ECONOMIC ANALYSIS OF DEFORESTATION IN AKWANGA LOCAL GOVERNMENT AREA OF NASARAWA STATE, NIGERIA.

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NSU/MSC/ERM/0104/16/17

DISSERTATION SUBMITTED TO THE SCHOOL OF POST-GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF SCIENCE (MSC) DEGREE IN ENVIROMENTAL RESOURCE MANAGEMENT. DEPARTMENT OF GEOGRAPHY, FACULTY OF SOCIAL SCIENCE NASARAWA STATE UNIVERSITY, KEFFI.

FEBRUARY, 2021.

DECLARATION

hereby declared that this dissertation has been written by me and is a report of my research. It as not been presented in any previous application for master's degree. All questions are ndicated and sources of information specifically acknowledged by means of reference.

ign..... Date.....

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CERTIFICATION

This dissertation titled "Economic Analysis of Deforestation in Akwanga Local Government Nasarawa State. Nigeria." Is written by Abimiku Margaret meet the regulations governing the a ward of Master of Science in Environmental Resource Management, Nasarawa State University Keffi and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to Almighty God whom in his infinite mercy, wisdom, strength and knowledge have been given unto me to carry out the research.

ACKNOWLEDGEMENTS

specially appreciate my supervisors, Prrof. N.D. Marcus and Dr. A.T. Ogah for their efforts nd guidance towards the successful completion of this thesis. Thank you and God bless you, Sir.

n addition, I am grateful to the entire staff of the Faculty of Environmental Science, Nasarawa State University: Prof. M. N. Idris, Prof. H. K. Ayuba, Prof. O. Iwugo, Prof. M. U. Mbanaso, Dr. K. S. Ishaya, Dr. A. Mahmud, Dr. Sani Yahaya, Dr. A. Mansir, Dr A. A. Kadafa, Dr. M. Alkali, Dr. Bello,Dr. U. S. Lay, Mr. Sunday Y. Kpalo, Mr. Daniel Adamu, Mr. M. A. Eya, Mrs. Ekpo A. S, Mr J. Kunda, Mr. Chuwate. T. Banki and Mr. Adana. Thank you all, for letting me benefit rom your wealth of knowledge and experience.

My grateful appreciation goes to Almighty God's spirit to withstand all the challenges that I face ip in my course of study and academic endeavor

, highly thank my parents who laid the good foundation for my academic career and also for heir good moral background and discipline instilled in me. My appreciation goes to my brothers or their both moral and financial support toward the success of my programme. In fact their contribution will never be forgotten in my life. I also appreciate my course mates for their effort nd time wasted to assist me in sourcing materials for my research and encouragement given to ne. I also highly appreciate my lecturer for their inspiration, moral and academic training me to become Environmentalist today. My conclusion prayer and hope that, may God blessed each nd every persons whose names is include in my work and those who I forgot to mention their names here, let God reward you abundantly Amen.

Table of Contents

ABSTRACT

he study provided an economic analysis of the losses from deforestation in Akwanga Local overnment, Nasarawa State Nigeria. Specifically, the study evaluated the effects of ocioeconomic factors affecting deforestation in Akwanga Local Government. It also identified e factors that influence the decision to deforest. The study further examined the nature and xtent of deforestation in the state. Primary and secondary data generated were analyzed with escriptive statistics, multiple regression and logit analytical techniques. Also total economic aluation (TEV) model of valuing deforestation was used to achieve aggregate economic loss om different deforestation operations in different sectors of forest use. The major finding of the udy shows that bush fire was the highest cause of deforstation in Akwanga Local Government. rom the study, 69% of the respondents stated that they had no knowledge of any orest extension services. Furthermore, the total economic value (TEV) loss of forests in the last hree years were N75,855,558.00 for 2008; N89,674,707.00 for 2007 and N85,683,956.00 for 006. Mulitivariable linaer results of farmland clearance of forest for cropping activities show hat only size of land, land tenure system and types of cropping were significant at 5% in xplaining the observed variabilities in the dependent variable (Y). The study further found out hat deforestation experience, household size, total landholdings, educational attainment and ender of respondents were significant at 10% in explaining the observed variabilities for ocioeconomic characteristics influencing the decision to clear forest for agricultural activities sing farmers level logit regression results. Based on the findings, the study recommends that orest extension services to the rural households that engage in forestry activities should be trengthened through frequent training. This will help them have adequate and recent nformation about government policies on environment and communicate the same to the rural takeholders. Also, there is need for constant use of both electronic and print media in trengthening anti-deforestation awareness and in communicating recent forestry policies of the overnment to all the stakeholders in the state. Government should encourage the use of energy aving stove. This will help reduce the quantity of fuel-wood use and hence reduce the level of eforestation in the study area.

CHAPTER ONE

INTRODUCTION

Background to the Study

r many developing countries like Nigeria and a state like Nasarawa State in particular, forests)resent an important resource base for economic development. If managed wisely, the forest s the capacity to provide a perpetual stream of income and subsistence products, while)porting other economic activities (such as fisheries and other agricultural activities) through ecological services and functions. Meanwhile, Nasarawa State has land area of about 8,000 .are kilometers and population of 3,257,298 according to National Population Commission PC 2006). The state has population density of about 406 persons per square kilometres. About % of the population lives in the rural areas where agriculture is the predominant economic ivity. Agriculture accounts for about 70% of employment in the rural areas while the vernment employment is only 5% of working-age population as reported by Eboh, et al.)06).

restland may be utilized in many different ways. It can be used for commercial timber traction; it may be converted for commercial agriculture purposes such as oil palm or rubber ntations. Furthermore, forest may be used for traditional subsistence activities (for example, ditional agricultural practices such as agroforestry and shifting cultivation, and/or for the traction of non-timber forest products or it may be afforded various levels of protection ough the establishment of a protected area, a national park or wildlife sanctuary among others :ording to International Institute for Environmental Development (IIED, 1994). According to :eh (2004), three activities are done in the forests that yield income to the rural households in sarawa State. These activities are gathering, processing and marketing of forest products.

ow best to manage forest resources by rural households so that they can make more income and en create more economic position has become a growing concern for policy makers, interest oups and the public due to the following reasons: the increasing scarcity of virgin forest land; eater awareness and understanding of the social and economic implications of destructive est practices especially at the rural level: and, a growing realization that the significant portunities for economic development based on forestry activities should not be wasted. eater attempts are now being made to rationalize the decision making process with respect to e use of forest resources. If the returns from forest resources are to be maximized over the long m, then the forest needs to be managed sustainably (i.e. the production of goods and services ed to be balanced with the conservation of the resource base of the forest). In order to make stainable forest management decisions, more reliable information on the environmental, social, d economic value of forests in their own right and relative to other land uses is urgently eded.

cording to van Kooten and Bulte (2000), deforestation refers to the removal of trees from a rested site and the conversion of land to another use, most often agriculture. There is growing ncern over shrinking areas of forests in the recent time (Barraclough and Ghimire, 2000). The elihoods of over two hundred million forest dwellers and poor settlers depend directly on od, fibre, fodder, fuel and other resources taken from the forest or produced on recently cleared rest soils. Similarly, Nzeh and Eboh (2007), poor people have thus been able to exploit e forest for food, fuel and other marketable products which create both income and ployment for the rural dwellers. Furthermore, deforestation has become an issue of global vironmental concern, in particular because of the value of forests in biodiversity conservation d in limiting the greenhouse effect (Angelsen et al., 1999). This has led economists to increase

ir efforts to model the process of deforestation and conversion of forests to other land uses. t, in the view of Enabor (1986), deforestation is the removal or destruction of forest vegetation hout any deliberate attempt at its regeneration. The term thus, includes not only felling of ıber trees, but also removal of shrubs, lianes and other plants from the forest. Deforestation is old as man himself and as Enabor (1986), rightly reported, the early stages of civilization ıde it essential to destroy and remove some of the abundant forests in order to pave the way for ivities such as arable farming and human settlements which advanced human development. forestation can therefore be regarded as primarily a result of man's efforts to meet his itimate needs for social and economic development through expanding agriculture, lustrialization and infrastructural development.

rests in the tropics are being destroyed at an alarmingly high rate in recent years especially in geria and particularly in Enugu State as reported by Eboh et al (2006). According to FAO)81), statistics estimated that between 8million and 20million hectares of tropical forests are noved annually and that the area of plantation in 1980 was about 12million hectares which)resent only 10% of the total forest areas deforested annually. Going by this high rate of forestation and the low level of aforestation, the World Resource Institute (WRI), (1985))jected that about 225million hectares of tropical forests would have been deforested by the ar 2000. Meanwhile, FAO 2011 reported that between 1990 and 2005 the loss of forests was ghest in the tropics. FAO 2011 further stated that the net losses in this region averaged 6.9 illion hectares/year between 1990 and 2005 and that the highest rate of conversion of forest ıd was in South America, followed by Africa.

Nigeria, the rate of deforestation appears to have accelerated in recent years. Deforestation timates for the country has been put at approximately 285,000 hectares annually (Oseni, 1998

:l Aruofor, 1999). It is believed that at this rate of deforestation about 50% of the nation's 'est land area was be destroyed in year 2017. Going by this trend, deforestation has thus :n described as the major problem facing the forest ecosystem in this country. The extent of forestation in any particular location or region should be viewed with economic, ecological d human consequences in mind. This is because forest degradation may in many ways be :versible. In the short term, because of the extensive nature of forest, the impact of activities ering their condition is not immediately apparent and as a result they are largely ignored by)se who cause them. The forest is often perceived as a stock resource, a free good, with the id as something freely available for conversion to other uses without recognition of the nsequences for the production services and environmental roles of the forest, hence many 'est ecosystem have been degraded into less diverse and stable ones according to Aruofor,)99)

:cording to Adeofun (1991), the degradation of the forest ecosystem has obvious ecological 'ects on the immediate environment, but it may also affect distant areas. For instance, ricultural plains or valleys that depend upon forest highlands for their water may suffer)oding or drought as a result of the destruction of the forests. Genetic damages and losses of nts, animals and insects can also be serious and possibly permanent.

:forestation can result in erosion which in turn may lead to desertification. The economic and man consequences of deforestation include loss of potential wood and paper products among hers which may then need to be imported. Furthermore, the loss of forest may run counter to at is for many developing countries the most urgent of all needs-fuelwood for cooking and ating. As environmental degradation and its consequences come clearly into focus we are :ed with

prospect that the renewable forest resources may be exhausted and that man stands the risk of troying his environment if all the impacts of deforestation are allowed to go on unchecked. It herefore, important to carry out a periodic economic analysis, monitoring and assessment of environment in Nasarawa State which is the major reservoirs of our natural resources and st especially the forestry resources.

Statement of Problem

oughout sub-Saharan Africa, including Nigeria, forests and tree products are rapidly being raded, logged and cleared for agriculture and other developmental projects. Estimates for l tropical Africa put the total loss in the forest cover between 1990 to 1995 to be about 18 lion hectares and 7% annual loss (FAO, 1997). Eboh et al (2006) stated that up to 50% of est/woodland may have been lost in the last 4 to 5 decades, judging from both FAO and land and vegetation (LUV) data over the last 3 decades. Meanwhile, FAO (2005) reported that geria, with total land area of 92,377,000 hectares, has annual change in total forest cover of -2% between 2000 and 2005 whereas her primary forest cover annual change within the same iod 2000 and 2005 stood at -11.14%. Also, Eboh (1995) observed that about 5% of the forests Nigeria are lost yearly through the industrial, commercial and other urban-related activities. other source put the average annual deforestation at 40,000 hectares between 1981 and 1985, ile the annual reforestation in the same period was 26,000 hectares (World Resources titute, 1992).

forestation in Nasarawa State is really an ongoing phenomenon. In the recent years, so much ve been said about the impacts of deforestation in Nasaraw State, as reported by Eboh et al. 005). This is becoming more pronounced with increasing population of the state which ording to NPC (2006) stood at 3,257,298. The effects of such depletion have led to a decline

forest cover, forest degradation, impoverishment of the soil and general deterioration in vironmental conditions. For example, deforestation has often led to frequent occurrence of sion, flooding and siltation of water bodies in some part of the study area. e critical aspect of the knowledge gap is the shortage of reliable economic values of orestation in Nigeria especially in Nasarawa State. Because of this shortage, policymakers en do not have credible evidence bases to promote sound forest management. While literature eplete with information about the consequences of deforestation, past studies did not produce ntitative estimates about the economic losses from deforestation.

nerally, the socioeconomic consequences of forest exploitation and consumption are rlooked. In Sub-Saharan Africa which includes Nigeria, many households cooking in the ne depend on fuelwood, which is responsible for more than 75% of all energy consumed in country annually as reported by Ardayfio-Schandorf (1993). Most small-scale industries and od-processing enterprises that women undertake depend in large part on fuelwood. This pendence on fuelwood has contributed to the growing exploitation of the country's forest. e economic implications of deforestation in the study area include scarcity of fuelwood for oking and heating especially among the rural populace. This accelerating nature of orestation is also threatening the sustained resources base of the forest raw materials. Another nomic implication is the decline in forest-dependent industries which according to Nzeh and oh (2007) involves forest product gathering, processing and marketing.

rtherance to the above observed implications, Woodall (1992) reported that in many cases litical decision-makers in developing countries like Nigeria intentionally permit deforestation continue because it acts as a social and economic safety value. By giving people free access to ested lands, the pressure is taken off politicians to resolve the more politically sensitive

blems that face developing countries, such as land reform, rural development, power-sharing, so on.

ilable data shows that forest area in Nasarawa State declined from 177,695.7 hectares in the r 1991 to 156.887.7 hectares in the year 1997 and finally to 135,396.4 hectares in the year 3 as reported by Eboh et al 2005. While, it is widely acknowledged that this forest decline far reaching social and economic consequence, there is little analytical insight into the ire, pathways and causation of these consequences. This gap in empirical evidence of the sequence of forest decline is hampering policy responses by government and forest eholders. This study therefore seeks to ameliorate this knowledge gap by inquiring into the ire, causes and patterns of deforestation in Nasarawa State.

find out the economic implications of these consequences of deforestation, there is need to y out this study. This will enable forestry policy makers, other stakeholders and even farmers he study area to be better informed about the implication of deforestation and seek innovative ans and ways to combat deforestation.

Research Questions

- What are the nature and extent of deforestation?
- What are factors that influence the decision to deforest?
- What are the effects of socioeconomic factors on deforestation?
- What are the ways for sustainable management and use of forests?

Objective of the Study

broad objective of this study is to conduct an economic analysis of losses (if any) from orestation in Nasarawa State. The specific objectives are to:

Examine the nature and extent of deforestation

Identify and analyze the factors that influence the decision to deforest.

Evaluate the effect of socioeconomic factors on deforestation and

Derive ways for sustainable management and use of forests.

Statement of Hypothesis

Deforestation has impact on socioeconomic development in Akwanga Local Government Area in Nasarawa State

Deforestation has no impact on socioeconomic development in Akwanga Local Government Area in Nasarawa State

Significance of the Study

economic and environmental problems facing the developing world are staggering in their gnitude and their complexity. They are fueled by the vicious cycle of population growth and sistent poverty. Most countries face serious problems in urban environment: overcrowding, mployment, growing crime, lack of portable water, inadequate sewage disposal, increasing pollution and the inappropriate disposal of toxic wastes. In rural areas, the deterioration of ural resources not only destroys the environment, but also undermines the very foundation on ch economic growth and long term prosperity depend. The catastrophic impact is seen in elerating soil erosion which results in permanent loss in agricultural productivity, in ancing desertification accompanied by drought and famine, in declining coastal and inland eries with the associated threats to food security, in the misuse of agrochemicals that poison

ı people and the environment, in the alarming sedimentation of fragile coral reefs; and in the ruction of biodiversity-rich wetlands. But suffice it to say that none of these natural resource ɔlems is more threatening, none more in need of immediate action, than the deforestation of forests.

hermore, an important element in the present and future programme for assessing the ıomic valuation of deforestation of forest resources is the availability of some modern lels to determine the resources stock, rate of use as well as the impact of the use on the ironment. Further resultant effects of lack of this policy include no ɔer planning of forestry activities in the state. This gap is causing sustainable management ɔlem of forest in the state. In other to solve this policy gap, research is needed to produce ɔirical knowledge that will guide policy makers. This study will also justified since rmation on economic analysis of deforestation estimate are not available in the study area, this can be derived from this study. Truly, researches have been carried out on the forestry ation in the state, as reported by Ujah and Eboh (2003) but none of them focused on nomic analysis of the forest losses especially as it relates to non-reserve forest. Meanwhile, study will be useful for the management of the state forest resources and for the provision of essary guidelines for its conservation.

ırt from the fact that results of this study will permit detection of nature, forms of forest ɔrestation and identification of those factors responsible, which can also act as guidance for ng decision on future land-use and a forestation projects in the study area.

CHAPTER TWO

LITERATURE REVIEW

Conceptual Framework

Nature and extent of Deforestation Activities in Africa

iculture is the main cause of deforestation in African countries according to Persson, (1987). forests of this continent now cover less than half the area for which they are considered the ıral climax. The greatest forest cover changes are occurring in West Africa where large ulation exits. Howard and Lanly (1975) in their views reported that the forest area in Cotede- re has been reduced by 30% in a ten year period. But according to FAO (2003) in the ıe Cote-de-Ivoire the annual rate of change of forest from 1999-2000 is put at -3.1%. vever, deforestation is most severe in the dry sub-tropical woodlands of the Sahel zone. This ecause more than 90% of the population in this zone depends on fuelwood for cooking and r average annual per capital consumption of fuelwood ranges from 225kg to 450kg (Eckhom, 6). Furthermore, Club de Sahel (1978) stated that in this zone wherever population densities eed twenty five persons per square kilometer, total deforestation is inevitable. In Nigeria, O 2011 reported that the country lost 55.7% of its total primary forests between 2000 to 2005 the rate of forest change increased by 31.2% to 3.12% per annum. spread of deforestation is most noticeable near urban areas. The growth of urban areas ıgs about appreciable demands for fuelwood, charcoal and sawn wood and this account for. ch of the observed decline in forest stocks. The cost of the cooking with fuelwood or charcoal l continue to be lower than the cost of other commercial alternatives as long as local wooded ıs and forests are not depleted. Thus the demand for fuelwood in urban areas will remain ıng and continue to account for much of the spread of deforestation in Africa, the

ortunities of substituting fuelwood with commercial fuels in these areas notwithstanding. ›ther important deforestation issues in Africa is as regards land clearing by farmers. It is a wn fact that land clearing is taking place extensively and perhaps contributes as much as/or e than fuelwood consumption to deforestation in Africa. Timberlake (1985) reported that ulation growth and migration into coastal country side also play vital role in land clearing. As nated five million hectares of forests were converted to agriculture in Cote-de-Ivorie veen 1966 and 1980 while farmers destroyed some 300million cubic metres of merchantable ›er. far more than was exported during the period. Felling of trees on farmlands is also espread. In Nigeria for example, unpublished surveys in the south and northern zones :aled that farm tree densities have declined from 15% per hectare in 1950's to 3% per hectare 970's (Anderson, 1986). Meanwhile, FAO (2003) reported that annual rate of change of st in Nigeria from 1990-2000 stood at -2.6%.

orestation estimates for some African countries have been given by Lanly (1983). For mple, the rate of forest depletion in Cote-de-Ivorie and Nigeria is estimated as high as 5% to per year while Ochanda and Epp (1982) stated that in Kenya the indigenous forest now ers only 1.9% of the land area and remote sensing have shown that about 16% of the forest is ıg lost in each ten year period. For Africa as a whole Parry (1986) reported that only 6% of land area is forested and that if clearance continues at the present rate, the forest cover would e been reduced to 5% by the year 2000.

Global Trend of Deforestation: Causes and Processes.

oughout history, the fates of the world's forests have strongly reflected the pattern and nsity of land use by societies. Demand for agricultural land, timber, and other forest products, well as technological change in agriculture, significantly impacts the mode and rate of

sformation of forested areas. In the views of Kapos, (2000), biophysical triggers may also a role, such as fire dynamics, which are linked to agricultural activities or other natural nomena. These demands are often linked to present-day developing countries experiencing restation which even affect our country Nigeria and Nasarawa State. total world's forest area according to Adeofun, (1991), has diminished considerably, from nt 5 to 4 billion hectares, over the last one hundred years. In the views of Mathews (1983), perate closed forest suffered the greatest losses of about (32 to 35%), the subtropical woody nnas and deciduous forests declined by about 21 to 24 percent while the tropical diminished ne tune of 15 to 20%. These estimates revealed that the tropical rain forests suffered the least oitation over the period. This was adduced to the fact that they were inaccessible as at that od. Deforestation has however intensified in the tropical rain forest since the Second World . This is because the growing rural population invades the forests in search of land for their s, fuelwood for cooking, and fodder for their animals. Also most tropical nations in an npt to raise foreign exchange earnings to execute economic development programs, turn to forests as a readily exploitable resource. As a result of this relentless exploitation most world ical forests are diminishing.

nost developing countries like Nigeria especially in Nasarawa State, deforestation is fast elerating. About 11million hectares of forest are cleared for other uses annually in developing ntries according Adeofun, (1991). Nigeria's forest cover in 2000 was estimated at 13.5 ion hectares compared to 17.5 million hectares in 1990 (FAO, 2001), indicating a forest er loss of close to 400 thousand hectares per annum, or a decline of about 2.6%. est/woodlands now stand at only 13% of the total land area (FAO, 2001). Between 1950 and 3, Melillo et al (1985) reported that forest and woodland areas declined by about 38% in

ral American and 24% in Africa. These estimates represent only the area completely cleared ses. The forests and woodlands are also deteriorating in quality. Each year 4million hectares ıtural tropical forests are exploited, thus becoming "secondary regrowth forests" according , 2001.The prevailing traditional utilization practices only allow for the mature stems of : few tree species with high merchantable value to be removed and this, according to Guppy 4), usually accounts for about 10 to 20% of the standing volume. Apart from this, another 30 % of the trees are also destroyed during logging operations thereby leaving the soil to be y disturbed to impede regeneration. In the open woodlands and savannas, fuelwood and er demands are out-stripping forest regeneration as population increases and forest stocks ne.

'son and Fishwick (1984) reported that fuelwood consumption now exceeds natural ıeration by 70% in Sudan, 75% in Northern part of Nigeria, about 150% in Ethiopia and % in Niger. Majority of the population that depends mostly on fuelwood are cutting wood r than it is growing back (FAO, 1983). This has made the woodlands to become ressively sparser and eventually disappearing at a faster rate.

interesting to note that deforestation has a number of repercussions, which include among rs deforestation that can lead to soil erosion or impoverishment, especially in tropical areas re soils tend to be thin and nutrient-poor. Deforestation is linked to habitat loss and iversity loss, particularly in humid tropical forests. Furthermore, Giest and Lambin (2002) rted that deforestation affects the hydrological cycle through changes in evapo-transpiration run-off and even concluded that deforestation, and particularly forest burning, contributes to n-house gas emissions that bring about climate change. Despite its apparent ease of ction, deforestation rates are still a matter of debate.

y, roughly 39million square kilometers (29%) of the world's land surface is under forest · (FAO, 2000), and of that 28million square kilometers is in so-called "closed forests" of canopy cover or above (Singh et al. 2001). Since the end of the last ice age, approximately he world's forest cover has been lost, most of it due to the expansion of human activities settlements (Kapos, 2000). In terms of primary forest (that is defined as a forest that has · been logged and has developed following natural disturbances and under natural processes, dless of its age), in contrast to secondary forest (that is defined as forests regenerating ly through natural processes after significant human or natural disturbance, and which differ primary forests in forest composition and/or canopy structure), or other successional ts, (like any forest type that has in its interior significant areas of disturbance by people, ding clearing, felling for wood extraction, anthropogenic fires, road construction, etc) much emains. The WRI (1997) estimates that only one-fifth of the world's original forest cover ins, largely in blocks of undisturbed frontier forests in the Brazilian Amazon and boreal of Canada and Russia.

y forests are far from being virgin or pristine and have been interfered with by man cially in Nasarawa State. Shifting cultivation is a factor in point even though its practice is lly consistent with the regenerative capacity of the forest. Under shifting cultivation, the lation is low and mobile, the economy is subsistence, the pattern of farming is polycropping adequate fallow periods and there is an ample area of forest in reserve for future use, thus ing this system of agriculture efficient and sustainable (Denevan, 1992).The abundant vated patches encourage the regeneration of the forest from seeds brought in by wind and ials from the adjacent forest. Big trees that are purposefully retained in the plots also urage forest re-growth (Clay, 1988), all contributing to resource abundance.

ortunately, forests are fixed resources whereas human population in Enugu State is easing at 3% per annum according to NPC 2006 in Nzeh (2007). However, it is not)rising that rising population densities in Enugu State led to the collapse of the shifting ivation system and the advent of rotational, bush fallowing that has turned a large proportion he original forests into bush vegetation. This means of deforestation has been powerfully sted by the introduction of chain saws into societies that used only less efficient steel axes. In views of Okoji (2001), in south eastern Nigeria which Nasarawa State is among, the rural r have no alternative source of energy for cooking but wood from the forest and this usually se deforestation in that area. Okoji (2001) equally stated that the same is truth for over 30% rban dwellers within the region. Forest resources are also lost through commercial logging logging for construction, furniture purposes or for export. As further reported by Okoji)1), such commercial logging may be selective where less than 10% of the tree are cut, more 1 60% of the forest trees may be damaged and large trees may be connected by other etation such as lianas. Large trees damage small ones when they fall and removing the logs ıages vegetation and soil (Parks, 1992).

)ther factor contributing to forest resource depletion in the study area and beyond is the ıblishment of tree crop estate agriculture. This system according to Uyanga (1980) in Cross er State alone, have resulted to approximately 75,962 hectares of forest been converted to ımercial monocrops such as cocoa, oil palm and rubber based on this operation. The fact that h estates are monocropped and that the undergrowth is regularly slashed or sprayed with)icides, means absolute elimination of forest resources and edible snails are usually collected slashers. In short, forest resource depletion, arising from deforestation, is a complex

phenomenon with multiple causes and varying contributions, but by and large, anthropogenic even stated the same in Enugu State as reported by Okoji (2001).

According to Okoji (2001), from environmental point of view, and depending on the extent of deforestation, forest depletion reduces and sometimes brings to an end the functions and services of the forest ecosystem. Meanwhile, deforestation has increased soil erosion in several parts of the country and even in different communities of Enugu State. There are some basic concepts concerning forest decline that need to be explained. This forest decline is interpreted as deforestation or degradation or a combination of both. According to FAO (1997), deforestation is define as the "sum of all transitions from natural forest classes (continuous and fragmented) to all other classes". The loss of forest cover attributed to these transitions must occur over less than 10% of crown cover for the phenomenon to qualify as deforestation.

In addition to above issues, forest decline is the result of actions by a number of agents. These agents are individuals, groups of individuals or institutions that directly convert forested lands to other uses or that intervene in forests without necessarily causing deforestation but substantially reducing their productive capacity. Other agents include shifted cultivators, private and government logging companies, mining and oil and farming corporations, forest concessionaires and ranchers. These agents clear forest lands or selectively exploit forests for agricultural expansion, to subsist, for mining, to obtain forest products and fuelwood, among other important forestry products. All these enumerated agents and even others not listed here are among the possible causes of deforestation in Nasarawa State.

Factors that influence the decision to Deforestation

influence of socio-economic factors is an important aspect of deforestation that demands ›hasis. In the views of Williams (1987), the extended family system is the most social unit, ch is the basic land holding unit in Nigeria. Furthermore, William (1987) stated that strong chment to land is derivable from the agrarian structure of the economy. There is no land iout an owner, thus the Nigerian culture recognizes man as an entity inseparable from land. nic groups' polarization and their different historical backgrounds did not allow for a iogenous land tenure system in the country. This notwithstanding, lands were acquired ugh settlement of family groups in areas of no resistance or of conquest as the case may be. individual land tenure system in the country and state now is gradually replacing the imunal land tenure system. This is basically as a result of increase in population, of the study which according to NPC (2006) is 3,257,298 with annual growth rate of 3%; introduction of tic cash crops, and the land commercialization. The common features of this land tenure em are that it encourages land speculation and landlessness among indigenous members of a imunity. The impacts of the various land tenure systems on the depletion of forest resources e some significance in two respects. In the first instance, a communal land tenure-system is compatible with agricultural production by small holder farmers in areas of high population sities. This is because this system limits members of the same land holding unit to a specified l area, increase in farming population results in a decreased land-to-man ratio and a sequent reduction in the fallow period. The shorter fallow periods often leads to incomplete oration of soil fertility, a break in the nutrient cycle, depletion of the lands resources and soil radation by erosion. The individual land tenure system leads to land fragmentation, culation and land commercialization. The system renders farmers landless especially those

o could not acquire land by transfer, inheritance or rent thus given room for landlords to ɔloit the poor on their own traditional lands.

e trend in the land-use often gives rise to the emergence of migrant farmers. According to kholm (1975) these farmers as rootless and landless people often squeezed from their neless by unequal land tenure or population growth. In the reviews of Udo (1975), these grant farmers are responsible for deforestation of most forest land in Nigeria. The above retions thus tend to be in line with the findings of Keay (1995) in which he stated that a nbination of high density of human settlements in the rainforest zones and a concomitantly ensive land-use systems of farming, timber exploitation, grazing, forest regeneration and fire, s caused vegetation changes as plant communities fail to attain their climax. The depletion of natural vegetation has therefore been as a result of the various land-use abuses, resulting in ious forms of land degradation such as soil erosion, loss of water shed and desert roachments which are all abounds in the various parts of the country even in the study area. cording to Butler (2005), report shows that 12.2% or about 11,089,000 hectares of Nigeria is ested, of this number, 2.9% or roughly 326,000 hectares is classified as primary forest, the ɔst biodiverse form of forest. Furthermore, Butler (2005) still reported that between 1990 and 00, Nigeria lost an average of 409,700 hectares of forest per year. This amounts to an average nual deforestation rate of 2.38%.

e socio-economic factors and conditions also exert great influence on forest depletion on geria. For instance, the economic benefits of timber supply to local and foreign markets have atly induced the over exploitation of the natural forests. In the views of Enabor (1981), the ɔloitation of the natural forests in the country started as early as the 1930's when more gerian timber species gained acceptance at the international market. Aurson (1998) reported

ı about one million trees were felled for exported in Nigeria then between 1905 and 1956 of ich more than 50% came from forests of South-western Nigeria.

e forest areas that produce the timber supply in the country is just about 2% of the total forest erve area. Going by the rapid population increase in Nigeria that stood at 140,033,542 with ɛrage annual growth rate of 3.2% according to NPC (2006), the timber resources are dequate to meet the demand for wood and wood products in the country. As far back as 1981, .O (1981) estimates thus revealed that log output volume in Nigeria decreased from 52% in 50 to about 30% in 1975. This shortfall in log output volume is an indication of forest ɔletion within this period. The annual consumption of fuel wood and charcoal has increased to million m3 in 1981 according to FAO (1981) estimate. This shows that there is an over pendence on biomass for energy requirement in the country as far back as the period in estion. Coupled with this is the problem of hunting and grazing of livestocks, unsuitable land ɛ practices such as burning of forests and timber extraction, all these have an overall adverse ect on forest depletion in the country.

e growth of urbanization and the development of infrastructures such as the establishment of lustries, construction of highways, airports, and stadia among other human activities have ɛatly influence the depletion of forest resources in Nigeria. The construction of highways and ɛ increase in the housing estates are perhaps the major forest depletion factors. In both cases, ge areas of forest lands must be converted. Similarly the creation of forest plantations through ificial regeneration method (afforestation projects) has resulted into large scale destruction of isting forest vegetation.

4 Effect of Socioeconomic Factors on Deforestation

eforestation which is the product of the interaction of many environmental, social, economic, ltural and political forces works differently in any given region. The mix of these forces varies om decades to decades, and from country to country according to Roper and Robert (2006). As consequence, generalizations are dangerous. According to Roper and Robert (2006) still, in ost cases, deforestation is a process that involves a competition amongst different land users r scarce resources, a process exacerbated by counter-productive polices and weak institutions. creates wealth for some, cause hardships for others, and almost always brings serious nsequence for the environment.

is deforestation can be classified into different forms on the basis of the factors causing such forestation. Five major categories of deforestation have been recognized by Umeh (1986) and ey are: deforestation by government for developmental projects; deforestation arising from forestation; deforestation without afforestation; deforestation due to ecological factors; and eforestation arising from fuelwood cutting and animal husbandry.

4.1 Deforestation from developmental projects: This is a powerful factor which has ntributed largely to deforestation in Nasarawa State and Nigeria at large. Large areas of forest tates have been encroached upon and cleared by the government for other forms of land use. r example, in Nasarawa State it has been reported that large proportion of forest reserves cated in different places like Akwanga local government area and Wamba local overnment area have been lost to rural expansion, agriculture activities and Power Holding ompany of Nigeria, PLC (PHCN) national grid lines. Also, so many forest reserves have been eforested as a result of road construction. Umeh (1986) pointed out further that in Oyo State rge areas of Ago Owa, Ife, Ogunpa dam plantations and Gambari forest reserves have been lost

farm settlement, industrial development and urbanization. Also according to Umeh (1986), 20 ctares of Ogun river forest reserve were converted into fish-pond. The impoundment of river ger at Kainji also resulted into several hectares of forest lands being depleted. This is the uation in most forest estates all over the country with the trend been more in areas of high pulation density.

4.2 Deforestation arising from afforestation: Aforestation means establishing a forest on an :a from which vegetation has always or long been, therefore the process of afforestation ually involves deforestation. In most cases, economic timber species and other forest products : cleared and burnt to prepare the site for plantation establishment through the artificial method regeneration. It has been estimated according to Adeofun (1991), that about 150,000 hectares plantations have been established in Nigeria since 1978 through afforestation. This is as a ult of the inability of the natural method of regeneration to cope with the rising demand for od and wood products in the country. Thus, afforestation can be said to be necessary evil ice plantations of fast growing species with shorter rotation ages have to be established in ier to satisfy both the national and state wood demand.

4.3 Deforestation without afforestation: The most important factor of deforestation in the pics is deforestation without afforestation. This factor can be broken down into different mponents which include the following: role of forest farmers in terms of shifting cultivation; le of timber trade in terms of timber extraction; animal husbandry and its role in deforestation; d deforestation through firewood cutting. Perhaps the most important of all these factors is the le of the shifting cultivators. It has been estimated that about 140 million forest farmers occupy million km2 of the tropical moist forest and they are believed to have eliminated at least 0,000km2 of forest annually as reported by Adeofun (1991). Also, in the views of Adeofun

1) still. out of the present tropical moist forest in Africa, about 400,000km2 are being ;ed under the shifting cultivation practice of agriculture and this has accounted for forest loss nated at about 40,000km2 per year.

ther important factor is the role of the timber extraction. A lot of timber species are removed i both the reserved forest estates and the free areas without replenishment. Also, the general l is that timber extraction is always far ahead of afforestation especially in Nasarawa State, :e this extraction and consumption trend will generate growing pressure to exploit the forest e and the consequent deforestation and degradation.

4 Deforestation due to ecological factors: Ecological factors such as drought, erosion, wind ws etc are well known agents of deforestation and they have claimed very large areas of our st resource base. In areas where these conditions or factors are severe drought for example led to deforestation and subsequent desertification especially in the northern parts of the ntry.

5 Deforestation arising from firewood cutting and animal husbandry: In many parts of country including Enugu State, forests are being destroyed as a result of widespread cutting ood for fuel. This is more pronounced in the rural areas according to Nzeh and Eboh (2007),) (1985), and National Bureau of Statistics (NBS) 2006 statistics shows that they (rural llers) depends on fuel wood for up to 75% of their total annual energy requirement. Animal bandry also plays a substantial role in deforestation especially in the savanna region of the ntry. The ecosystem are subjected to unrestricted livestock grazing, with the nomadic smen habitually looping the branches and tops of young trees to provide fodder for cattle as rted by Adeofun (1991).

Impacts of Deforestation on the Environment

:ording to Ogigirigi. (1986) the impacts of deforestation on the environment are many and the st direct impacts are noticeable on the soil, hydrology and the atmosphere. This is because the jor role of forest in maintenance of environmental stability is in providing physical protection the soil by interception thereby reducing the sticking force and frictional action of rain and *d.*

1 Deforestation and soil erosion: Soil erosion is the most pronounced form of environmental radation all over the country today and even in Nasarawa State which is directly linked with orestation. Soil erosion is generally brought about by the action of water or wind when etation cover is removed such that all the physical protection offered by the vegetation is also ıoved.

: continuous forest exploitation and removal of vegetation cover for various purposes has :eased in intensity and rate with population increase in the country so much to the extent that erosion has become so pronounced in many parts of the country. The direct impact on soil l accelerated run-off in areas without vegetation cover leads to serious soil erosion and the ısequent development of extensive gulley which may extent over a very large area. Many ımples of gulley and sheet erosion have been reported in many part of the country. For ımple, Adeofun (1991) reported that the extent and intensity of gulley erosion in parts of old) and Anambra States, Southeast of Nigeria. Whereas, Okoji (2001), highlighted various ns of erosion in different parts of the country in relation to forestry practices that should be)pted. Soil erosion usually reduces soil productivity, retards agricultural economy and troys costly infrastructural facilities such as building and road networks due to constant orestation.

2.5.2 Deforestation and wind erosion: In Southern part of Nigeria, coastal and gulley erosion are of greater importance. This is because these parts of the country have a long duration and high intensity of rainfall and hence erosion by water is more prominent. In the northern part of the country, however, erosion by wind is of greater significance in environmental degradation. The rapid rate of desert encroachment in this part of the country has been attributed to excessive deforestation resulting in exposure of dry sandy soils of the semi-arid zones to strong winds during the long dry seasons (Anon, 1977).

Deforestation and the consequent wind erosion in this region accelerates desert conditions typical of a moisture less environment, desiccating winds, drifting sand dunes and the extreme difficulty in establishing a thriving animal or plant life. These conditions constitute a precursor to desertification and its aftermath Adeofun (1991).

2.5.3 **Impact of deforestation on water resources***:* Deforestation impact on water resources is very important in views of the fact that it poses serious water resources problems resulting from the extensive destruction of watersheds. Results of hydrological investigations from tropical Asia have shown the significance of forest cover in proper and efficient management of soil and watershed resources as reported by Adeofun (1991).

Removal of vegetation cover reduces interception of rainfall which varies from a few to as many as 50% of total annual precipitation. Deforestation will increase the rate and volume of run-off thereby resulting into increased stream flow which often gives rise to flooding and usually with disastrous consequences to life and property. Increase rate of run-off will also adversely affect recharge of underground water, and water storage capacities of water courses. This according to Enabor (1986) is already evident along the River Niger and Benue and many other rivers in the savannah zone of Nigeria.

The increased rate and volume of run-off arising from deforestation will increase the sediment load in the run-off water and its erosion power. This will eventually lead to sedimentation of surrounding water bodies, which after a long period will result to a progressive reduction in volume and depth of the water bodies until they become seasonal or eventually disappear. The protective effect of forest cover on water yield and erosion has been demonstrated by an accidental fire in the Snow Mountains of New South Wales in Australia (Brown, 1999). The flow of pattern changed abruptly after the fire while water yield and sediment load increased significantly in the first four year after the fire. Champhaka (1986) also reported the adverse consequences of deforestation to watershed in some Asian countries where many water bodies are completely silted up and dams disrupted. Other impact of deforestation often leads to the permanent lowering of the water table, especially when such deforestation is permanent and irreversible such as in the case of the semi-arid regions of Nigeria. Deforestation arising from indiscriminate land clearing and bush burning in the savannah regions of Nigeria has been identified as factors aggravating the hydrological problems in these areas as recorded by Adeofun (1991).

2.5.4 **Deforestation and atmospheric conditions**: There has been a global concern about the possible consequence of deforestation on atmospheric conditions. Many literatures have reported that the likely increase of carbon dioxide percentage in the atmosphere by up to 10% and a resultant increase in global temperature through the green house effect is a possible effect of total deforestation of all tropical rainforest.

Deforestation also has its implication for the general climate change. For example, the negative impacts of deforestation are already measurable in the form of increase in light intensity, air and soil temperatures and decrease in soil moisture and atmospheric relative humidity according to

Woodall (1992).

A very important consequence of deforestation is the elimination of the gene pool, the permanent loss of valuable plant and animal genetic resources. Many plant species of importance such as valuable commercial species and source of pharmaceutical products are near extinction as a result of deforestation. Also the destruction of wildlife habitat has drastically reduced animal populations and productivity such that many rare species are now threatened with extinction as reported by Roper and Robert (2006).

2.6 Ways of Sustainable Management and Use of Forests

Environmental Sustainability and Forest Resource Management Sustainability is a term that has gained much popularity in recent time. It means that a resource is used in such a way that it continues to be available. It is a consensus that we must learn how to sustain our environmental resources including forest so that they continue to provide benefits for the people and other living things on our planet. One fundamental premise for sustainable development is the recognition that environment and development are not exclusive of each other but are complementary and inter-dependent. For some people in the world, environmental sustainability is about meeting a basic need, such as clean water or sanitation. But for others in consumer-based societies, environmental sustainability in development practices can reduce climate change impact, energy consumption, pollution, and material use. Environmental sustainability is never an option but imperative. For a better world to live in; we need good air, pure water, nutritious food, healthy environment and greenery around us. Without sustainability, environmental deterioration and economic decline will be feeding on each other leading to poverty, pollution, poor health, political upheaval and unrest. The rapid increase in greenhouse gases in the atmosphere, land degradation, increasing floods and droughts, advancing deserts and

deteriorating conditions of fragile ecosystems, deforestation, loss of biodiversity and environmental pollution have become subjects of serious global concern. The overall impact of these phenomena is likely to result in depletion of ozone layer, change of climate, rise in sea level, loss of natural resources, reduction in their productivity ultimately leading to an ecological crisis affecting livelihood options for development and overall deterioration in quality of life. Development based on utilization of natural resources, pressure of population and their growing demands and poverty of the people took a heavy toll of our environmental assets. While natural assets have shrunk, demands have grown resulting in overdrawals being unsustainable. We have to improve our economic growth rate, provide basic minimum life support services to a large section of our population and deal with the problems of poverty and unemployment. At the same time, we have to pay attention to conserving our natural resources and improving the status of our environment. Ways of sustaining forest management;

2.6.1 Co-management of forest: Co-management or collaborative management is a participatory management process where there is active involvement of all the relevant stakeholders in management activities (Kusumanto et al. 2005). These activities may include the development of a joint vision, adapting to new management practices and learning jointly. Other terminologies closely related to 'co- management' include joint management, participatory management, or multi-stakeholder management (Kusumanto, 2005). In co-management arrangement there is collective action of different stakeholders with regards to natural resources management. The stakeholder's responsibilities are identified following continuous consultation and negotiation processes. Co-management is also important in empowering the community since all the stakeholders and especially the local people participate in decision making and in benefit sharing (Yasmi,2003). For a successful collaborative management;

The stakeholders must participate in all stages of management; reflection, planning, ıplementation and monitoring.

. There should be the building of effective local skills, interests and capacities that can adjust to ynamic and rapid changes after the end of the project. (Kusumanto 2005). Co-management has ceived increasing attention over the years as it provides a substantial promise to resource base ınflict (Yasmi, 2003).

.6.2 Community-based resource management: Community-based resource management is a ·ocess of achieving sustainable development. It applies local knowledge, practices, and stitutions, in partnership 19 with state/governmental organizations (GOs) or non-governmental ·ganizations, NGOs (Pongquan, 2009), where the primary actor is the community and the state ıd NGO are secondary actors. Fellizar et al. (1993) define CBRM as; "a process by which :ople are given the opportunity/responsibility to manage their own resources, define their :eds, goals and make decision affecting their well-being." CBRM can also be defined as a rategy for achieving a people-oriented development where the decision making process ·garding resource-use sustainability in a locality is in the hands of the people living in that ıcality. By giving the local people the right to manage their resources, they will gain autonomy ver a pre-determined area covering the resources, and in such a case there is sharing of ·sponsibilities regarding the resource by the different stakeholders. Through this initiative, it is ‹pected that the authority delegated to the rural people will result in sustainable use and ıanagement of natural resources, improved livelihoods and good governance. It is believed that ·hen the locals are given the right over a resource, they will develop a sense of ownership over ıat resource and will work towards sustaining that resource rather than depleting it. One nportant factor of CBRM is property rights; without property rights local management of the

:source will likely fail. As defined by Schlager and Ostrom (1992), rights refer to particular :tions that are authorized: while property right is the authority to undertake particular actions :lated to a specific domain (Commons, 20 1968 cited in Schlager & Ostrom, 1992). In terms of atural resources, we agree with Schlager and Ostrom (1992) that ownership of natural resources composed of five clearly distinct rights, the right to access the resource, to withdraw or harvest ıe resource, to manage the resource, to exclude the others from the use of the resource, and to ienate part or all feasible uses to third parties.

chlager and Ostrom (1992) Access and withdrawal, are operational-level property rights while ıanagement, exclusion, and alienation, are collective-choice level property rights. The collective ıoices determine what the operational rules of forest management are and who may participate ı changing these rules (Schlager and Ostrom, 1992). Thus when the locals have the proprietor ght, they possess the collective choice right to participate in management and exclusion. This is nportant because access to the resource will be controlled as they will authorize who may :cess the resource and how the resource maybe utilized. If the local people have management ghts, they will have the authority to determine how, when, and where harvesting from a :source may occur, and whether and how the structure of the resource may be changed Schlager & Ostrom, 1992 cited in Bouriaud & Schmithuesen, 2005). When harvesting of a :source is controlled, in this manner it will give the resource time to regenerate and ensure ıstainability. Thus when the locals are given property right over a resource, they will be more ommitted to sustaining the resource more than when they have no right over it, in which case it ;ill be treated as state-owned.

.6.3 Education and training: Education and training is important because it creates wareness, and acts as a tool for development of skills and also helps in capacity building. It is a

hannel through which knowledge from research is passed on to the users. Education can be rough meetings, seminars or workshops.

.6.4 Forest management; Forest management is; "The process of planning and implementing ractices for the stewardship and use of forests and other wooded land aimed at achieving ecific environmental, economic, social and/or cultural objectives"(FAO, Global Forest esources Assessment 2005). This management can be for aesthetics, recreation, wood products c. and can be based on conservation or economics purposes or both. The rising demand for rest products and resources requires that the forest should be sustainably managed, so as to sure its availability in the future

.6.5 Community Forestry; This is a Community-Based Resource Management approach ith a focus on the forest and forest resources. Through decentralization, management of forests as been transferred to the rural communities, and according to Brown & Lassoie, (2010); this rocess gives the local communities the opportunity to regain rights to forest resources which ey were deprived of due to colonization and central management of forests. Community restry is a forest management strategy which involves active participation of an organized ommunity. FAO (1978), defines community forestry as, "any situation which intimately volves local people in a forestry activity.". This embraces a spectrum of situations ranging from oodlots in areas which are short of wood and other forest products for local needs, through the rowing of trees at the farm level to provide cash crops and the processing of forest products at e household, artisan or small industry level to generate income, to the activities of forest welling communities.

inally, Sustainability concepts are emerging from theory to practice as the solution to the roblems of climate change. They demonstrate that national policy and legislation are evolving

ınd informed by a science-based understanding of sustainability. They clearly show that industry ınd the market place have incorporated concepts of sustainability into regular business practice. t is important to recognize that all parties engaged in development of the conceptual framework 'or suitable forest/environmental management to combat climate change implicitly accepts that, vith proper environmental management, it is possible to achieve sustainable environmental nanagement in practice. All parties should enter into negotiations leading related international ıgreements. With that in mind, those involved in the business of financial supporting :ertification systems must have market-driven incentives to achieve sustainable environmental nanagement. In effect, all parties are committed to the principle that it is possible to maintain ınd enhance the site productivity, water quality, and biodiversity of environment managed with 'arying intensities over the long-term at stand and eco-region levels of resolution by applying nanagement systems that consider climate change, environmental, economical, and social :riteria. It is hoped that with adoption of the adaptive measures, adequate sensitization and full ɔarticipation of local people-the vanguards of the relic environment-community base :nvironmental management; culture of conservation would be imbibed rather degrading it hereby sustaining and managing the environment sustainably. Effective environmental ıustainability to combat climate change in Nigeria faces many challenges as the threats to :nvironmental integrity are strong and growing stronger in the face of population growth and ınsustainable practices.

CHAPTER THREE

RESEARCH METHODOLOGY

.1 Study Area

ıkwanga is a Local Government Area in Nasarawa state, Nigeria .it's; headquarters are in the ɔwn of Akwanga, it has an area of 996km2 with a population of 513,930 at the 2006 census. ıkwanga is situated at a geographical coordinates of latitude 8.920 and longitude 8.38 east, the tudy area is about 359 meters above the sea level, among the LGA created prior to the creation f Nasarawa state in 1st October 1996. The study area has eleven districts/wards as follows ıgyaga, Akwanga, Anchio, Andaha, Angwan Zaria, Anjida, Bohar, Gudi, Gwanje, Nigha, Junku. Akwanga is bounded in the south by Nasarawa Eggon LGA, to the west Keffi LGA, to ıe north/ north west is bounded by Sanga and Jema.a LGA area of Kaduna state and to the east ɔy Wamba LGA.

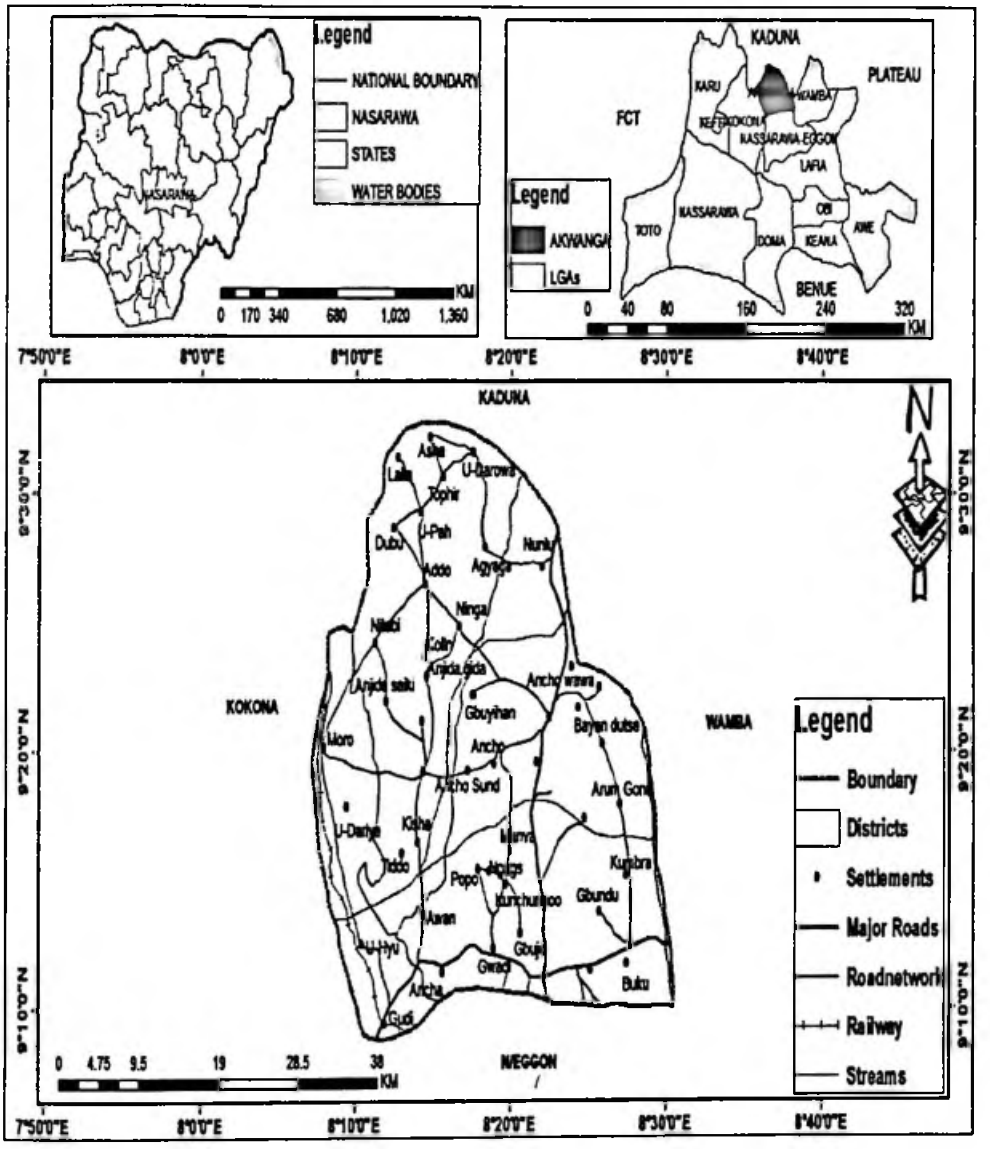


Figure 1.1 Nigeria showing Nasarawa state

Source: Land and Survey Akwanga

3.1.2 Relief/Morphology

The study area settlement is located at the lower foot of Jos plateau. The central and northern part is characterized by hill and rock rising to over 600m (2000ft). Andaha hills, while eastern and southern parts of the study areas is dominated by undulating plains and outcrops, inselbers, scattered around the regions eastern and northern strip.

3.1.3 Geology

Akwanga is almost predominantly underplayed by igneous and metamorphic rock which belongs mainly to the lower pal azoic basement complex. Land resources study, (1981) they include younger granites, schist, gneiss belt outcrops along the southern and eastern part of the study area, include sandstones and shale's (Mada river feasibility study and design (1976) the total area constitute a very conspicuous physiographic unit is form of rugged terrains on the north, east and south. Generally the topography and landscape is hilly and rocky.

3.1.4 Weather and Climate

Akwanga local government has two distinct seasons, namely the rainy season that begins around march and runs through October and the dry season which begins from October and ends in march within these season is a brief harmattan season that is occasioned by the north east trade wind and the attendant dust haze, increase cold and dryness with June, July, august and September been with heaviest with rains, while the dryness month being December to February.

The temperature is stable with negligible variability, throughout the year, between 28^0 Celsius during the cold harmattan period and 36^0 around March and April prior to rain unset.

›.1.5 Vegetation

\kwanga local government falls within middle belt zone of Nigeria, the vegetation is of guinea avannah of the semi rain forest type with tall trees and bushes. Plains that form one of the urviving northern, most occurrences of the matured forest vegetation in Nasarawa state.

he remaining part of Akwanga from the northern to the southern end is of varying shades of rassland with dotted trees and scattered forest, the vegetation shade their leaves in dry season uring which the grass becomes dry.

›.1.6 Socio-Economic activities of the people

he major economic activities (occupation) of the people in the study area is farming, trading, mbering, art and craft, fishing along rivers(River Mada). Thus, for centuries farming activities nd hunting has been going on in various villages/district areas. As local and most illiterate armers, these activities were going on without recourse to environmental impact and ustainability. Thus, the fauna and flora has been depleted without caution and /or hindsight for omorrow. With increase in population over the years, there has been an increase in nvironmental depletion while luxuriant floral has given way to open savannah and most of the auna has gone into extinction.

›.2 Method of Data Collection

›.2.1 Research Design

)escriptive survey design was used to collect the information for this research. This was used ›ecause it is an already existing problem in the population and necessary information could be ollected easily. This opinion is supported by Azuezuilo and Agu (2004), who said that

descriptive research design aims at collecting data and describing in a systematic feature or fact of a given population.

3.2.2 Types and Sources of Data

The types of data required for this study include such data as the livelihood activities in the study area, the socioeconomic and demographic composition of the inhabitants, their perception of drought and its effect on their livelihood activities as well as the coping strategies adapted locally in the study area.

These data were acquired from both secondary and primary sources of data. The secondary data sources for the study were published and unpublished articles on the issues of drought. Among such articles are academic research reports, journals, magazines, institutional publications and reports. Primary data on the required types of data for the study were also acquired from sampled respondents in the study area.

3.2.3 Types and Sources of Data

Data for this study were collected from both primary and secondary sources. The primary data were obtained by the use of structured questionnaire. Information sought include, among others, age of household heads, occupation of household heads, cash income from selected forest products (e.g. timber, fuel wood, fruits, bamboo etc), information on consumption of forest output, expenditure on forest outputs, employment from forest production, causes of deforestation, financial and economic losses of deforestation, changing strategies of resource management in forest as applied by the households and even other constraints associated with deforestation activities. Furthermore, personal contacts, oral interviews and observations were used during visitation; this aided the primary data collection techniques.

Secondary data were sourced from relevant publications which include: text-books, bulletins, periodicals, journals, annual reports, seminar papers, unpublished materials of relevance to the study, report documents from different ministries and even internet search to obtain the most recent information on the subject matter.

3.2.4 Sample and Sampling Techniques

A convenient sampling technique was used to select sixty respondents from each area. A total of three hundred (300) respondents filled the questionnaire.

3.3 Techniques for Data analysis

Data collected during the study were analyzed using relevant econometric and other statistical tools in other to achieve specific objectives.

Objectives i, iii and v were also realized by using descriptive statistics, such as frequency tables, percentages, graphs, charts and so on.

Objective iv was analyzed by the use of total economic valuation (TEV) model of valuing deforestation.But objective ii was analyzed by employing logit model and multiple regression analysis.

3.3.1 Specification of TEV Model

For the purpose of this research, total economic valuation (TEV) model for realizing objective iv is represented as follows:

$$TEV = [\sum DV + \sum IDV + \sum EV + \sum BV] \quad \ldots\ldots 1$$

$$TEV = [\sum AND + \sum AIDNN] \quad \ldots\ldots 2$$

$$AIDN = \{\sum DV + \sum IDV\} \quad \ldots\ldots 3$$

$ADNN=(\sum EV+\sum BV)$.....4

$DV=(\sum CUV+\sum NCUV)$.....5

$CUV=|(\sum CMG+IMG+TM+FR+AN)|$.....6

$NCUV=\sum(SV)$.....7

$IDV=\sum(EPV+CV+Spv)$.....8

$TEV=\{|\sum(CMG+IMG+TM+FR+AN)|+|\sum(SV+EV)|+|\sum(EPV+Spv)|+[\sum(r)|\}$.....9

Where:

TEV=Total Economic values of deforestation (annual in Naira).

DV = Monetary value of the forfeited benefits due to direct loss of use of forest

IDV = Monetary value of the forfeited benefits due to indirect loss of use of forest.

EV = Monetary value of the forfeited benefits due to loss of existence use of forest

BV = Monetary value of the forfeited benefits due to loss of bequest use of forest

CUV = Monetary value of the forfeited benefits due to loss of consumptive use of forest

NCUV = Monetary value of the forfeited benefits due to loss of non-consumptive use of forest

CMG = Monetary value of the forfeited benefits due to loss of commercial marketable use of forest

IMG = Monetary value of the forfeited benefits due to loss of industrial marketable use of forest

TM = Monetary value of the forfeited benefits due to loss of timber harvesting

ADN = Monetary value of the forfeited benefits due to loss of annual wood use of forest

ADNN = Monetary value of the forfeited benefits due to loss of annual non-wood use of forest

FR = Monetary value of the forfeited benefits due to loss of fruits gathering use of forest

AN = Monetary value of the forfeited benefits due to loss of animals harvest use of forest

SV = Monetary value of the forfeited benefits due to loss scientific use of forest

EPV = Monetary value of the forfeited benefits due to loss of environmental protection use of forest

CV = Monetary value of the forfeited benefits due to loss of cultural use of forest

Spv = Monetary value of the forfeited benefits due to loss of herbal use of forest

r = any other values not associated with the above values.

3.3.2 Specification of Logit Models:

Logit models and multiple regression analysis were used to achieve objective ii.

3.3.3 Logit model

This model was used to address objective ii which is to identify and analyze the factors that influence the decision to deforest in the study area.

In the multinomial logit model, according to Enete (2003), a set of coefficients β(1),β(2), β(3), were estimated as: (1)

The model however is unidentified in the sense that there is more than one solution to β(1),β(2), β(3), that leads to the same probabilities for Z=1, Z=2 and Z=3. To identify the model, one of β(1),β(2), β(3), is arbitrarily set to 0. That is, if we arbitrarily set β(3)=0 the remaining coefficients

β(1),β(2), would measure the change relative to the Z=3 group. This simply means that we will be comparing households that have access to more than 60% of landholdings forest to those that did not have such access (1 and 2). Then setting β(3)=0, the above equations (1) to (3) become:

(1).The relative probability of Z =1 to the base category is given as:

If we call this the relative likelihood and assume that X and β(1)k are vectors equal to (X1, X2, X3....Xk, and β(1)1, β(1)2,....β(1)k) respectively. The ratio of relative likelihood for one unit change in X1 relative to the base category

Therefore, the exponential value of a coefficient is the relative likelihood ratio for one unit change in the corresponding variable as reported by Enete (2003).

3.3.4 Definition of Variables.

From the discussion so far, the dependent variable is defined to have two possible values: 1 if the household cleared forest for agricultural and any other activities in the last six (6) years; 0 if the household has not cleared forest for any activity in the last six (6) years.

Therefore, deforestation in the study area may be related to the following farmer specific model:

Pr = f (Fx, Gd, Ae. Ed. Dx Hs. Lc. Ta. Cr) +μ

Where:

Pr = Clearance of forest for agricultural/other activities within the past six (6) years (ha).

Fx = Assistance from forest extension agents (1 for assistance, 0 other wise)

Gd = Gender of respondent (1 for male, 0 for female)

Ae = Age of household heads (years)

Ed = Educational attainment of household heads (years of formal schooling)

Dx = Deforestation experience (Number of years in deforestation operation)

Hs = Household size (number)

Lc = Location of land [i.e. distance from home (Km)]

Ta = Total land holding (ha)

Cr = Credit access (amount of farm credit obtained last year in Naira)

μ = error term

3.3.5 Multiple linear model of farm level

But, for the farm specific model of deforestation in the study area using multiple regression analysis, it is represented as:

$Y = f(Dt, Sx, Tk, La, Te, Or, Az,) + \mu$.

Where:

Y= Number of years since the farmland was first cleared for cropping

Dt = Distance from home of respondents (Km)

Sx= Size of land own by respondent (ha)

Tk = Topography of land own by respondent (1, for flat land, 0, otherwise)

La = Land tenure system use by respondent (1, if inheritance; 0, if otherwise)

Te = Types of cropping for the past three (3) years (1, if sole cropping, 0 if otherwise)

Or = Output of land per year for the past three (3) years (Percentage of annual farm output)

Az = Amount of fertilizer for the past three (3) years (kg)

μ= Error term

It is important to state here that the above model seeks to ascertain how forestland cleared in different time period is related to current patterns of management and use. This will provide some insights into the dynamics of forestland clearance and give indications as to the incentives and stimuli for deforestation and changing land use patterns.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Demographic and Socio-Economic Characteristics of Respondents

4.1.1 Age of respondents

In many economic activities including deforestation activities it require little else than physical vigour; that is, muscular strength, a good constitution and energetic habits as reported by (Marshall, 1961). According to Samuelson (1985), muscular efficiency involved in doing a particular work is a function of age, physical and moral conditions of the key player. Figure 4.1 below shows the age distribution of the respondents in the study area. Figure 4.1 indicates that the bulk of the respondents fall in the age bracket of (31-60 years) of age and constitute 52%. The old age group (≥ 61 years) formed 42% of the respondents while the youth is made up 6% of the respondents. The results of the analysis show that middle-aged men and women dominate in the deforestation activities in the rural areas. It also suggests that youths are massively leaving deforestation for other economic activities.

Figure 4.1: Distribution of respondents according to age

Source: Field survey, 2018

4.1.2 Sex of respondents

Figure 4.2 shows that 74% of the respondents in the study are males, while the rest (26%) are females (i.e. more males involve in deforestation than females). The greater number of males does not presuppose out-rightly that males outnumber the females in the study area. Rather, this can be attributed to the fact that males seem to have more access to forest and its deforestation activities than females. This confirms with the finding of Falconer and Arnold (1991) that generally men have greater access to the cash economy from forest product activities and often generate cash as their primary activity, while women's activities revolve more around the subsistence needs of the household, most particularly food production and child care.

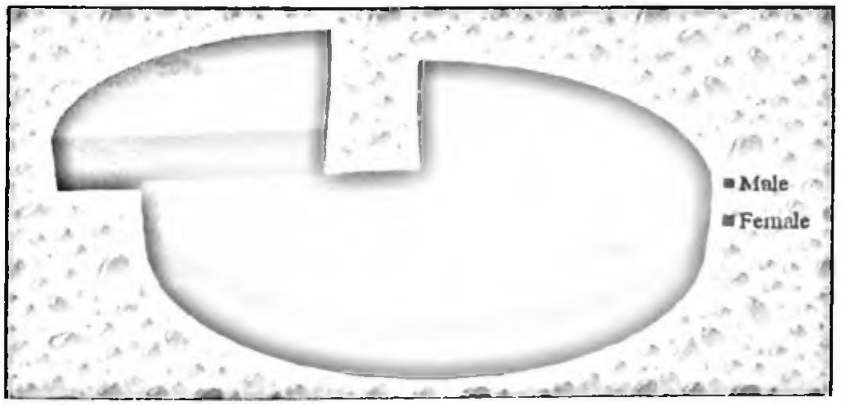


Figure 4.2: Distribution of respondents according to sex

Source: Field survey, 2018

4.1.3 Martial status of respondents

From figure 4.3 below it can be seen that 76% of the respondents are married and are involve in deforestation activities in Akwanga Local Government. The same figure 4.3 shows that 15% of the respondents are single whereas only 9% of the respondents are widows. The implication of

the below result is that many widows in the study area are not involve in deforestation activities. One may suggest that the reason(s) may be connected to the fear of female going into forests for many kinds of activities including deforestaion. Furthermore, one may say that the culture of the area may have not allowed females much access to forestry activities.

Figure 4.3: Distribution of respondents according to marital status

Source: Field survey, 2018

4.1.4 Educational status of respondents

Generally, education broadens the horizon of human activities, operation and understanding of his environment. The educated farmer also has better understanding of the importance of forest to the environment (Desai and Mellor, 1993). He has more access to government programmes, production credit, improved technologies and membership of rural institutions (cooperatives). The educated man is also conscious of his environment and tends to preserve forest/wooded vegetation land. In the study area, deforestation is usually appreciated by all for its role as source of fuel wood, furniture and building materials among others. Figure 4.4 presents the distribution of the respondents according to educational attainment and their corresponding deforestation behaviour.

Figure 4.4 below indicated that the bulk of the respondents (40%) in the study reported that they had primary education as their highest level of education attainment. From the same figure 4.4, 25% of the respondents agreed that they did not attend any form of formal education. Critical analysis of figure 4.4 below equally shows that 22% of the respondents reported that their highest level of education is secondary education, whereas only 13% of the respondents had post secondary education in the study area. The scenario above indicates that least deforestation activities in Enugu State were attributed to those with post secondary education. This is because these set of educated respondents understand the negative implications or consequence of deforestation to the state economy and the environment.

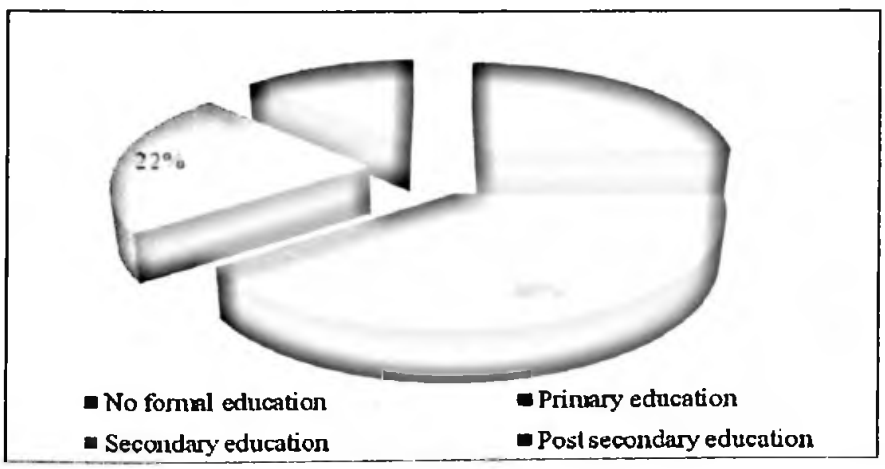


Figure 4.4: Literacy level of respondents

Source: Field survey, 2009

4.2 Nature and extent of deforestation

4.2.1 Clearing of forest for agricultural activities

Figure 4.2.1 show that 93% of the respondents reported that they cleared forest for agricultural activities within the past six (6) years. Furthermore, from the same figure 4.2.1, only 7% of the

respondents agreed that they did not clear forest for any agricultural activities within the last six (6) years. The implication of the above high percentage of the respondents being involved in clearing forests for agricultural activities within the last six (6) years indicated that there is constant deforestation occurring in the study area. This equally implies that there will be higher rate of climate change in Akwanga since deforestation, as reported by Adesina and Adejuwom (1994), is one of the major causes of climate change.

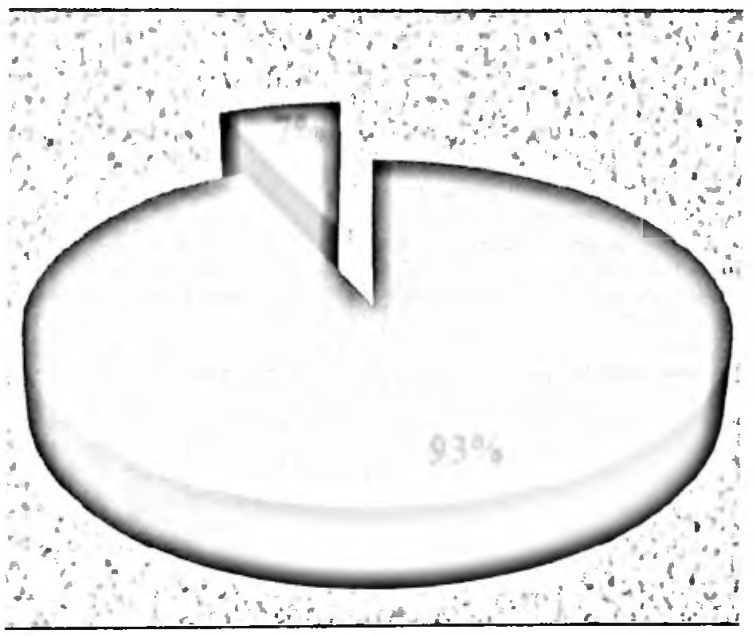


Figure 4.5: Distribution of respondents according to clearing of forest for agricultural activities within the past six (6) years

4.2.2 Use patterns of deforested land

Figure 4.2.2 below indicated that there are different historical dynamics of deforested land in Enugu State in which different crops are grown in different year period. From the figure below, higher percentage of the respondents 36% reported that in the first 5years or less of their deforestation of land; they grew mixed crops of yam/cassava/maize/okro. From the same figure, 23% of the respondents reported that in the first 5years or less of their deforestation of land they

op yam/cassava/melon; whereas 18% of the respondents said that they grew combined crops of
ım/cocoyam/cassava/maize. The figure below also shows that 9% each of the respondents
ported that they grew combined arable crops of cassava/groundnut/okro and other crops like
)ybean respectively at their first 5years or less of deforestation of land. Finally, as 9% of the
spondents reported that in the first 5years or less of their deforestation of land they grew other
ops like soybean among others, only 5% of the respondents agreed that they grew combined
ee crops like oil palm/cashew/cocoa/oranges in the first 5years or less of deforestation of land
. their community.

rom the analysis above, one can see the switch in resource allocation preference of the farming
ouseholds in Akwanga in which much of the arable crops and few of the tree crops are used
) replace the forest. The lower percentage of respondents that reported that they grew tree crops
; listed above to replace forest is expected because these farmers engage in farming activities to
ıake quick returns to their capital investment and it takes higher years for tree crops to mature
ıd yield revenues to these rural farmers. Due to this reasons, these farmers engage in growing
ıainly arable crops in any deforested land of the state; be it at the earlier years of deforestation
r later years.

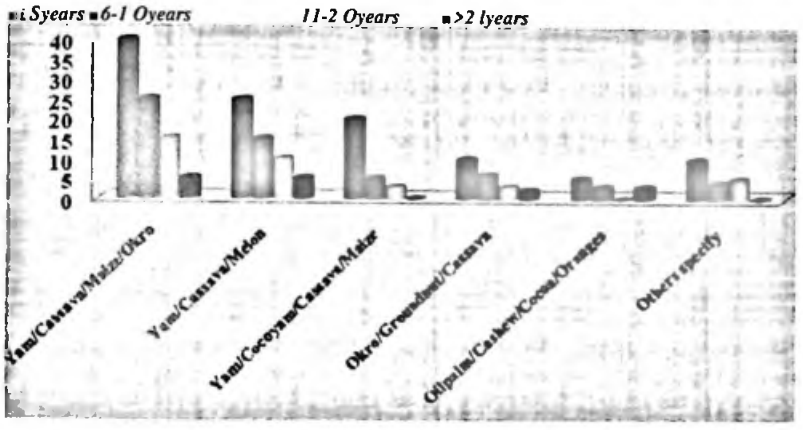


Figure 4.6 Distribution of respondents according to types of crops grown in different years

4.2.3 Number of hectare(s) of land cleared for agricultural activities

From figure 4.2.3 below, 50% of the respondents in the study area agreed that they cleared ≤3 hectare(s) of land for agricultural activities within the past six (6) years.

Also the same figure 4.2.3 indicated that 42% of the respondents stated that they cleared between 4 and 6 hectares of land for agricultural activities. Finally, only 8% of respondents cleared ≥ 7 hectares of land for the same purposes within the past six (6) years as seen in figure 4.2.3.

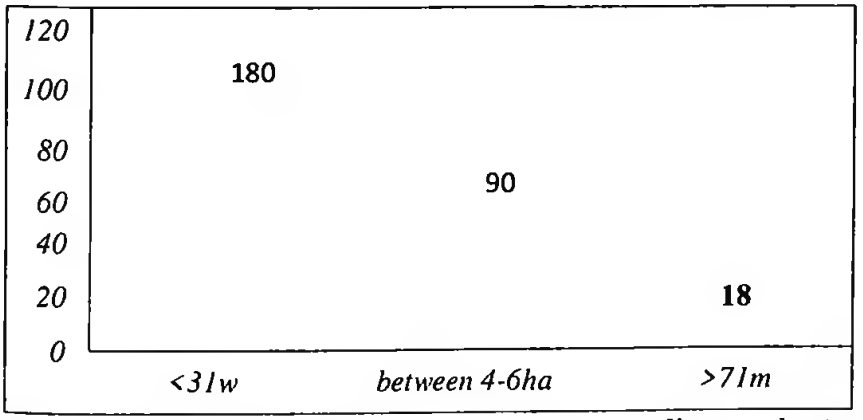
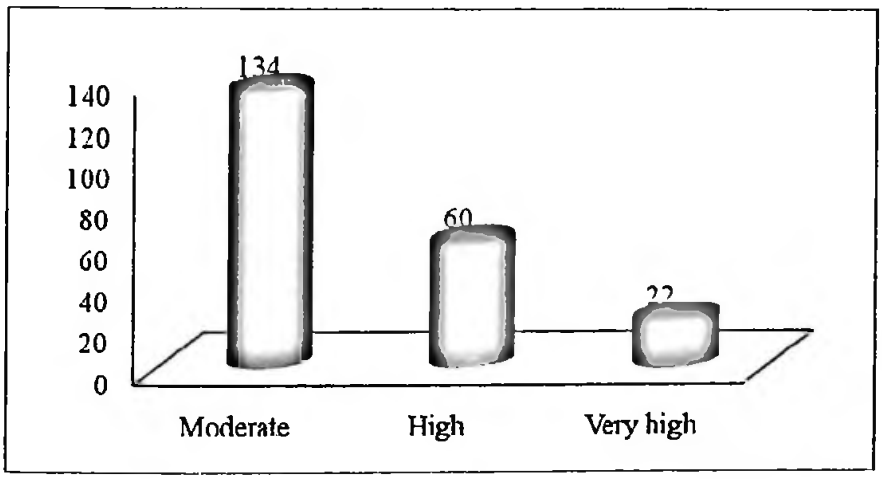


Figure 4.2.3: Distribution of respondents according to hectares of land cleared for agricultural activities

4.2.4 Nature of deforestation

Figure 4.2.4 shows that 62% of the respondents agreed that the degree of deforestation in the study area is moderate. Furthermore, 28% of the respondents stated that the degree of deforestation in Akwanga is high but only 10% of the respondents reported that the degree of deforestation

in the study area is very high. The implication of both high and very high nature of deforestation in the study area is that the economy from forestry resources will be further depleted thereby creating a reduced income and employment for rural households who dependent in forestry earning for their livelihood.



deforestation.

4.3 Factors that influence decision to deforest

4.3.1 Determinants of rural household heads farmland clearing for cropping activities

To ascertain the determinants of farmland clearing for cropping activities, a multiple regression analysis was carried out. The four functional forms linear, double log, semi-log and exponential were used. The linear functional forms was chosen since it provided higher number of variables

ith significant levels and also based on its records of having best R2, F-ratios and also the best oefficients when signs and significant are considered.

he F-test was statistically significant at 5% level, suggesting a relationship between the haracteristics of farmland clearance for cropping activities and the independent variables.

able 4.3.1: Linear regression results of the determinants of the forest clearing for ropping activities.

/N Explanatory Variables	Coefficients	t-ratios
. Distance from home(Dt)	-1.218884	-0.65
. Size of land (Sx)	3.821211	(1.72)**
. Topography of land (Tk)	-1.42735	-0.27
. Land tenure system (La)	0.509881	(2.03)**
. Types of cropping (Te)	17.61003	(3.19)**
. Output of land per year (Or)	0.0040607	0.04
'. Amount of fertilizer (Az)	0.0013264	0.02
3. Constant term	4.58664	
). R2	(0.4726)	
10. F-Value	(12.21)**	
11. N	216**	

Significant at 5%

4.3.2 Analysis of Regression Results

From the results in the table 4.1, based on the linear functional form model, the R2 value of the model is 0.4726 implying that the independent variables in the model explained only about 47% of the variability in farmland clearance effect. This means that outside the tested variables, some

variables which may be relevant in the regression model were omitted. Such variables may include farming experience, leadership status of households, economic orientation of household heads (i.e. percentage of total household output from farming clearance activities that is marketed), technology use for the clearance of the farming activities, off-farm employment, educational levels of respondents, etc. Outside the above factors, the remaining variables are those assumed to have no significant effect on the level of R2 and can be justified by the nature of the study. Specific deductions were made using the T-ratios.

The coefficients of both size of land (Sx), land tenure system (La), and types of cropping (Te) were both positively signed and significant at 5% in conformity with the expectations. This implies that both variables are significantly related to the level of farm land clearance (i.e. are major determinants of farmland clearance for cropping activities in the study area). Coefficients of distance from home (Di), topography of land (Tk), output of land per year (Or), and amount of fertilizer used (Az) are insignificant at 5%. They were therefore ignored. Since the variables were not significant at 5% level when their coefficients were compared, it implies that no significant relationship exists between them and level the of farm land clearance (i.e. they are minor or no determinants to farmland clearance for cropping activities in the study area) when considered separately but the F-test confirms that in combination these factors affect level of farmland clearance by rural households significantly.

4.3.3 Plot-level analysis of factors influencing the decision to clear forest for agricultural/other activities.

A set of socioeconomic characteristics of forest clearance to determine the decision of the farmers as regards whether to clear or not clear plots of land for agricultural/other activities was analyzed. These are: information from change agents, years of experience acquired in

forestation, educational attainment of households, credit acquisition, size of household, oximity of land location, land holding, age of household and gender of respondents. The study plied logit model to determine the effect of forest clearance by agricultural/other activities in e past six (6) years. The essence was to determine the key socioeconomic characteristics of forestation that influences their conversion to agricultural and other uses. The result of the alysis is presented in table 4.3.3

able 4.3.3: Model estimates of socioeconomic factors influencing the decision to clear rest for agricultural/other activities

N Variables	Coefficients	Z
Assistance from forest extension agents (Fx)	-0.0056531	-0.01
Gender of respondent (Gd)	-3.159365	-(2.33)**
Age of household heads (Ae)	0.0024837	0.08
Educational attainment (Ed)	-0.55427	-(4.77)**
Deforestation experience (Dx)	1.247557	(3.43)**
Household size (Hs)	0.2491188	(2.19)**
Location of land (Lc)	0.0460843	0.21
Total land holding (Ta)	0.54655	(2.87)**
Credit access (Cr)	0.0003239	1.63
0. Constant term	-4.56821	-1.51
1. N	216	

=Pr(pr)(predict)

.94678812

* Significant at 10%Source: Computer Analysis of the field survey Data, (2009).

As shown in the table 4.3.3 above, part of objective ii was realized using logit model to determine the effect of socioeconomic factors on deforestation. From the result above, the overall goodness of fit as reflected by Pro>Chi2 value was good (0.946). In terms of consistency with expectations on the relationship between the dependent variable and the explanatory variables, the model appears to have performed well.

The analysis of result shown in table 4.3.3, indicates that deforestation experience (Dx), household size (Hs) and total land holding (Ta) were positive and significant at 10%. This is consistent with the expectation. This shows that households with deforestation experience, larger household size and even greater total land holding were likely to be involved in more clearance of the forest for agricultural and other activities for the past six (6) years. Also the same table 4.2 shows that gender of respondent (Gd) and educational attainment (Ed) of the respondents were significant at 10% and negatively signed. The implication of the above analysis is that those households in the study area with better educational background and where the gender of the household heads are female are most likely not to be involved in much clearance of forest for agricultural/other activities for the last six (6) years. Thus, this leads to decrease in the clearance of forest for agricultural/other activities in the past six (6) years. This agrees with the reports of (Godoy, et al, 2006; Moran, 1989; Moran, 1989a and Tongpan, 2000) which confirms that formal education lowers pressure on the forest because it should ease out-migration and the adoption of modern farm technologies that raise the productivity of land and of labor. Furthermore, this agrees with the findings of Phillips (1994) that research in Asia shows that farmers with more than four years of education found it easier to adopt new farm technologies thereby create less negative impact in deforestation of the environment for agricultural/other activities.

Meanwhile, from the table 4.3.3 above, coefficient of assistance from forest extension agents Fx), age of household heads (Ae), location of land (Lc) and credit access (Cr) are insignificant t 10% and therefore were ignored. Since the variables were not significant at 10% level when heir coefficients were compared, it implies that no significant relationship exists between them nd level of clearance of forest for agricultural/other activities for the past six (6) years in the tudy area. This means that they are minor or no determinant to the level of clearance of forest or agricultural/other activities in the study area when considered separately but the Z-test onfirms that in combination these factors affect level of clearance of forest for agricultural/other ctivities significantly in the past six (6).

4.4 Activities and processes associated with deforestation

Farmers' behavior and practices regarding forest conversion to other land uses is by this research eferred to as the various options and alternative uses of forestland including all the actions nvolved in such uses. This study identified many activities and processes involved in this act esulting to numerous deforestation occasioned in Akwanga. This is in line with the finding of Adger (1993), which stated that most of the competition for space between human and other pecies is demonstrated by the conversion of land (including forestry areas) to agriculture, nfrastructure, urban development, surface mining, fuel wood collection, industry and nsustainable forest use.

4.4.1 Conducts that cause deforestation

According to figure 4.4.1 below several factors are attributable to deforestation in the study area. From the figure 4.4.1, one can see that respondents in the sampled size that agreed that bush fire s the highest cause of deforestation recorded 22%. Also the same figure 4.4.1 shows that 19% of he respondents stated that fuel wood harvesters are the second highest cause of deforestation.

Critical analysis of the figure 4.4.1 indicated that 15% of the respondents reported that timber harvesters were among the first third major causes of deforestation in the study area. Further more, both agricultural expansion and population growth recorded 13% respectively as the major causes of deforestation as can be seen in figure 4.4.1 below. Finally, from figure 4.5 it can be seen that the least of the causes of deforestation in Akwanga are miners and pest which accounted for 1% and 2% respectively.

The higher percentage of the respondents that reported that fuel wood harvesters are second to the major causes of deforestation agreed with Odoemena (2006) which reported that fuel wood is a traditional source of energy for domestic use in Akwanga, and that because of the lean financial resources of the poor rural households in the state, they usually find it economically difficult to resort to other sources of energy for domestic activities (cooking and pressing clothes) except fuelwood thereby resulting to forest exploitation called deforestation.

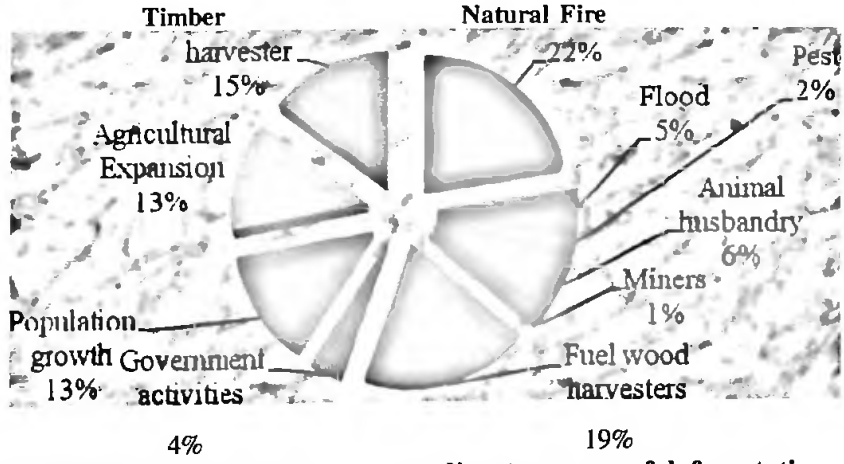


Figure 4.4.1 Distribution of respondents according to causes of deforestation

4.4.2 Perception of deforestation

The table 4.4.2 below shows the distribution of respondents according to their perception of deforestation in the study area. According to table 4.4.2, timber harvesters (98), agricultural expansion (97), fuel wood harvesters (85), bush fire (81), and population growth (75), are in the

ajor categories of the high causes of deforestation as perceived by the respondents. urthermore, from the same table 4.4.2 below, causes of deforestation perceived by the spondents in the study area as moderate include among others animal husbandry (91), opulation growth (86), and timber harvesters (71), government activities (69), agricultural xpansion, (62) and bush fire (57). Finally, the low perception of causes of deforestation as own by the respondents in the study area are; pest (117), miners (113), flood (105), animal usbandry (85) and government activities (72). From the analysis below, one can see that major auses of deforestation as perceived by the respondents in the study area agreed with what Nzeh nd Eboh (2009) reported that both flooding, erosion, agricultural expansion and timber arvesting are among the peculiar climate change risks especially in the Southeast of the country.

able 4.4.2: Distribution of respondents according to their perception of deforestation

erception of deforestation	Level		
ctivities	High	Moderate	Low
imber harvesters	98	71	28
gricultural Expansion	97	62	24
uel wood harvesters	85	72	32
ush Fire	81	57	58
opulation growth	75	86	27
overnment activities	23	69	72
est	18	24	117
lood	17	37	105
nimal husbandry	16	91	85
liners	10	24	113

ource: Field survey, 2018

4.4.3 Number of years engaged in deforestation

Figure 4.4.3 stated that 40% of the respondents in the study area agreed that they were enagaged in deforestation activities for period less than or equal to three (≤3years) only. Furthermore, the same figure 4.6 below indicated that 30% respondents agreed that they were involved in deforestation activities between 4 and 6 years and ≥7years respectively. The implication of figure 4.6 below shows that the rate of deforestation activities in Enugu State is of recent on the high side. This may be connected to the high population growth rate of the state which stood at 3,257,298 with an annual average growth rate of 3%, according to NPC (2006), but without corresponding increase in employment generation. Therefore, for the households to sustain their livelihood, they usually engage in exploitation of the forest resources.

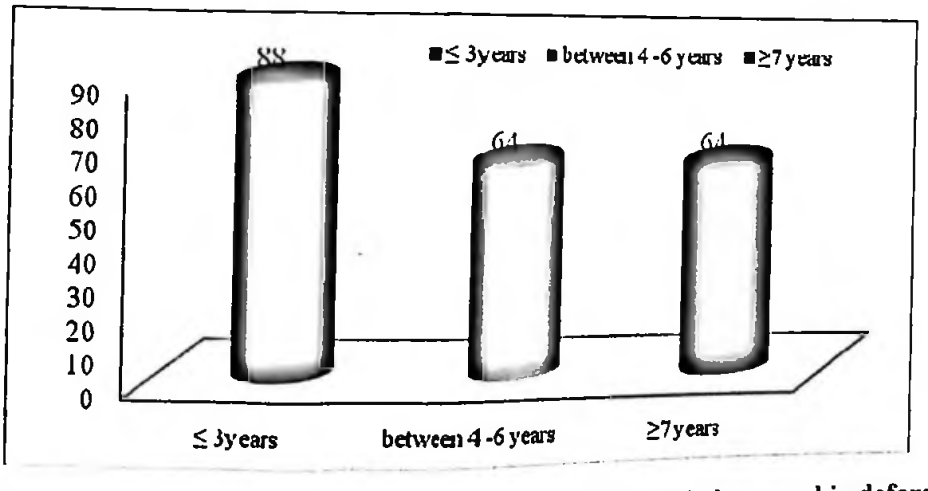


Figure 4.6: Distribution of respondents according to period engaged in deforestation

4.4.4 Methods of deforestation by households

Figure 4.4.4 contains the distribution of respondents according to ways in which households engaged in deforestation in the study area. From the figure 4.4:3.4 below, 62% of the respondents were engaged in deforestation activities in Enugu State through the use of manually operated equipments. Critical analysis of the figure 4.4.4 indicated that 25% of the respondents were involved in deforestation by the use of both mechanical and manual means. Finally, from

the same figure 4.4.4 only 13% of the respondents in the study area agreed that they use mechanical ways for deforestation in Akwanga. The Akwanga lower percentage recorded by those respondents that use modern means for deforestation may be linked to lack of modern knowledge concerning forestry activities due to infrequent presence of forest extension agents as observed in figure 4.4.4

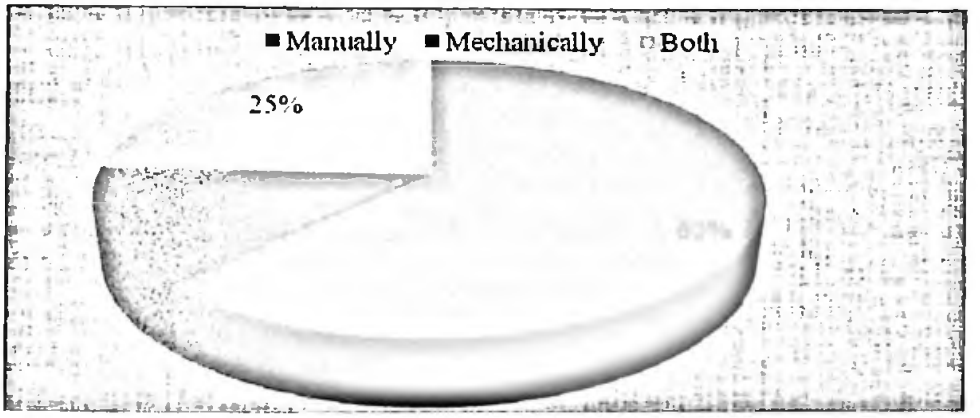


Figure 4.4.4: Distribution of respondents according to ways households engage in deforestation.

4.4.5 Distance of forests from home

From figure 4.12, it can be seen that higher percentage of respondents (59%) reported that the distance of forest from their home was 4 to 6kilometers. Also from the same figure 4.12, it can be observed that 17% of the respondents agreed that the distance of forest from their home was $\leq$ 3kilometers, but other respondents 14% and 10% stated that the distances from their homes to forest were $\geq$10 kilometers and 7 to 9 kilometers respectively. As can be seen from the below figure 4.12, the implication of proximity of forest to home will mean that more deforestation will be taking place; hence so many households relied on forest for income, employment and fuelwood.

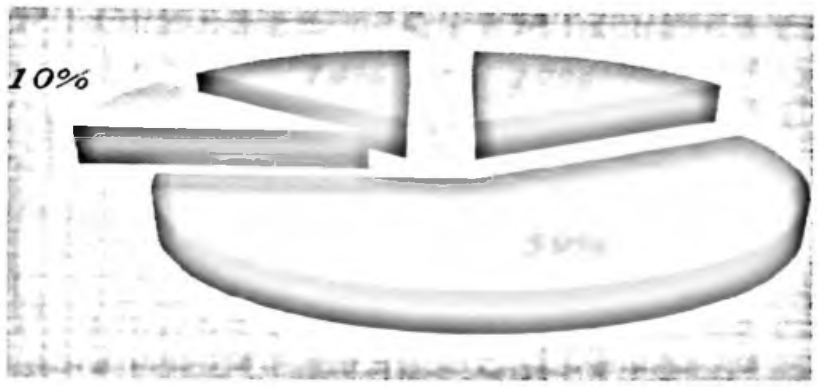


Figure 4.12: Distribution of respondents according to distance of forest from home

4.4.6 First clearing of farmland by household

Figure 4.14 below indicates that 67% of the respondents stated that their household farmland was first cleared in ≤ 40years. Furthermore, figure 4.14 shows that 24% of the respondents agreed that their household farmland was first cleared for cropping activities between 41 to 80 years ago. But, only 9% of the respondents reported that their household farmland was first cleared ≥ 81years ago.

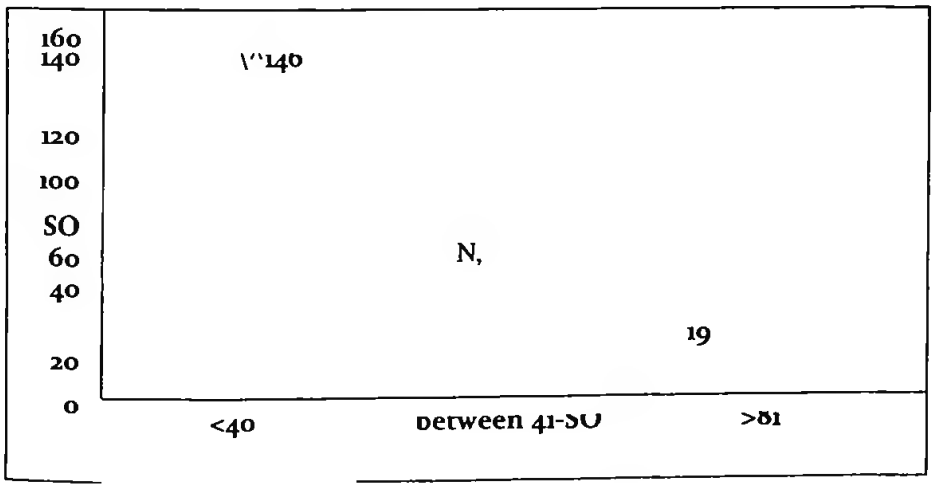


Figure 4.14: Distribution of respondents according to number of years since farmland was first cleared for cropping

4.4.7: Economic Losses from deforestation

The global economy is losing more money from the disappearance of forests (called deforestation) than through the recent global financial crisis, according to an EU-commissioned study as reported by Black (2008). Black (2008) further puts the annual cost of forest loss at between $2 trillion and $5 trillion. The figure comes from adding the value of the various services that forests perform, such as providing clean water and absorbing carbon dioxide among others according to Black (2008).

4.4.8 Awareness of forest extension services

As can be deciphered from figure 4.22, only 31% of the respondents were aware of forest extension services in the sampled size, while the remaining 69% had no knowledge of any forest extension services. This simply indicates that few percentages of respondents with forest extension services knowledge may be those living nearer government forest reserve areas. The implication of the high percentage of the respondents in the sampled size not being aware of forest extension services is that there will be more deforestation activities by these respondents leading to indiscriminate exploitation of forest resources.

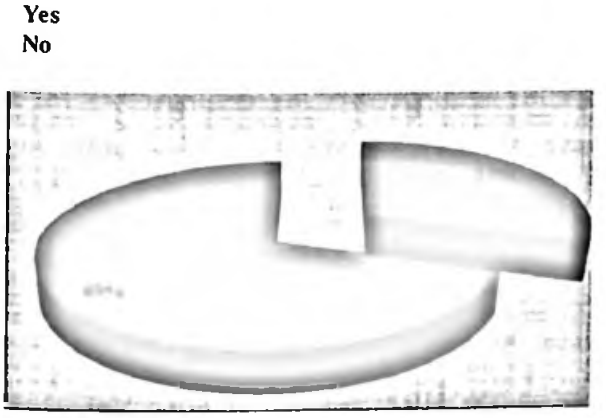


Figure 4.22: Distribution of respondents according to awareness of extension services

4.4.9 Services received from forest extension agents

From figure 4.24 below, it can be seen that 90% of the respondents in the study area who acknowledged being aware of forest extension agents agreed that they receive information concerning forest use from these forest extension agents. Furthermore, figure 4.24 equally shows that both respondents that receive information on marketing of forest products and information on government policy concerning forest recorded 4% only. Finally, only 2% of the respondents reported that they received information from forest extension agents in the study area on forest credits.

The few respondents that receive information about government policies concerning forest still indicate that these respondents may be engaging in deforestation activities within the state due to lack of adequate knowledge about recent government programme concerning forest. These therefore result to negative consequences of deforestation to both humanity and economy of the state.

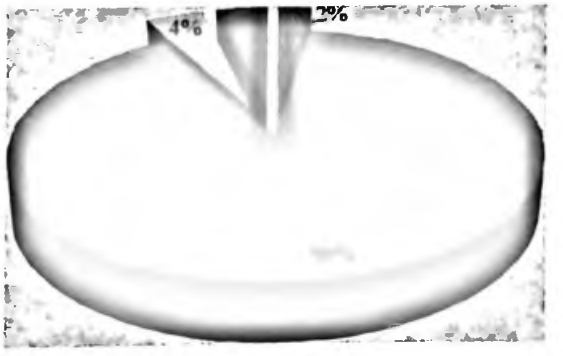


Figure 4.24: Distribution of respondents according to types of services received from forest extension agents.

4.4.10 Other source(s) of income

Part time income earning activities including trading on forestry resources fall within the category of other sources of income to different households. It usually represents those activities, which occupy less than 30% of the working time of the households to support their financial base as reported by (Deepar and Pritchett, 1977).

Figure 4.25 contains the distribution of respondents according to other sources of income by the respondents in the study area. The figure shows that 53% of the respondents reported that their other source(s) of income is trading on the forestry resources. Also, the same figure 4.25 indicates that 24% of the respondents reported that their other source(s) of income are both trading on the forestry resources and public service. Further analysis of the same figure 4.25 shows that only 23% of the respondents stated that their other source(s) of income is through public service.

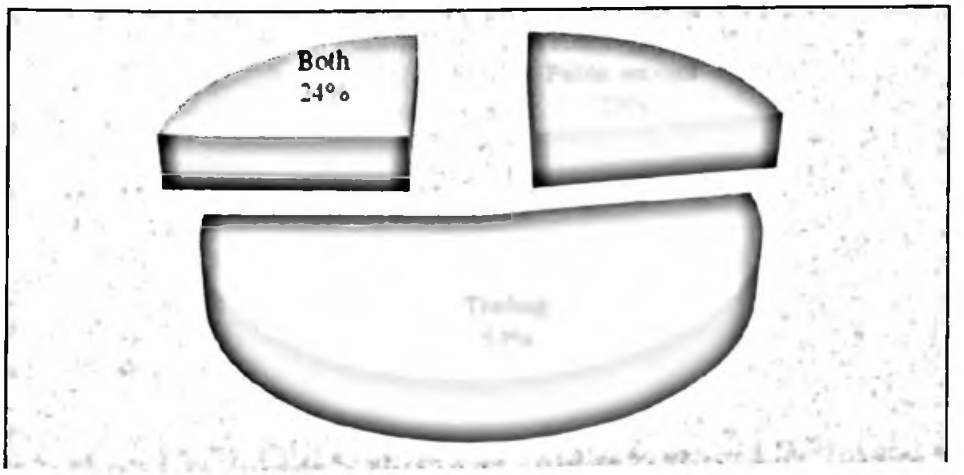


Figure 4.25: Distribution of respondents according to other sources of income

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

.1 Summary

cientific knowledge about deforestation, its causes and consequences have been dominated by terature, stressing the conceptual and theoretical dimensions of the phenomenon. Generally, opulation, economic growth, market penetration, infrastructural development and poverty are ome of the principal factors theoretically held responsible for the deforestation activities. The nteraction of these factors and the magnitude of their effects on the deforestation activities in the tate especially the rural settings are lacking. Yet, it is at the household level that much decisions o deforest or not is taken. These problems create knowledge gap for stakeholders in forest anagement at both private and/or public sector forestry. The situation also posits olicy constraints for public agents, civil society and advocates in sustainable environmental anagement especially in Akwanga Local government.

is against this background that this study was conceived to produce critical reliable knowledge mbodying the clear and better explanation of the economic analysis of losses from deforestation n the study area.

he specific objectives are to: critically examine the nature and extent of deforestation in the tudy area, identify and analyze the factors that influence the decision to deforest, determine and nalyze the resource-use patterns and processes associated with cleared forest land, estimate and nalyze financial and economic losses from deforestation, evaluate the effect of socioeconomic actors on the deforestation in Akwanga Local government.

he research outcome identified 52% of the sampled size are within the age bracket of 31-60 ears. However, with exception of some respondents who made up only 25% of the respondents, thers obtained formal education. The result shows that 40% obtained primary education, 22% btained secondary education and the remaining 13% obtained post secondary education. As :vealed by this study, only 31% of the respondents were aware of forest extension services 'hereas 69% had no knowledge of any forest extension services, and this usually lead them into ngaging in deforestation activities. The study also observed that 53% of the respondents had ading on the forestry resources as their other sources of income, but 23% of the sampled size ad public service as their other sources of income, as 24% had both (trading and public service) s their other sources of income.

nother major finding of the study is that bush fire was the highest causes of deforestation in the udy area as it recorded 22%. Also 19% of the respondents stated that fuel wood harvesters were ıe second highest cause of deforestation. Whereas only 15% of the respondents reported that mber harvesters' were among the first third major causes of deforestation in the study area. urthermore, the study appraised the number of period respondents engaged in deforestation ctivities in Enugu State by the rural households and it was discovered that 40% of the espondents in the study area agreed that they were engaged in deforestation activities for less ıan or equal to three (≤3years) only. It was also discovered that 30% respondents agreed that ıey were involved in deforestation activities between 4 and 6years and ≥7years respectively. he study also explains methods of deforestation by households in Enugu State. From the study, 2% of the respondents stated that they engaged in deforestation activities in Akwanga Local overnment through the use of manual equipments. Further investigation reveals that 25% of the

espondents reported that they involve in deforestation by the use of both mechanical and manual ieans; but only 13% of the respondents use mechanical deforestation method.

n addition, this study found out that total economic loss (TEV) value of forest in the last three ears were N75,855,558.00 for 2008 which represents 30% loss from different deforestation ctivities in the study area. Meanwhile, this study also indicated that N89.674,707.00 which epresents 36% of total loss from various deforestation activities in Enugu State in 2007. astly, N85,683,956.00 further represents 34% loss from different deforestation activities in the udy area in 2006.

n regression results for the farmland clearance for cropping activities only size of land, nd tenure system and types of cropping were significant in explaining the observed ariability's in the dependent variable. Whereas in logit regression model results for socio-conomic characteristics affecting clearance of forest for agricultural/other activities only gender f respondents, educational attainment, deforestation experience, household size and total land oldings were significant in explaining the observed variabilities.

.2 Conclusion

n conclusion, it is evident that there were economic losses from different sources of eforestation activities in Akwanga Local government. The major determinants that led to rmland clearance which result to economic losses from deforestation were land tenure rrangement, types of cropping and size of farmland of the farming household. From the analysis f the study, it was observed that gender of the farming household; literacy status, household ize, and even experience of the household in deforestation were other major causes of economic osses from deforestation in Akwanga Local government. The study also established that

conomic losses from deforestation in the study area were driven by bush fire, fuel wood arvesters, agricultural expansion and population growth.

urthermore, credit accessibility, proximity to market, technological level of the farmers were qually factors that affected household decisions toward deforestation of the environment ıereby leading to economic losses. However, from the discussions so far in this study, it should e easy to deduce that economic losses from deforestation in the forest of Akwanga Local overnment suffered both state and local governments' neglect. Therefore, there is need for nproved policy on deforestation activities in the state if the government hopes to generate both ɔcal and foreign exchange from the forestry sector. This is because the contributions of this ɛctor would not be met without provision of efficient and effective forestry polices which will ɛduce under and over exploitation of the forestry resources. There is also the need to address the ɔncerns of the rural dwellers that are involved in over and under exploitation of the forestry ɛsources that lead to economic losses from this sector.

ased on the above premise and other relevant issues raised in this study, it is therefore, ɔnsidered very necessary that to meet with the demand of the society, the government and other ıterested policy makers may find the following under listed recommendations useful.

.3 Recommendations

ased on the above research findings, the following recommendations are advanced as means of reventing economic losses from deforestation in the study area.

i. The study recommends that policies that will divert the abundant energy expended on indiscriminate deforestation activities by the middle aged men to afforestation, reforestation, tree husbandry and tree planting in the state should be encouraged. This

will help to checkmate the recent frequent conversion of forestland to arable cropping and other uses in Akwanga Local government.

ii. The findings from the study indicated that involvement in deforestation declined with level of education. This implies that attainment of more education improves the income level and broadens the horizon of the rural farmers in the use of improved technologies, easy access to inputs and off farm employment. Therefore, the study recommends that government at all levels should reinvigorate adult literacy programme or expand the universal basic education programme to allow farmers with the primary education to upgrade themselves. This will help them improve on their environmental friendliness. The educational framework should handle issues like positive impacts of deforestation to the society, factors leading to the forest conversion, effects of conversion and ways of avoiding unnecessary conver sion of the natural resources.

iii. The study equally recommends that forest extension services to the rural households that engage in forestry activities should be strengthened. The forest extension agents should adequately be motivated. trained toward giving relevant, clear and sensible technical advice to the stakeholders in the forestry activities.

iv. The study further recommends that community participation in the forestry conservati on and protection initiatives should be made mandatory. This will encourage these communities to always innovate indigenous methods to stop under and over exploitation of forest. They will also develop a sense of ownership and commitment to all decisions made about reducing deforestation.

v. The study recommends that Akwanga Local government at all levels should adopt strategies and policies that will encourage improved farming practices and agricultural methods such as alley cropping and taungya farming. This will divert the attention of these rural famers that are constantly involved in deforestation due to proximity of these forests to their homes. This will further protect our cherished agricultural activities which is the mainstay of our economy.

vi. The study also recommends that frequent use of workshops, advocacy and seminars are necessary to educate the rural farmers more on the negative consequences of deforestation. This will help the rural stakeholders to have adequate information on the new policies of the government concerning forestry sector.

vii. The study equally recommends the enforcement of the 1901 Act of planting twenty (20) trees in the place of every one stump.

viii. Finally, the study recommends the provision of energy saving stove by the government to the rural people. This energy saving stove will help to reduce the quantity of fuel wood used and hence reduce the level of deforestation.

.4 Limitation of the study

his research work could not cover a large sample area because of financial constraints ncounter by the researchers. The study covered about 1000 students within the studied area. his does not give more room for more option to be sought on the problem under the study. lso, some individuals decline attending to the questionnaire because of illiteracy and inferiority omplex.

me problems were encountered at the cause of the data collection. Some individuals found it ficult to release their records to us. This could be due to ignorance; due to fear that we may be vernment secret agents or that we might have an evil intention in our research work, vertheless, some where friendly enough to give us the necessary information that we needed. search work is capital intensive.

5 Contribution to Knowledge

is study contributed to the ongoing body of knowledge on the economic analysis of forest in kwanga Local Government of Nasarawa State, Nigeria.

is study revealed the inability of policies addressing issues of forest resources exploitation in sarawa state on address specifically issue of commercial charcoal production. This study posed the sustainability of the policies as well as possible areas of amendment.

is study also exposed the socio-cultural influence deforestation in Akwanga, Nasarawa state.

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