: **Quantity of Fuelwood Used for Domestic Purposes Daily**

Quantity (cord)	**Frequency**	**Percentage (%)**
1 – 5	43	32.8
6-10	60	45.8
11- 15	19	14.5
16 and above	9	6.9
T0tal	131	100

Source: Author's Field work, 2009.

4.22: **Quantity of Fuelwood sold daily:** The section shows the daily estimate of fuelwood sold by individual respondent in the study area. Table summarises the results obtained from the question: What Is the Quantity of Fuelwood Sold and Used for Commercial Purpose Daily?

Table 4.22: **Quantity of Fuelwood Sold Daily**

Quantity (cord)	**Frequency**	**Percentage (%)**
10 – 20	22	16.8
30 – 40	51	38.9
50 – 60	40	30.5
70 and above	18	13.7
T0tal	131	100

Source: Author's Field work, 2009.

4.23: **Reason for Preference of Fuel Wood as Source of Energy**: The section shows why some respondents prefer the use of fuelwood to other sources of energy. Table 4.23 summarises the results obtained from the question: Why Do You Prefer the Use of Fuelwood to Other Alternative Energy Source?

Table 4.23: **Reason for Preference of Fuelwood as Source of Energy**

Reason	**Frequency**	**Percentage (%)**
Cheap	68	51.9
Readily available	46	35.1
Easy to use	11	8.4
Lack of other alternatives	6	4.6
Others (specify)	0	0
Total	131	100

Source: Author's Field work, 2009.

4.24 **Whether Fuelwood Users Are Willing To Change to Other Alternative Sources:** The section shows whether the respondents are willing to accept other sources of energy apart from fuelwood if made available to them. Table 4.24 summarises the results obtained from the question: If Other Sources Can Be Easily Obtained Will Change?

Table4.24: **Survey on Whether Fuelwood Users are willing to Change to Other Alternatives Sources**

Option	Frequency	Percentage (%)
Yes	125	95.4
No	6	4.6
Total	131	100

Source: Author's Field work, 2009.

4.25 **Experience of Any Problems Due To Fuelwood Use on the Environment**: The section shows whether the respondents experienced any environmental problem resulting from fuelwood activities. Table 4.25 summarises the results obtained from the question: Do You Experience Any Problem Due To the Use of Fuelwood in Your Environment?

Table 4.25: **Survey on Experience of Any problems Due to Fuelwood Use on the Environment**

Options	**Frequency**	**Percentage (%)**
Yes	114	87.0
No	17	13
Total	56	100

Source: Author's Field work, 2009.

4.26 E**nvironmental problem experience by Fuelwood user:** The section shows some environmental problems experienced by the fuelwood users. Table 4.26 summarises the results obtained from the question: Which of the environmental problems do you experience?

Table 4.26: **Survey on Environmental Problem Experience by Fuelwood User**

Problems	**Frequency**	**Percentage (%)**
Depletion of tree species	63	55.3
Soil erosion	16	14.0
Reduction in biodiversity	9	7.9
All of the above	12	10.5
Others (specify)	14	12.3
Total	114	100

Source: Author's Field work, 2009

4.27 **Possible Remedies to Environmental Problem:** The section shows some possible remedies to environmental problem by respondent (fuelwood user). Table 4.27 summarises the results obtained from the question: What are you doing to remedy the problem?

Table 4.27: **Survey on the Possible Remedies to Environmental Problem**

Remedy	**Frequency**	**Percentage (%)**
Reforestation	20	15.2
Use of alternative source of energy	66	50.4
Sustainable method of land clearing	8	6.1
All of the above	33	25.2
Others (specify)	4	3.1
Total	131	100

Source: Author's Field work, 2009

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This chapter presents the data collected by the Researcher in 2009 and analyzed to prove the presence of environmental problem resulting from the interference of man through his numerous activities such as fuelwood exploitation and agricultural.

5.1 Discussion

5.1.1 Analysis/Interpretation of Data in Table 4.1

Table 4.1 reveals that the age distributions of our respondents were as follows: those between 10-20years accounted for 18.2%, 21-30years, 44.7%, 31-40years, 25.1% and 41years and above, 7.3%. 4.7% of the questionnaires were not returned. This implies that the sample population constitutes of working population. By implication any type of activity engaged in by this category of sample population is going to be at high rate.

5.1.2 Analysis/Interpretation of Data in Table 4.2

Tables 4.2 show the occupational distribution status of the respondents. It is seen that public servants accounted for 19.8%, farmers/livestock rearers, 58.9%, traders 9.8% and others, 11.5%. This implies that majority of the respondents in the area are farmer/livestock rearers, (58.9%). This occupational distribution is likely to affect the extent of deforestation in the area for most of their activities deal with exploitation of the forest.

This implies that since the major occupation in the area is agriculture, the level or extent of deforestation would be high, since farmers' account for 58.9% of the population of the area.

5.1.3 Analysis/Interpretation of Data in Table 4.3

Table 4.3 show the sources of energy used for domestic activities e.g. cooking. It revealed that fuelwood accounts for 85.9%, 9.5% kerosene, 3.8%, electricity and 0.8 others (Gas, Caw dung, crop residues). This implies that majority of the respondents use fuel wood. Hence, this indicates high dependence on fuelwood which may result in high rate of forest exploitation. The consequence of this high rate of exploitation is environmental problems. However, 9.3% use kerosene while 3.5% and 0.8% of the remaining small proportion of respondents respectively use electricity and others (gas, Caw-dung, crop residues).

5.1.4 Analysis/Interpretation of Data in Table 4.4

Table 4.4 reveals the types of farming systems engaged in by the respondents in the study area. It indicates that crop farming accounts for 53.4%, 31.5%, animal rearing, 15.1%, mixed farming and 0%, others. This implies that majority of the sample population are engaged in crop farming in the study area. However, animal rearing engages a substantial number of the populace (31.5%). This reveals the high numbers of Fulani nomad present in the area. This further indicates the kind of pressure and destruction forest resources going on in the area.

5.1.5 Analysis/Interpretation of Data in Table 4.5

Table 4.5 shows that the duration of farming activities in the area. Between 1-3 years account for 2.7%, 5.5% between 4 - 6 years, and 13.7% between 7 - 15 years and 78.1% 12 years and over. This indicates that most of farmland have been under cultivation for years. This prolonged activity on the same piece of land exposes it to different climatic factors (rainfall, sunshine, wind) as well erosion which may result in environmental degradation.

5.1.6 Analysis/Interpretation of Data in Table 4.6

Table 4.6 shows the method of farm clearance or preparation the respondents (farmers) used in the area. It also revealed that mechanized system is 15.1%, Slash-and-burn system account for 27.7%, 45.2% cutting and burning 12.3 others. This implies that majority of the population used cut and burn system of land clearance. However, 15.1% of the

population, mostly the civil servants, traders and politicians, used the mechanized methods. This by implication destroys the biodiversity and soil structures which may expose the land to danger.

Plate: I and II show further details on cut and burn system of farmland clearance at different locations. They clearly show how the forest was destroyed by the respondent in the study area. The trees were cut-down and burned, with only few left on the farmland. Some of the respondents said that it adds nutrients to the soil.

5.1.7 Analysis/Interpretation of Data in Table 4.7

Table 4.7 shows the type of farming implements used by respondents in the farming operation. From the table it is observed that modern farm tools account for 12.5%, 25%, farm animals, 62.5%, simple farm tool and 0% others. This indicates that overwhelming proportion of the people used simple farm tools in their farming operation which accounts for 62.5%. Mechanized means accounts for 12.5%, while 25% used animals and 0% for others and Size of farm lands. However, the size of farmland by each respondent may be determined by the type of implement used. It also suggests that the farming operation in the area is labour intensive due to the nature of farm implement used by the respondents.

5.1.8 Analysis/Interpretation of Data in Table 4.8

Table 4.8 indicates the sizes of farm lands owned by individual respondents (farmers). From the table, it is seen that those who owned between 1 - 5 hectares accounts for 53.3%, 31.7% between 6-10 hectares and 2.7% between 16 and over hectares. This implies that the overwhelming majority of the people owned between 1-5 hectares as shown by 53.4% responses. This may be attributed to types of farm tools used by the respondents. It may also be as a result of economic capacity of the respondents in the study area. Those who owned more than 10 hectares (2.7%) are mostly politicians, civil servants and contractors e.g. Bala Gunna's farms at Kundu Ward and Garin Gabas etc. Plate III is an example of individual farmland. From the plate one can hardly see the end of the farmland and the vegetation has been destroyed. In some parts of the farm, land degradation has started gradually; hence, there is the need to act now to prevent further damage to the environment.

5.1.9 Analysis/Interpretation of Data in Table 4.9

Table 4.9 shows responses of respondents on whether they have ever experienced any environmental problems on their farms. It indicates that majority of the respondents (97.3%) have experienced environmental problems on their farms and hence their response were "yes". However, the remaining proportion of 2.7% has responded "No" meaning they have not experienced environmental problems. Quantitatively, it suggests that environmental problems have been experienced on farmlands in the study area. Therefore, the respondents have one or more environmental problem to tackle on their farm which may be as a result of their activities on the land.

5.1.10 Analysis/Interpretation of Data in Table 4.10

Table 4.10 shows the responses of the respondents on the types of environmental problems they experienced in the study area. It revealed that 48.4% of the respondents experienced vegetation depletion, 20.5% soil erosion, 4.5% reduction in biodiversity, 17.9% all the three mentioned problems and 8.9% others. As requested the other problems mentioned by the respondents include; soil infertility, increase in heat or temperature and less rainfall. This implies that if measures are not taken to reduce the exploitation of the natural vegetation in the area it is bound to have negative effects not only on the environment but can also affect man.

5.1.11 Analysis/Interpretation of Data in Table 4.11

Table 4.11 reveals the responses of the respondents on the possible causes of farm yield reduction. It was observed that vegetation depletion accounted for 19.2%, soil erosion, 15%, reduction in biodiversity, 4.2%, all of the above, 18.3% and 43.3% others (Lack fertilizer, insecticides and herbicides).

The respondents attributed low yield of farm product to lack of money to buy fertilizer. Some of the respondents said that lack of fertilizer forces them to practice shifting cultivation. This suggests that there would be a continuous destruction of virgin land to seek for fertile land.

5.1.12 **Analysis/Interpretation of Data in Table 4.13**

Table 4.13 shows responses of the respondents on the source of fuel wood used for commercial and domestic activities (e.g. cooking) in the L.G.A. It indicates that roadside accounted for 19.1%, owned land, 35.1%, private land, 30.5%, and state forest, 15.3%. This implies that majority of the respondents collect (source) their fuelwood on their own land or private land. It also suggests that other places respondents collect their fuelwood include; roadside and state forest. (See plate VI and V)

The collectors use different means to convey fuelwood to their homes and they claimed that they collect the fuelwood from their own land.

5.1.13 Analysis/Interpretation of Data in Table 4.14

Table 4.14 reveals the responses of the respondent on the distance covered to collect Fuelwood. It is seen that 1-3 kilometers accounted for 7.6%, 4-6 kilometers, 19.1%, 7-9 kilometers, 42.8%, 10 and above kilometers, 30.5%. This suggests that majority of the respondents travelled far distance before they get to fuelwood. This is evidence of vegetation depletion (deforestation) in the study area. This also revealed extent of forest resource destructions as well as the fuelwood exploitation in the study area.

5.1.14 Analysis/Interpretation of Data in Table 4.15

Table 4.15 shows responses of respondents on why they are engaged in Fuelwood collection in the study area. The table indicates that domestic use accounted for 38.2%, commercial use, 26.7% and 35.1% for domestic and commercial uses. This implies that majority of respondents in the study area collect Fuelwood for the personal use. It also revealed that majority of the sampled population collect Fuelwood for both domestic and commercial purposes. It further indicates that only 26.7% of total respondents collect Fuelwood for commercial purpose only. Plate 4.6 and 4.7 Show fuelwood trader along Kagara – Kaduna.

5.1.15 Analysis/Interpretation of Data in Table 4.16

Table 4.16 shows the rate of felling trees for fuelwood in the study area. It revealed that those who collect Fuelwood daily accounted for 22.9%, weekly, 15.3%, monthly, 6.1%

and 29 %, others (any time there is demand or need. This suggests that 29% responded that there is no specific time for logging since logging rate depends on the demand and availability of the species desired. However, this implies that the high rate of demand leads to more fuelwood collections to meet the demand of communities. Hence, there is a need to look for alternative ways of satisfying the demand for Fuelwood.

5.1.16 Analysis/Interpretation of Data in Table 4.17

Table 4.17 reveals whether the collectors (loggers) replant (replace) trees where they fell/cut them as a measure of controlling deforestation in the study area. From the table it is observed that "yes" responses accounted for 0% while the "No" responses accounted for 100%. This implies that the collectors (loggers) do not replant trees where they fell or log. However, respondents claimed that the trees in the bush do not need to be replanted, they grow naturally. Some claimed that they pay revenue to the government as such the government should be held responsible.

5.1.17 Analysis/Interpretation of Data in Table 4.18

Table 4.18 shows whether environmental problems are experienced where cutting of trees take place. From the table it indicated that "yes" constitutes 87.8% total responses, while" No" accounted for the remaining 12.2%. Quantitatively, this implies that the collectors experienced environmental problems where they cut or fell trees. However, 12.2% of the collectors do not experience environmental problems; to them, the cutting is selective.

5.1.18 Analysis/Interpretation of Data in Table 4.19

Table.4.19 shows the responses of the respondents on the environmental changes they noticed in the study area. The result revealed that vegetation depletion accounted for 78.9%, soil erosion, 6.3%, reduction in biodiversity, 4.7%, all of the above, 7.8% and others 2.3 %. This implies that vegetation depletion is experienced. This cutting of trees exposes the ground to sunlight and other elements of weather. The cutting of trees also affects other biomass or plant species when trees fell on them. It may accelerate soil erosion by rains and wind. Destruction of biodiversity affects ecological balance of the area.

5.1.19 Analysis/Interpretation of Data in Table 4.20

Table 4.20 Show the method of obtaining fuelwood commercial and domestic activities. From the table it indicates fuelwood purchase accounted for 29.7% while self-cutting is 71%. This implies that majority of the respondents (71 %) collect fuelwood by themselves. However, 29% of respondents purchased fuelwood for either domestic or commercial use. This suggests that since majority of respondents do not buy fuelwood, there is tendency for indiscriminate use of fuelwood by the respondents in the area. This may worsen the rate of vegetation depletion and other environmental problems.

5.1.20 Analysis/Interpretation of Data in Table 4.21

Table 4.21 shows the estimated quantity of fuelwood used for domestic activity (in term of cords) in the area. From the table, it indicates that 1-5 cords accounted for 32.8%, 6-10 cords, 45.8%, 11-15 cords, 14.5% and greater than 16 and above cord, 6.9%. This implies that majority of the respondents' uses 6 - 10 cords depending on the activities and size of the family. However, a substantial proportion of extended families living together used 6-10 cords daily for domestic cooking and other home activities.

However, 14.2% of the respondents used 11-15 cords daily largely for domestic purposes such as catering services. 5.9% of the respondents used greater than 16 cords daily such as for bread making. According to respondents the quantity of Fuelwood used daily depends largely on the size and activities involved.

5.1.21 Analysis/Interpretation of Data in Table 4.22

Table 4.22 shows the estimated quantity of fuelwood sold daily by the traders (in terms of cords) in the area. The table shows that 10 – 20 cords represented 11.5 %, 30 - 40 cords, 38.9%, 50 – 60cords, 30.5%, 70 and above cords, 13.7%. This implies that majority of the respondents sold between 30 -60 cords daily. Though some explained that the sales depend on the demand from consumers while others attributed it to season.

However, 13.7% of the respondents sold between 70 and above cords but largely are suppliers (whole seller). It also suggests that 16.8% of the total proportion some explained that they sold to meet their daily demand as well as to supplement other main occupation.

5.1.22 Analysis/Interpretation of Data in Table 4.23

Table 4.23 indicates the responses of the respondents on their reasons for preferring fuel wood as a source of energy for domestic activities. The table shows that "cheap" accounted for 51.9%, 35.3%, "readily available", 13.2%, easy to use and 4.6%, lack of alternatives. This implies that overwhelming majority (87%) of responses preferred using fuel wood because it is cheap and readily available in the area as compared to other sources. Other alternatives sources like Kerosene are more expensive, while others are not even available in some locality such as electricity and gas. (See figure VI)

5.1.23 Analysis/Interpretation of Data in Table 4.24

Table 4.24 shows whether the respondents are will to change from fuelwood to other alternative sources for domestic use. It shows that "yes" response accounts for 95.4% indicating their interest to change to other alternative sources. The "No" response represents 4.6% indicating that the respondents will not change to other alternative sources. This percentage is negligible to cause much impact on the environment. Hence, there is the need to make other sources of energy available and at affordable rate to both rural and urban Fuelwood users.

5.1.24 Analysis/Interpretation of Data in Table 4.25

Table 4.25 shows whether the respondents experienced any environmental problem resulting from the use of Fuelwood in the study area. From the table it is seen that "yes" accounted for 87% while" No" accounted for 13%. This implies that the respondents experienced environmental problems due to use of Fuelwood. However 12.5% of the vendors (traders) do not experience environmental problems; according to them, it involved dead trees.

5.1.25 Analysis/Interpretation of Data in Table 4.26

Table 4.26 shows that vegetation depletion (tree species) accounted for 55.3%, soil erosion, 14%, reduction in biodiversity, 7.9% all of the above, 10.5% and others, 12.3%. According to the respondents other environmental problems include; exposure of the ground to weather elements such as sunlight, rain and wind, increase in heat or temperature of the area since trees that provide shade are felled, accelerated soil erosion by heavy

rainfall and strong wind, reduction in wild life and forest organism including birds, offsetting the biodiversity and ecological balance of the area and dryness of the areas where trees are cut down.

5.1.26 Analysis/Interpretation of Data in Table 4.12 and 4.27

Table 4.27 and 4.12 shows the responses of the respondents on what they may perceive as solutions to the problems they experienced in the study area. The table indicates that reforestation accounted for 15.2%, use of alternative source of energy, 50.4%, sustainable method of land clearing, 6.1%, fertilizer application, 54.2%, crop rotation, 7.5%, herbicides and insecticides, 5.8% others, 3.1%. Others as mentioned by the respondents include; strong government law, availability of electricity, gas and kerosene at affordable prices.

However, this implies that vegetation depletion can be reduced if other sources of energy are made available to both rural and urban population at affordable prices. Hence, the government should create and implement law that would not hamper the activities of rural people but that will protect the environment.

5.2 Summary

This study was conducted to find out the environmental consequences of fuelwood exploitation in Rafi Local Government Area of Niger State.

Based on the research findings, the sampled population constitute largely of working population with 69.8% between the ages of 21- 40 that are engaged in most of the activities in the study area. About 37.1% of the respondents are engaged solely in farming and livestock rearing. It also indicates that 85.9% use fuelwood as their main source of energy. The domestic use and commercial use of fuelwood in the area accounted for 64.9%, while 34.5% were domestic/commercial fuel wood users. The implication of the foregoing on the environment is that for human activities such as farming, timbering, and provision of energy (in the form of fuelwood and charcoal) for domestic and commercial uses to be carried out effectively, forests have to be destroyed.

The extent and level of deforestation in the local government area is obvious on the landscape. Areas which were hitherto covered with thick forests consisting of varieties of plants and animals lives are fast diminishing paving way to farmlands, expansion of urban areas and other land use into the forest land so that the extent of coverage of the guinea savanna vegetation has drastically diminished over the years. The extent of forest depletion may also be compared to the distances covered by different fuelwood collectors in the area. The proportion or percentage indicates that 72.3% covers distance of 7 and above kilometers in search of fuelwood. The study suggests that majority of the respondents travelled far distances any time they need fuelwood for their use.

However, 65.6% of the sampled population collect fuelwood from private land or owned land. It also revealed that 22.9% collect fuelwood every day. This further shows the extent of exploitation in the study area. The vegetation of the area at present is no longer natural due to interference as a result of human activities.

The consequences of the foregoing human activity have started showing on the environment. These consequences include depletion of the specific tree species, reduction in biodiversity, soil erosion. Others consequences are increase in temperature in the area since the trees which provide shade are felled, accelerated soil erosion by heavy rainfall and strong winds, reduction in wildlife and forest organisms including birds, dryness of the area where logging is carried etc.

The tree planting campaign by various levels of government has been more of ceremonial and political than practical efforts to tackle the problem of energy crises. The local population is also ignorant about the consequences of deforestation on the environment and human life. Hence there is need for public awareness, re-orientation of the attitude of the public towards conservation and sustainable exploitation of the environment. There is urgent need for the government agencies to practically apply and implement the policies to remedy the situation.

5.3 Conclusion

The study was carried out using questionnaire method, proportions and percentages to assess the environmental consequences of Fuelwood exploitation in Rafi Local Government Area. The result showed that percentages and proportions can be used to identify fuelwood sources, extent of fuelwood exploitation, possible solutions and recommendations by the respondents in the study area.

However, it becomes obvious that environmental problems in Rafi local Government area of Niger State is linked to the interference of man through his numerous activities such as fuelwood exploitation and agricultural activities. The consequences of man's interference are having an impact on the environment thereby destroying the forest, soil organisms and biodiversity.

There is also a need for re-orientation of attitudes of the populace towards sustainable use and protection of natural environmental resources (forest). Hence, practical implementation of government policies and programmes would reduce the rate of indiscriminate exploitation of fuelwood in the area.

Finally, considering the importance of natural environmental resources for sustainable development, there is need for more research, so as to have current and reliable data for sound decision making that would improve the economy of the community and the country at large.

5.4 Recommendations

This study presents the analyzed data using proportion and percentage on environmental consequences of fuelwood exploitation. The demand for forest product is expected to continue to increase thus there is need for reforestation and effective management of forest resources. In order to be able to harness the full potentials of the forest resources on sustainable basis in Rafi L.G.A, the following recommendations are regarded as important:

There is need for public awareness and re-orientation of the attitude of the public towards conservation and sustainable exploitation of environmental resources.

Many farmers are forced to cut wood illegally because of limited rural employment opportunities. If other employment opportunities are created, some will abandon this business. People need to be mobilized to form self-help groups, so that the government, non-governmental organizations, and donors can assist them in their efforts.

Agricultural (or rural development) extension services should pay more attention to and have greater capacities for evaluating woody biomass issues and opportunities. By extending the reach of policies and interventions to people on the ground, initiating and spreading successful innovations, and detecting trends and trouble spots, calls for decentralised networks of information and expertise.

Political will must be secured to ensure that forestry initiatives are upheld, the level of public awareness of the value of forests must be increased while Non-Governmental organizations, stakeholders and Donor - agencies should be encouraged to play more active roles in forestry development

The effort to control the exploitation of forest resources should be done through community involvement in policy formulation and decision making.

The tree planting campaign should be taken with all seriousness rather than for political motives or personal interests.

There is need for relevant government agencies to educate the farmers on the adequate and appropriate methods of farming and land management to reduce the rate of environmental resources exploitation (Fuelwood). This will also alleviate the impact of population pressure. For example, mixed farming, crop rotation could be enhanced as a way of improving the practice of slash and burn shifting cultivation.

Government should encourage the use of alternative sources of energy that would minimize reliance on fuel wood. The government should subsidise the cost of other sources (Gas, Kerosene, electricity) and making it available to both urban and rural area dwellers.

Media coverage of environmental and fuelwood/energy issues should be promoted, especially about local problems and initiatives on local radio and posters. Malawi and Tanzania have made significant moves in this direction.

The need for general alleviation of poverty cannot be overemphasized in view of the inherent damaging effects of poverty on the environment. In this regard, the government can encourage the farmers by subsidising the cost of inputs as well as purchasing the products from farmers at a reasonable price. Other alternative sources of fuel, such as solar energy, wind energy and biomass can be developed and exploited to reduce dependence on fuelwood.

However due to population pressure and the limited land and forest resources, shifting cultivation is no longer a suitable land use system because it is destructive to the environment. Therefore there is a need to stress multiple-land use systems in the rural areas. Farmers in these areas, in addition to growing food crops, should be encouraged to plant trees, for fruits, fodder, fuel, poles, income, and other economic uses.

Finally, there is the need for good governance that has the interest of the society and ready to protect its interest. And importantly the government at all levels should show more commitment and political will in areas of protecting our natural environment (forest resources) through intense enlightenment campaign on conservation and sustainable use.

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FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

QUESTIONNAIRE FOR THE RESEARCH ON ENVIRONMENTAL CONSEQUENCES OF FUELWOOD EXPLOITATION IN RAFI LGA OF NIGER STATE. 2009.

In an attempt to bridge the information gap existing in the field of knowledge, the questionnaire is designed to collect data to examine the environmental consequences of fuelwood exploitation in Rafi LGA. Therefore, the questionnaire is purely for academic purpose.

1. Age.....
2. Sex.....
3. Occupation.....
4. What is the main source of energy use at home?
   a. Firewood
   b. Kerosene
   c. Electricity
   d. Others
5. Which role do you play in firewood activity?
   a. Collector (logger)
   b. Domestic user
   c. Commercial user
   d. Domestic/commercial user
   e. others
6 Which type of farming system do you practice?
   a. Crop farming
   b. Animal rearing
   c. Mixed farming
   d. others
7 What is the size of your farm land?
   a. 1 -5 hectares
   b. 6-10 hectares
   c. 11-15 hectares
   d. 16 and above
8 Which type of farming implement do you use?
   a. Modern farm tools
   b. Hoe and axe
   c. Simple farm tools
   d. Animal
   e. others
9 Which method of land clearance do you use?
   a. Mechanized
   b. Slash and burning

c. Cutting and burning
d. others

10 How many years have you been working on this farmland?
a. 1-3 years
b. 4-6 years
c. 7-9year
d. 12 and above

11 Do you experience any environmental problem in you farmland?
a. Yes
b. No

12 If yes, which environmental problems do you experience?
a. Vegetation depletion
b. Soil erosion
c. Reduction in biodiversity
d. All of the above
e. Other specifies

13 Do you experience reduction in your farm yield?
a. Yes
b. No

14 If yes, what do you think is the cause of reduction in your farm yield?
a. Soil infertility
Inadequate rainfall

b. Climate change
c. Deforestation
d. Others (specify)

15. What do you think is the possible solution?

a. Reforestation

b. Fertilization application

c. Crop rotation

d. use of herbicides and insecticides.

e. others (specify)

FUELWOOD COLLECTOR

1. Where do you collect your firewood?
a. Roadside
b. Own land
c. Private land
d. State forest

e. other

2. How far is the firewood cut?
   a. 1-3 kilometer
   b. 4-6 kilometer
   c. 7-9 kilometer
   d. 10 – above kilometer
3. Why do you collect firewood?
   a. Domestic use
   b. Commercial use
   c. Domestic/commercial user
4. How often do you collect firewood?
   a. Once a week
   b. Twice a week
   c. Thrice a week
   d. Four times a week
   e. Five times and above
5. Do you know of any official regulations guiding fuelwood cutting?
   a. Yes
   b. No

6. Do you replace (replant) the trees you fell?
   a. Yes
   b. No

7. Are you aware of the effect of firewood collection (logging) on the environment?
   a. Yes
   b. No
8. Do you experience any change in your environmental?
   a. Yes
   b. no
9. Which of the environmental changes do you experience?
   a. depletion of tree species
   b. soil erosion
   c. reduction in biodiversity
   d. all of the above
   e. others specify

FUELWOOD USERS

1. How do you obtain your firewood?
   a. Purchase
   b. Self- cutting

2. What is the quantity of fuelwood you use for domestic purposes daily?
   a. 5 pieces (cords)
   b. 10 pieces(cords)
   c. 15 pieces(cords)
   d. 20pieces(cords) and above
3. What is the quantity (log) of firewood you use for commercial purposes daily?
   a. 10 -20pieces(cords)
   b. 30 -40 pieces(cords)
   c. 30 -50 pieces(cords)
   d. 50pieces(cords)
   e. 60 pieces (cords)and above

4. Why do you prefer the use of firewood to other alternative energy sources?
   a. Cheap
   b. Readily available
   c. Easy to use
   d. Lack of other alternatives
   e. Others
5. If other sources can be easily obtained will you change?
   a. Yes
   b. No
6. Do you experience any problem due to the use of firewood in your environment?
   a. Yes
   b. No
7. Which of the environmental problems do you experience?
   a. Depletion of tree species
   b. Soil erosion
   c. Reduction in biodiversity
   d. All of the above
   e. Other (specify)
8. What are you doing to remedy the problem
   a. Reforestation
   b. Changing to other alternative source of energy.
   c. Sustainable method of land clearing
   d. All of the above
   e. Other (specify)