

**AN ECONOMIC ASSESSMENT OF THE POVERTY-ENVIRONMENTAL QUALITY NEXUS IN THE LAMBUSSIE-
KARNI DISTRICT OF GHANA**

By
KNUST

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DECLARATION

I hereby declare that this submission is my own work towards the Master of Arts degree and that, to the best of my knowledge, it contains no materials previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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Date

DEDICATION

This work is dedicated to my parents, Mr. Cuthbert Nakpa-Der and Madam Celine Be-ire and brothers and sisters for the foresight they had to send me to school.

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ABSTRACT

The poor in Ghana depend on the environment for their livelihood and survival and their lives are greatly affected by the way they use the environmental resources. This study aimed to examine the poverty-environment nexus in Lambussie-Karni District. The study puts the hypothesis of bi-directional link between poverty and environment to test.

The results provide evidence in consonance with the dominant view in the literature that environmental degradation spurs rural poverty and vice versa thereby providing evidence in support of the poverty- environment nexus in the study area. Also results indicate that environmental degradation spurs rural poverty and vice versa. Furthermore it was found that the impact of poverty on environmental degradation was greater than the impact of environmental degradation on poverty. The results indicate that income levels of majority of the respondents were below the poverty line (US\$1 per day), with the environment severely degraded. The livelihoods of the poor in the Lambussie-Karni District would be significantly enhanced by close integration of poverty-alleviation and environmental strategies aimed at reducing environmental problems.

Also development of alternative sources of energy, intensification and modernization of environmental education are also essential to alleviate poverty in the district.

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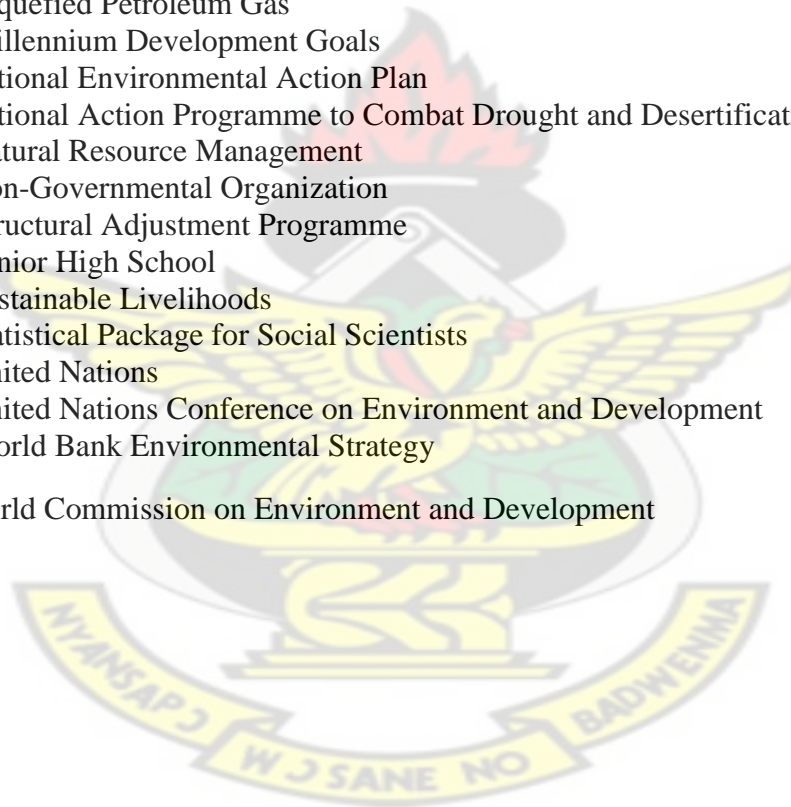
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ABBREVIATIONS AND ACRONYMS USED

ARES	Africa Region's Environmental Strategy
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
ERP	Economic Recovery Programme
GPRS	Ghana Poverty Reduction Strategy
GSS	Ghana Statistical Service
GLSS	Ghana Living Standards Survey
IFAD	International Fund for Agricultural Development
ICT	Information and Communication Technology
ISSER	Institute of Statistical, Social and Economic Research
JHS	Junior High School
LKD	Lambussie-Karni District
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
NEAP	National Environmental Action Plan
NAPCDD	National Action Programme to Combat Drought and Desertification
NRM	Natural Resource Management
NGO	Non-Governmental Organization
SAP	Structural Adjustment Programme
SHS	Senior High School
SL	Sustainable Livelihoods
SPSS	Statistical Package for Social Scientists
UN	United Nations
UNCED	United Nations Conference on Environment and Development
WBES	World Bank Environmental Strategy
WCED	World Commission on Environment and Development



CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND TO THE STUDY

Two of the most important global issues today are pervasive poverty and problems related to environmental degradation. The Brundtland Report (1987) of the World Commission on Environment and Development (WCED 1987) declared poverty to be a major cause and effect of global environmental problems. According to the report, the poor are seen as the victims of environmental degradation and also are the agents of the degradation. They are basically short-run maximisers; they try to meet the needs of the present at the cost of the future. The poor and hungry often destroy their immediate environment for their survival. They cut down forest, their livestock overgraze grassland, and they overuse farm lands. It is in this context that the first report on Human Development sees poverty as one of the greatest threats to the environment (UNDP 1990). This means that the poor are vulnerable to environmental degradation because they depend heavily on natural resources which the rate of degradation far outweighs the rate of regeneration, have less alternative resource, and most often exposed to environmental hazards, and are least capable of coping with environmental risks. About 41% of the population of Sub-Saharan Africa – more than 300 million people lived on less than US \$ 1 per day in 2005 – the highest poverty rate of any region of the world (World Bank, 2007). In recent years there has been some progress in reducing poverty in Sub-Saharan Africa but the rate of progress falls far short of the Millennium Development Goals of cutting poverty in half by 2015 (World Bank, 2007).

According to the World Bank (2000/1), conceptions of poverty have changed in recent years, with more attention now given to non-market aspects of deprivation. For example, the World Bank has developed a three-part analysis of poverty that includes not only economic opportunity but also relative vulnerability to risk (security), and influence or access to the levers of power World Bank, 2001 (World Development Report, 2000/01).

According to a research conducted by the International Fund for Agricultural Development (IFAD) , poverty in Ghana is predominantly found in the rural sector. About 70% of the country's poor live in rural areas where they have limited access to basic social services, safe water, and electricity and telephone services (IFAD, 2005). The degree of reliance upon the environment for the majority of rural dwellers, and notably the poor who often lack the resources to diversify their livelihood base, explains the level of concern over access to natural capital (Kunfaa, 1999). As more than 65% of the people engaged in the wood fuel business in Ghana are women (Energy Commission, 2006), the increasing scarcity of firewood means that women must spend large portions of the day in search of fuel, diverting time from other important activities such as income generation and child care (Todaro and Smith, 2003). The time thus lost by women greatly affects the household economy considering the role of women in household welfare especially in the rural environment.

The Ghana Living Standard Survey (GLSS, 2006) Report also notes that 93% of households in rural savannah are engaged in agriculture (Ghana Statistical Service, 2006). Unfortunately, the environment, the very source of livelihood of the people is deteriorating at an alarming rate. According to Nsiah-Gyabaah (1994), Ghana's environment especially the northern savannah and woodlands are being degraded at an increasing rate. Apart from domestic energy purposes, charcoal and firewood is a major

source of income for many rural people especially in the savannah area. Aggregate household dependence on wood fuels in Wa and other major towns in the Upper West Region is 90% (Ghana Energy Commission, 2002). The poverty situation in the Upper West Region of Ghana for instance, is partly attributable to the fragile natural environment of the area which is the result of insufficient protection in the past (Government of Ghana, 2002). Most farming practices involve the indiscriminate cutting of vegetation and burning. This makes the land prone to erosion and loss of productive potential. In areas where the population density is high, people are compelled to continuously cultivate the same parcel of land year after year. This makes the environmental situation a very serious problem in the Upper West Region and for that matter the Lambussie-Karni District.

Therefore there is a two-way linkage between poverty and environmental degradation. Degradation of environment caused either by the poor or the rich has both direct and indirect impacts not only on the cost of production but also on the productivity of crops and thus on the income of the people. Thus a vicious link is established between poverty and environmental degradation. Each becomes the cause and effect of the other.

1.2. STATEMENT OF THE PROBLEM

The major economic activity in the northern part of Ghana is farming- food crop and animal production. The rural population in this area depend more on the environment for their livelihoods than on other sources such as manufacturing and trading (GLSS, 2006).

Many studies like that of Cavendish (2000) and Jodha (2000) on poverty-environmental degradation nexus have established that the rural poor in developing countries are heavily dependent on local natural resources for their sustenance (Cavendish, 2000; Jodha, 2000; Shiva & Verma, 2002; Escobal and Aldana, 2003; Narain, Gupta & Veld, 2005). The implication is that as a result of the environment being degraded through households livelihood activities such as bad farming practices like slash and burn, indiscriminate fuel wood harvesting without replanting, results in yields from crops and livestock become reduced leading to low consumption and therefore poverty levels are bound to increase where there are no alternative sources of livelihoods. Most farming practices involve the cutting of vegetation and burning. This makes the land prone to erosion and loss of productive potential.

Usually, most poor people do not have any alternative sources of livelihoods and hence depend on the environment for fuel wood leading to the environment being degraded especially where the rate of fuel wood cutting exceeds the annual re-growth, a deficit situation arises and thus, non sustainable resource use, resulting in accelerated environmental degradation. In some areas, the shortage might be so acute that even over cutting does not meet the minimum requirement of the people. This cyclical relationship is commonly referred to as the poverty-environment nexus (Nelson and Chomitz, 2004; Dasgupta et al. 2003, Duraipappah, 1998). Dasgupta (1993) describes how closely dependent poor people are on their surrounding environmental resource base for their livelihood, and how poverty can be a driving force behind environmental degradation. He argued that poor farmers are limited to labour intensive production strategies, as they are unable to use external inputs such as fertilizers to support sustainable environmental resources usage. They are therefore destined to contribute to natural resource degradation.

A study by Rural Life in Ghana (2006), a Non Governmental Organization, indicates that poverty is highest among food crop farmers. Food crop farmers are traditional, small scale producers who prepare the land manually, many of whom are women. According to the survey, rural poverty affects about 54% of people in Ghana.

According to Songsore (2003), about 69% of households in Ghana use firewood and 26% use charcoal as their main source of fuel for cooking. It is estimated that 79% of the country's charcoal supply comes from the most ecologically fragile Savannah zones, 15% from the semi deciduous zone and only 6% from the rainforest zone. As remarked by Songsore (2003), this is one major hidden cause of ecological degradation because of the lack of access of rural households to clean energy sources such as LPG and electricity. The Ghana Energy Commission (2005) also found that the demand for fuel wood in the country in 2000 was about 14 million tons. This means that fuel wood is a major livelihood resource for most Ghanaians especially those in the rural areas. Firewood extraction from indigenous forests is causing widespread deforestation in rural areas. A large and growing population of rural people struggling to survive in a limited land resource base has led to the overexploitation of the environment. Crop production is seriously affected by unreliable rainfall. Yields have been falling due to loss of soil productivity. Land under crop cultivation has been increasing due to increasing population and efforts by farmers to increase total production.

The Lambussie-Karni District has been faced with some of the most severe problems of resource degradation and deepening poverty according to the Environmental Protection Agency (EPA, 2002). The major environmental degradation problems include severe erosion, deforestation and frequent bush fires. These problems have been associated with low crop productivity, high dependence of households

on the environmental resources for cooking, lighting and heating at home. Also yields have also been falling due to loss of soil fertility. In parallel to resource degradation social welfare conditions in general have deteriorated across the district. The symptoms of poverty are apparently high in the area as well; there is high prevalence of undernourishment, infant mortality and other consequences of deprivation such as low income and consumption levels, high illiteracy rate (GLSS, 2006).

These arguments above notwithstanding, studies on poverty and environmental degradation in the Lambussie-Karni District by the Ghana Living Standards Survey (GLSS 2006), the Environmental Protection Agency (2002) and Non Governmental Organizations have ignored the links between the environment and poverty. This calls for the need to understand and empirically investigate these links as well as to assess the impact of the conditioning factors. The study aims at filling this research gap.

1.3. OBJECTIVE(S) OF THE STUDY

The main objective of this study is to examine the nature of poverty-environment relationship in the areas of households' incomes and consumption levels, sources and uses of fuel wood and bush burning and also to suggest measures that could be considered in future poverty reduction and environmental quality strategies. Specifically the research seeks to:

1. Assess the benefits that people derive from environmental resources in the Lambussie-Karni District.
2. Assess the extent of poverty and environmental degradation that exist in the Lambussie-Karni District.

3. Examine whether poverty causes environmental degradation and whether environmental degradation also causes poverty in the Lambussie-Karni District.
4. Examine alternatives that exist to alleviate rural poverty and improve environmental quality in the Lambussie-Karni District.

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1.4. JUSTIFICATION OF THE STUDY

In order to achieve greater economic development especially for developing countries, world leaders in 2000, adopted the Millennium Development Goals (MDGs) which among other things, aim at halving extreme poverty and ensure environmental sustainability by 2015 (World Bank, DFID, EC, UNDP, 2002). The fulfilment of the MDGs depends upon efficient environmental management and the integration of poverty-environment issues, including ensuring the management of fuel wood harvesting and bush burning and also improving the living conditions of rural people.

The Lambussie-Karni District is one of the districts ranked poorest in Ghana by the Ghana Living Standards Survey with a rise from 83.9% to 88% in 1998/99 and 2005/2006 respectively of households below the upper poverty line. This is higher than most districts especially in the southern part of Ghana (GLSS, 2006). The most common household size in each of the nine districts of the Upper West Region is either the large household or the very large. The average household size in the Lambussie-Karni District is 7.1 which is higher than the national average of 5.1 (Ghana Statistical Service, 2000).

The essence of this study is to help the society, government and other policymakers understand the extent to which poverty heightens environmental degradation and vice versa. Also the focus of the study is to understand the nature of natural resource uses and dependence among the rural poor. This will help government and stakeholders make an informed decision, appreciate and provide appropriate solutions to the problems, and also pave way for future researchers who might be studying on a related problem.

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1.5. THE STUDY AREA

The people in the Lambussie-Karni District are predominantly peasant farmers cultivating cereals such as millet, sorghum, maize, cowpea, rice. They also cultivate tubers including yam and some vegetables such as pepper, okra, and tomatoes. Land use and crop cultivation in these areas is subjected to seasonal problems such as setting of annual fires causing vegetative cover loss, erratic rainfall pattern and shortened or even elimination of fallow periods, due to increased pressure on land (Owusu Agyeman and Kranjac-Berisavljevic, 2008).

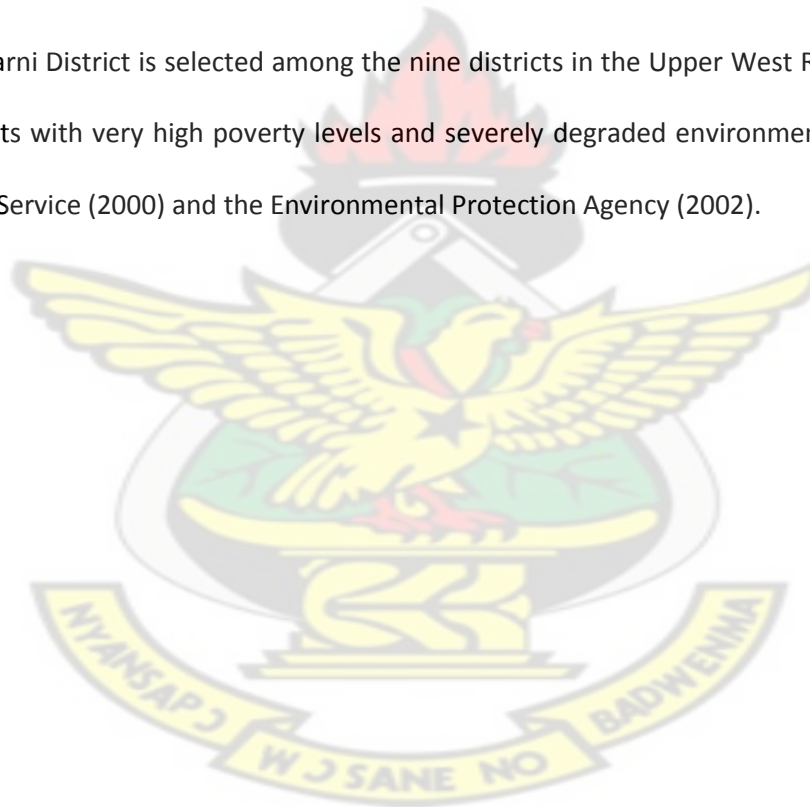
The Lambussie-Karni District is selected because it is in the guinea savannah vegetation belt with different uses of land in terms of farming practices and livestock rearing. Also, the district is one of the districts ranked poorest in Ghana by the Ghana Living Standards Survey with a higher proportion of 88% poor households. Nine in every ten people in the district falls under the poverty brackets. Income levels are among the lowest (GLSS, 2006).

1.6. METHOD OF THE STUDY

The relationship between poverty and environment are complex and multifaceted. It is therefore not possible for a study like this one to deal with all the aspects of poverty and environmental degradation. As a result, the study examined particularly the linkage between consumption poverty, bush burning and deforestation. The methodology below has therefore been designed to achieve the research objectives.

1.6.1. POPULATION AND SAMPLE SIZE

The Lambussie-Karni District is selected among the nine districts in the Upper West Region because it is one of the districts with very high poverty levels and severely degraded environment according to the Ghana Statistical Service (2000) and the Environmental Protection Agency (2002).

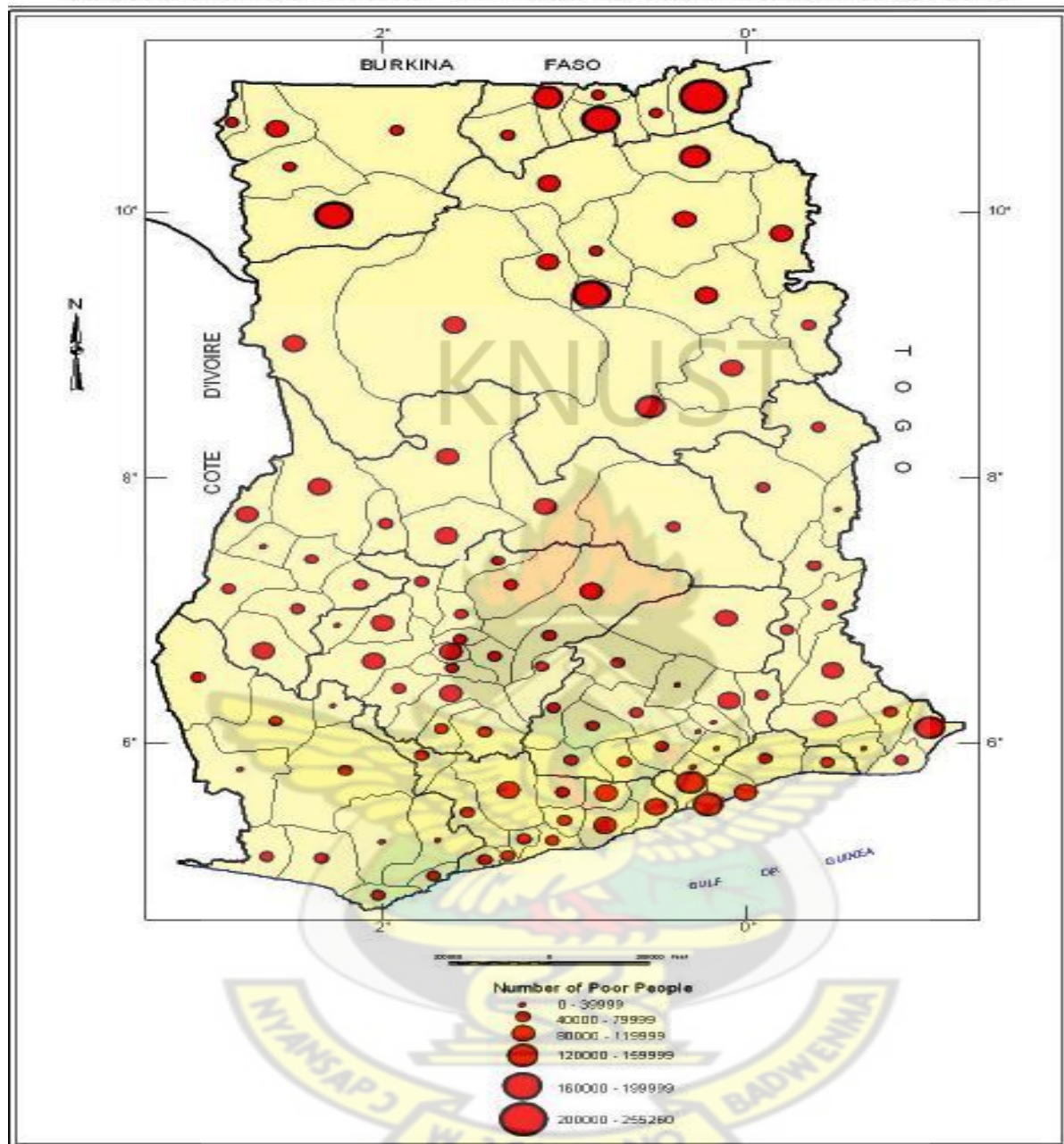


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Figure 1.1;



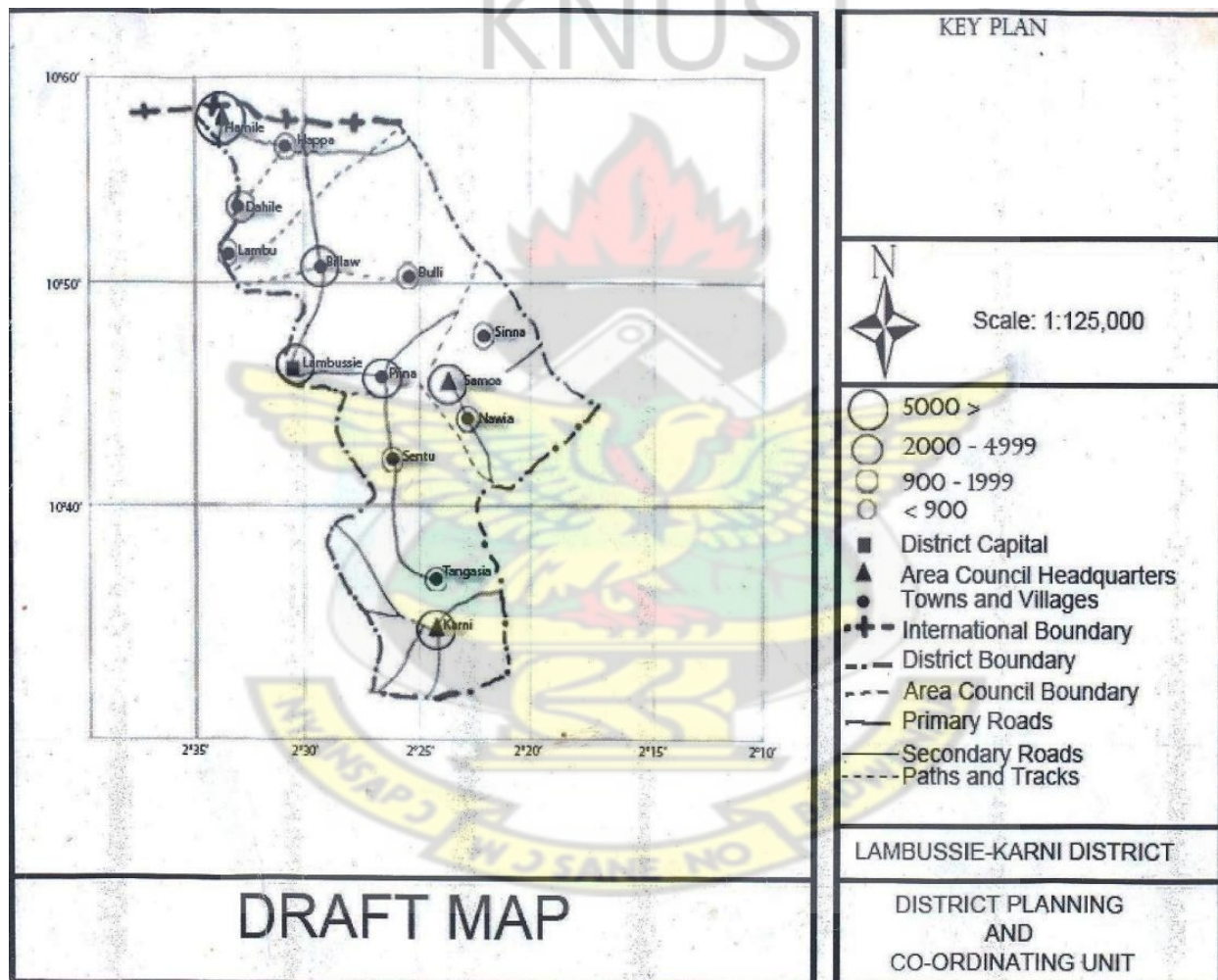
GHANA POVERTY MAP: ESTIMATED NUMBER OF POOR PEOPLE (GHANA)



The Lambussie-Karni District was divided into six sub-districts to represent every part of the district that is north, south, east and west and also to capture the major ethnic groups that inhabit the district. Within each sub-district, one-third of the total population of households were entirely selected by means of simple random sampling where each household had equal chance of being selected for the

interview based on the presence of household head or any member at the time of the interview. In all 120 households were interviewed. Observations in the form of written notes were also collected during each research activity.

Figure 1.2: District map of Lambussie-Karni



Source: District Planning Office, 2010.

1.6.2. SCOPE OF THE STUDY

The economic activities of humanity, particularly during the last couple of centuries, have had a profound impact on the natural environment. Fast depletion of the world's forest resources raised many moral as well as practical questions concerning present and future generations (Kula, 1992).

The target group is the household who depend on environmental resources in the Lambussie-Karni District. However, as a result of time and material constraint, the research is narrowed down to the inter-relationships between poverty and environmental quality in the areas of bush burning, wood harvesting and uses and their impact on the environment. Also poverty is narrowed down to consumption poverty where monthly incomes of households, their consumption levels were considered. This approach has been used by Cavendish to assess the extent of dependence of rural people on the environment in rural Zimbabwe (Cavendish, 2000). This was to enable the researcher undertake a critical evaluation of the extent of the linkage in the Lambussie-Karni District.

1.6.3. THE RESEARCH HYPOTHESES

The study tested the following hypotheses:

1. H_0 : environmental degradation does not increase the severity of poverty in the Lambussie-Karni District.
 H_1 : environmental degradation increases the severity of poverty in the Lambussie-Karni District.
2. H_0 : higher poverty does not lead to environmental degradation in the Lambussie-Karni District.

H₁: higher rural poverty leads to increased environmental degradation in the Lambussie-Karni District.

1.6.4. DATA COLLECTION

In order to achieve the objectives of the study, both quantitative and qualitative data were employed in obtaining the data. Both primary and secondary data were used.

1.6.4.1. Primary Data

The main data for the study was obtained from primary sources. A survey was conducted in the form of structured questionnaire administered in the district to elicit personal data of respondents: age, marital status, household size, economic data: primary occupation of household heads, employment status, income and consumption levels, and natural resource uses and dependence. The administration of the questionnaire was done by means of face-to-face interviews. The Contingent Valuation Method (CVM) through the bidding game method was used to assess the willingness to pay for environmental deterioration since environmental resources do not attract market value. The merit and rational for choosing this format is that, it involves a straightforward estimation, and that the maximum willingness to pay is obtained.

1.6.4.2. Secondary Data

Secondary data were collected by reviewing literature on issues relating to the study from both published such as the Ghana Living Standards Survey, unpublished documents and the Internet.

The data source on issues of poverty in Ghana is the Ghana Living Standards Surveys (GLSS), which were published in 1987/88, 1988/89, 1991/92, 1998/99 and 2005/2006.

1.6.5. Data Analysis

Primary data obtained from the field was edited, all corrections made and coded. After which it was fed into the Statistical Package for Social Sciences (SPSS) version fifteen (15) for processing the primary data. In analyzing the data, frequency tables, bar chart, regression analysis were used as analytical techniques. The researcher also used the two-stage linear regression models to test the above hypotheses that poverty and environmental degradation are both causes and effects of each other in the Lambussie-Karni District.

1.7. ORGANIZATION OF THE STUDY

The research was organized into five chapters. The first chapter consisted of the introduction which included the background to the study, statement of the problem(s), where the main issue that prompted the need for conducting the research is discussed. In addition the researcher looked at the objectives of the study, justifications and methodology. Chapter two comprised the literature review. This is where the writer reviewed what other people have written about the topic and made comparisons. This chapter is divided into two, theoretical and empirical studies. Chapter three focuses on the methodology of the study which focuses on sources of data, sampling procedure, population and sample size, questionnaire administration, a survey of the study area and method of analysis. Chapter four consisted of presentation, analysis and discussion of the information acquired. Here also tables, graphs and other econometric and statistical models were being employed. Finally, the last chapter gives the conclusion and recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

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2.1. Theoretical Overview.

One out of five people on earth still live with \$1 a day, and many coordinated efforts and commitment have been targeted to reduce the number of poor people including the Millennium Development Goals: halving extreme poverty by the year 2015 (World Bank, DFID, EC, UNDP, 2002). Unlike poverty issue, which has been in the mind of the world leaders for generations, environmental problems started to gain global widespread attention in 1970s, especially after the Stockholm Conference on the Human Environment in 1972 (World Bank, 2000).

Poverty is a human condition. There have been several theoretical approaches to defining poverty (Cooksey, 1994). One of the most frequent and conventional way of measuring the economic status of people is their incomes. Pigou (1952) defines poverty as the incapability of getting minimum standard of living in which condition people never wanted to live. According to Sen (1992), Noland and Wheland (1996) poverty is strongly linked with low income. This notion gives income as the paramount variable of poverty. In many developing countries, however, there are difficulties in trying to assess rural incomes (Collier, 1986). A number of approaches have been suggested to reflect a true picture of the

situation. Such approaches include the UNDP Human Development Index (HDI) which goes beyond pure income considerations to include educational achievements and life expectancy (UNDP, 1997).

Also many environmental problems are associated with poverty especially the fact that, environmental degradation in many cases, and many ways, affects the livelihood of the poor. The poor are vulnerable to environmental degradation because they depend heavily on natural resources, have less alternative resource, and most often exposed to environmental hazards, and are least capable of coping to environmental risks (Dasgupta and Mäler, (1994), World Bank, DFID, EC, UNDP, (2002)). This means that the rural poor are heavily dependent upon natural resources for their livelihoods. Non-farm income will become increasingly important for rural livelihoods in the future in many areas, but at the present the reliance by the poor on access to natural resources is key.

2.2. Causality and Linkages of Poverty and Environmental Degradation

The literature that treats the link between poverty and environmental degradation usually focuses on the "vicious circle" between poverty and degradation; the circle is Malthusian in inspiration, where farmers, pushed by population increase and poverty, extend cropping onto fragile marginal lands, degrading them. The latter reduces yields of farmers which further impoverish farmers (Dasgupta and Mäler, 1994; Pearce and Warford, 1993; Mink, 1993). The implication of the focus on the vicious circle of poverty and degradation is that poverty alleviation will necessarily reduce degradation of the environment, and its inverse, that arresting and reversing environmental decline will help the poor. (Leonard et al., 1989; Cleaver and Schreiber, 1994).

A new dimension to the link between poverty and environmental degradation was brought out in 1995 when Reardon and Vosti introduced the concept of 'investment poverty' and related the same to other measures of poverty (Reardon and Vosti 1995). The notion of poverty was examined by them in the context of categories of assets held and categories of environment change with particular focus on farm household income generation and investment strategies as determinants of the links. According to them the strength and direction of the poverty-environment links in rural areas are different depending on the composition of the assets held by the rural poor and the types of environmental problems they face. Finally they advocated that the links between poverty and environment in a given setting depend on the level, distribution and type of poverty and environmental problems. The relationship could hardly be direct since, as some have argued, low living standards in the rural areas contribute to increased pressure on natural resources which in turn aggravates poverty (Reardon and Vosti 1995).

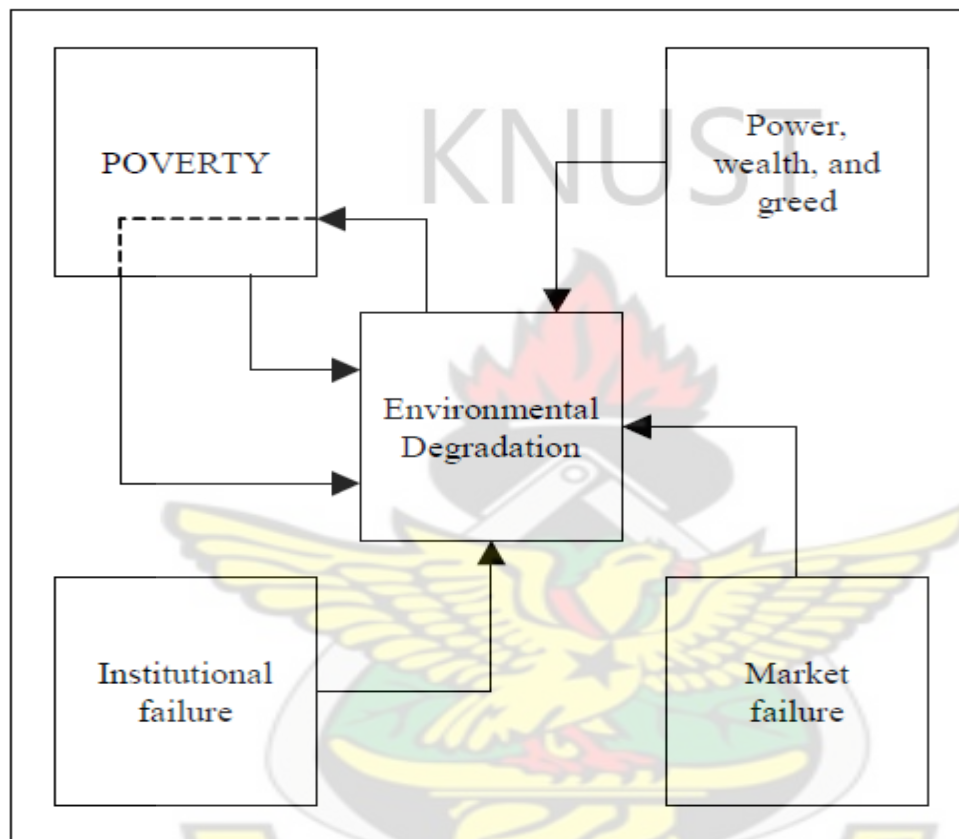
According to Angelsen, the link between poverty and environment in developing countries has been gaining increasing attention of the international development agencies and policy makers (Angelsen, 1997). Many studies have established that the rural poor in developing countries are heavily dependent on local natural resources for their sustenance (Cavendish, 2000; Jodha, 2000; Shiva & Verma, 2002; Escobal and Aldana, 2003; Narain, Gupta & Veld, 2005). The poor depend heavily on the open access resources like the forests, pastures, water resources that leads to their over exploitation (Jodha, 2000). Animals like sheep or goats that act as capital resource for the rural poor degrade the vegetation and soil faster than the livestock of the richer rural population like buffaloes (Rao, 1994). This cyclical relationship is commonly referred to as the poverty-environment nexus (Nelson and Chomitz, 2004; Dasgupta et al. 2003, Duraiappah, 1998).

One thread of this literature (recently reviewed by Beck and Nesmith, 2000), Veldeld et al. (2004) and Kuik, have tried to quantify how dependence of common-pool natural resources varies with the level of household income, where dependence is usually defined as the share of overall income derived from natural resource use. A common finding in this literature is that dependence on natural resources declines with income. Cavendish (2000), based on data from 197 households in 29 villages in Zimbabwe, finds much higher rates of dependence, with poor households deriving as much as 40% of their incomes from natural resources and the rich deriving about 30% (Cavendish, 2000).

The above discussion on the various studies conducted worldwide show that there is a two-way linkage between poverty and environmental degradation. Degradation of environment caused either by the poor or the rich has both direct and indirect impacts not only on the cost of production but also on the productivity of crops and thus on the income of the people. The Poor get more affected than the rich and become poorer due to environmental degradation manifested through destruction of forest for fuel wood, timber, degradation of land water through the use of chemical fertilizer, pesticide, etc in modern farming; and pollution of air due to consumption of biomass fuel. Thus a vicious link is established between poverty and environmental degradation. Each becomes the cause and effect of the other.

Duraiappah (1998) put forward some postulates of causality relationship which may exist between poverty and environment.

Figure 2.1: Duraipappah's Model on Poverty-Environmental Degradation Nexus.



Duraipappah's (1998) postulate of poverty-environment nexus

Figure 2.1 shows the possible causes of environmental degradation to include market failure, institutional failure, power, wealth, and greed, and also poverty. Environmental degradation and poverty, however, may have mutual causality. Environmental problems have been seen as the effect of the failure of market to take into account the full value (price) of the services from the environment.

Also market failure has been generally accepted as the main cause of environmental degradation. Institutional failure in the form of inappropriate government policy, or ill-defined property right as a cause of environmental degradation has also been widely accepted as the cause of environmental degradation (Dasgupta and Mäler, 1994, Pearce and Warford, 1993). There are however other causes of environmental degradation and poverty which are not captured in Duraiappah's model which are worth mentioning. These include population growth, climate change, floods, drought, pollution and soil erosion. These all contribute negatively to the quality of the environment and also cause poverty.

According to Lopez (1992) a common hypothesis is that the major source of forest, biomass and soil degradation is poverty. The poor tend to be highly dependant on natural environment for their survival. According to this hypothesis, the rural poor who make up for more than two thirds of the worlds poor according to World Bank (1992), have no option but to consume the environmental resources to survive, for example, slash and burn practices, cutting trees for fuel wood, and unsustainable cultivation practices. In this view, environmental destruction and poverty reinforce each other.

Poverty-constrained options may induce the poor through their livelihood activities such as bad farming practices and indiscriminate cutting of trees for firewood to deplete resources at rates that are incompatible with long-term sustainability (Holden *et al.*, 1996). In such cases, degraded resources causes a "downward spiral," by further reducing the income of the poor (Durning, 1989; Pearce and Warford, 1993). Rapid population growth, coupled with insufficient means or incentives to intensify production, may induce over-exploitation of fragile lands. Again, a downward spiral can ensue (World Bank, 1992). The downward spiral hypothesis maintains that poor people and environmental damage are often caught in a downward spiral. Past resource degradation deepens today's poverty, while

today's poverty makes it very difficult to care for or restore the agricultural base, to find alternatives to deforestation to prevent desertification, to control erosion and to replenish soil nutrients.

Norman (1993) argues that the poor feel are compelled to do what they often recognize is harmful to their own long-term interest yet they feel they have no alternative by virtue of their absolute poverty. Hence, these farmers are often the principal source of deforestation, desertification, and soil erosion, together with mass extinction of species.

2.3 Dasgupta's Hypothesis of Poverty-Population-Environment Nexus

In explaining the linkage between poverty and environmental degradation, Dasgupta's (2000) model is a combination of how the poor in rural economy, population, and environment are related to each other within the context of common property resources. In his deterministic and static model, a common-property-resource-based rural economy consist of N identical households, each has n household members maximizing the quadratic production function (or net income, which we could regard as level of well-being, the lower of which could be considered poverty).

$$\max y(n) = -\alpha + \beta n - \gamma n^2$$

where $\alpha, \beta, \gamma > 0$ and $\beta^2 > 4\alpha\gamma$. Each household maximize equation (1) taking α, β and γ as given.

Household optimum decision will result in $n^* = \beta / 2\gamma$ and $y^* = -\alpha + \beta^2 / 4\gamma$.

This model implies that environmental degradation (e.g. represented by increase in α or γ , or decrease in, β) can reduce y^* , hence poverty. However, it does not yet tell anything that the reverse (poverty cause environmental degradation) may occur. Dasgupta (2000) then follows that the state of the local natural-resource base is a function of the total village population, M , or $\alpha = \alpha (M)$, $\beta = \beta (M)$, $\gamma = \gamma (M)$. The higher the total village population, the lower the state of the resource degradation. However, the total population M is not in the consideration of optimizing behaviour of each household. It is an externality problem, which Dasgupta (2000), calls as 'reproductive externality'. In a symmetrical equilibrium, $M^* = Nn^*$.

This model has given significant contribution to our understanding of poverty-environment linkage is conditioned by the following critical notes. First, Dasgupta's model does not say that poverty directly cause environmental degradation, it is channeled through other variable namely population growth or increasing household size. Therefore, population is importantly indispensable, could not be excluded, in poverty-environment nexus. Being poor in itself, is not the cause of environmental degradation. If a household, for instance, decides not to increase its family size, as a response to being poorer, then we could not simply accuse the poor as agents of environmental degradation

2.4. Theoretical Model for Poverty-Environmental Quality Nexus

This study adopted the vicious cycle model on poverty and environmental degradation. The model was first used in the report of the World Commission on Environment and Development (WCED, 1987). According to the Brundtland Report (WCED 1987) the poverty condition generates through the environmental degradation a vicious cycle (also known as poverty-environment downward spiral,

poverty-environment hypothesis) where the poverty condition leads to the natural resources degradation and thereby deteriorates the living standards of the poor and perpetuates the poverty condition. Following the approach of Deininger and Minten (1999), poverty is hypothesized as a function of environmental degradation along side other controlled variables as specified below;

$$P_1 = F(\alpha + \beta x_i) = \frac{1}{1 + e^{-(\alpha + \beta x_i)}} \dots\dots\dots(1)$$

where P_1 is the probability that the i^{th} household will be poor given x_i , where x is a vector of explanatory variables and e is the natural logarithm. Equation (1) can be written as;

$$P_1 = \left[1 + e^{-(\alpha + \beta x_i)} \right]^{-1} = 1 \dots\dots\dots(2)$$

Where,

$$\alpha + \beta x_i = \log\left(\frac{P_1}{1 - P_1}\right) \text{ and } \frac{P_1}{1 - P_1} \text{ is the odds ratio, whose log gives the odds that}$$

a household is poor or the environment is degraded. The model to be estimated is specified as,

$$\log\left(\frac{P_1}{1 - P_1}\right) = \alpha + \beta_0 Edu_i + \beta_1 Pop_i + \beta_2 Occ_i + \beta_3 Env_i + \beta_4 Inc_i \dots\dots\dots(3)$$

Where Edu_i is the level of education of the people, Pop_i is the population of the area, Occ_i is the occupation, Env_i is an index for environmental conservation, and Inc is the income levels of people.

2.5. Theoretical Considerations of Variables for Poverty-Environmental Quality Nexus.

The study analyzed some factors influencing poverty and environmental degradation the basis for selecting these variables stems from the fact that these variables have been considered by Pigou (1952), Narayan et al., (2000), WCED (1987), the World Bank (1992) and Ravnborg (2003) in their analysis of the poverty-environmental degradation nexus. One of the recent studies is a study by Swinton and Quiroz (2003), who used regression analysis of 1999 farm survey data in Peru to analyze whether poverty is to blame for soil, pasture, and forest degradation.

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2.5.1. Dependent variables

The dependent variables for this study include households' monthly income and the sources of fuel used at home.

Income

One of the most frequent and conventional method of measuring the economic status of people is their incomes. A person is poor when their personal income or consumption is below a specified 'poverty line' (Coudouel and Hentschel, 2000). However many poor people rely on their own production and informal sector activities in which the concept of profit is unclear, rather than on a formal income (Glewwe and Van der Gaag, 1988). When households monthly income increases, rural poverty and environmental degradation are expected to decrease as dependence on forest resources is reduced and therefore the relationship is inverse. (Meza et al.). Therefore households monthly incomes were used in the regression analysis to determine correlation or otherwise of poverty and environmental degradation.

Sources of Domestic Fuel

It is known that majority of the population especially in the rural areas depend heavily on firewood and charcoal for their energy needs. As people fell trees for firewood and charcoal production, the environment is made bare. In such cases, degraded resources can further reduce the income of the poor (Cleaver and Schreiber, 1994; Dasgupta and Maler, 1994; Durning, 1989; Ekbom and Bojo, 1999; Mink, 1993; Pearce and Warford, 1993; Prakash 1997; World Bank, 1992; World Commission on Environment and Development, 1987). More than half of households (54%) use firewood as the main cooking fuel. Charcoal ranks second (31%). In urban areas, 53% of households use charcoal for cooking. In the rural areas, about four fifths of households use wood while 14% use charcoal. A larger proportion of urban households (20%) use gas for cooking than rural households (9.5%) GLSS (2005/2006).

2.5.2. Independent variables

The independent variables considered in this study include education of respondents, household size, bush fires, occupation and uses of fuel wood.

Education

Poverty and environmental degradation are related to the level of education in a country. It is expected that, the higher the educational attainment of most members of the household, all things being equal the lower the incidence of poverty. Torras and Boyce (1998) report that in low-income countries, higher literacy rates improves environmental quality and vice versa. Therefore, higher education may be a prerequisite for a higher demand of a clean environment. It is expected that, the higher the educational attainment of the majority of members of the household, all things being equal the greater the value

they will place on environmental issues. Education is expected to expose a person to a lot of environmental issues particularly, the dwindling of nature's resources and its implications. Moran (1994) had a negative sign in his regression analysis of the poverty-environmental quality nexus, however Hadker *et. al* (1997), found a positive sign for education.

Household size

Average household size is a socioeconomic variable that can affect poverty as larger household

size is expected to increase the severity of poverty. This has been observed previously by Allen and Barnes (1985), Ehrhardt-Martinez (1998), Rudel (1989), Rudel and Roper (1997). This argument is based on the evidence of positive correlation between larger family size and high dependency ratio (i.e. larger family sizes) indicate larger proportion of household members are children and elderly who are dependent on the minority of the working age members.

Bush Burning

When bush fires destroy forests on heavy or lateritic soils and organic matter near the soil surface is consumed, the soil tends to become hard, dry and impervious to water, especially at the beginning of the rainy season (Korem, 1985). Korem argued that bush fires are often the main cause of acute scarcity of firewood in many parts of northern Ghana. Wood collectors (mostly women and children) have to spend valuable time and energy in search of wood. Exposed land surfaces caused by bush fires are further degraded by wind and water erosion.

Occupation

Crop cultivation is a major contributing factor to environmental degradation especially land degradation. Before crops are planted, the land is cleared. Many farmers use burning as a form of clearing. The vegetation is slashed and then burnt. Burning as a form of farm clearing facilitates erosion, causes plant nutrient destruction and destruction of rare animals and plant species (Nsiah-Gyabaah, 1994). In the rural areas agriculture dominates the economy. About 75% of the employed are engaged in agriculture. A larger proportions of males are engaged in agriculture compared to females in both urban and rural areas GLSS (2005/2006).

Uses of Fuel wood

It is known that majority of the population especially in the rural areas depend heavily on firewood and charcoal for their energy needs. In such cases, degraded resources can further reduce the income of the poor (Cleaver and Schreiber, 1994; Dasgupta and Maler, 1994; Durning, 1989; Ekbom and Bojo, 1999; Mink, 1993; Pearce and Warford, 1993; Prakash 1997; World Bank, 1992; World Commission on Environment and Development, 1987).

According to the Ghana Living Standards Survey (2006) the main sources of lighting for households are kerosene and electricity (both at 49%). Kerosene is the main light source for households in rural areas (72%), while electricity is the main source for urban households (79%) GLSS (2005/2006).

2.6. Empirical Literature on Poverty

According to Coudouel and Hentschel, a person is poor when their personal income or consumption is below a specified 'poverty line' (Coudouel and Hentschel, 2000). Poverty is a relative term and as such there is no consensus on how poverty should be defined. Poverty has been defined according to what is prioritized as a 'need'. It is usually conceptualized as an economic or social condition and has major implications for policy. From an income point of view, people are poor when they are in a state where, "their income (or consumption) is less than that required to meet certain defined needs." Poverty relates to lack of resources for production to afford a decent standard of living. Inability to access basic, but essential goods and services leads to both physical and mental dearth. In the 1960s consumption of goods and services gained favour as a superior poverty indicator, as it presents a more stable indicator over time than income. A bundle of goods deemed necessary for meeting basic needs is identified, consisting of food expenditure and modest expenditure on non-foods (Lipton and Ravallion, 1993). Despite subsequent broadening of the definition of poverty, consumption has remained the most widely used indicator (Baulch, 1996). As the definition of poverty expanded with the concept of basic needs in the 1970s, qualitative indicators expanded to incorporate the satisfaction of those needs.

Extreme poverty (consumption poverty) refers to the proportion of the population who are unable to afford the basic food needs for the day, while overall poverty refers to the proportion who cannot afford the basic food needs as well as the non-food needs for the day. In Ghana the extreme poverty line is currently anchored at ₵2,884,700, while the overall poverty line (upper poverty) is anchored at ₵3,700,900 (which is equivalent to \$1/day/adult) for a year. However, personal income can vary greatly from year to year, is only appropriate for wage earners, and has less relevance to the poor. Many poor people rely on their own production and informal sector activities in which the concept of profit is unclear, rather than on a formal income (Glewwe and Van der Gaag, 1988). With an average exchange

rate of GH¢0.92 (¢9,176.48) to the US dollar prevailing in June 2006, the average annual household income was US\$1,327 and the average per capita income was US\$433. There were regional differences with Greater Accra region recording the highest of GH¢544.00 whilst Upper West and Upper East regions had less than GH¢130.00. This implies that the incidence of poverty is indeed high in the Upper West Region.

2.6.1. Rural Poverty and Rural Livelihoods

According to the DFID, livelihood is defined as comprising of the capabilities, assets (both material and social) and activities required for a means of living (DFID 1999). In order to survive and prosper in what can often be difficult circumstances; rural agrarian households employ livelihood strategies. The main livelihood activities practised by the poor in Ghana, as highlighted through the Ghana Social Assessment (1998) include petty trading (women and youth), production of cooked food (women), artisanal self-employment (men), blue-collar work and small-scale agriculture for dwellers of the larger urban centres. The rural and provincial urban poor are found to be engaged in arable farming (men, women, youth), wood cutting for building purposes, fuel wood harvesting (women), petty commerce (women) and livestock rearing (mainly men in the northern Ghana) (Korboe, 1998).

According to a study by Rural Life in Ghana (2006) a Non Governmental Organization, women make the poorest 20% of the population and many are the head of their household. In general, women work more than twice as much as men and bear harsh working conditions. Nonetheless, women have less of a voice in decision making. The sick, aged and disabled are also amongst the poorest in Ghana. Many have or have used up their resources to pay for medical care and have ended up with no means of finances. An estimated 54%, of Ghanaians live in rural sectors

and are crops and livestock farmers, or fisher men. Farms are usually subsistent farms, and are often run by families where all members participate in the workload. (“Rural Life in Ghana,” 2006). While farming provides a reasonable means of income, it is often not enough. People often look for other means of making money such as crafting, petty trading, raising and breeding livestock etc.

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2.6.2. The Incidence of Poverty in Ghana

The incidence, depth and severity of poverty is computed and decomposed across the regions and sub groupings. In terms of the upper poverty line of 900,000 cedis, 39.5% of Ghanaians live below the average poverty line in according to the Ghana Living Standards Survey (2006). The trend in terms of regional decompositions is not very different from the extreme poverty case. The three northern regions again have the highest incidence rates, Northern (69.2%), Upper West (83.9 %) and Upper East (88.2%). The Greater Accra has the least (5.2%). The inclination is clear; the less endowed Savannah regions of Ghana have the highest incidence and severity of poverty GLSS (2006). According to the Survey, Poverty is still deep and severe in Ghana and more especially in the three northern regions. Across the regions Greater Accra has the lowest incidence rate of 2.4%, whilst the three northern regions, have the highest rates; Northern region (57.4%), Upper West (88.0%), and Upper East (70.9%). Interestingly, the indexes gap for Volta (4.6%), Ashanti (4.6%) and Brong Ahafo (4.5%) regions are not too different from each other, though the incidence rates vary from 16.4% in Ashanti to 20.4% for Volta.

Table 2. 3: Trends in Poverty Incidence by Region and Location 1990-2006

Proportion below the Lower poverty line

Proportion below the Upper Poverty line

Regions	1991/92	1998/99	2005/2006	1991/92	1998/99	2005/2006
Western	42.0	14.0	7.9	60.0	27.0	18.0
Central	24.0	31.0	9.7	44.0	48.0	20.0
Greater Accra	13.0	2.4	6.2	26.0	5.2	11.8
Eastern	35.0	30.4	6.6	48.0	44.0	15.1
Volta	42.0	20.4	15.2	57.0	38.0	31.4
Ashanti	25.0	16.4	11.2	41.0	28.0	20.0
Brong Ahafo	46.0	18.4	14.9	65.0	36.0	29.0
Northern	54.0	57.4	38.7	63.0	69.2	52.3
Upper West	74.0	68.3	79.0	87.0	83.9	88.0
Upper East	53.0	88.0	60.1	67.0	88.0	70.9
Urban	15.1	11.6	5.7	27.7	19.4	11.0
Rural	47.2	34.4	25.6	63.6	49.5	39.0
National	36.5	26.8	18.2	51.7	39.5	28.5

Source: Ghana Statistical Services, (2007) Pattern and Trends of Poverty.

There is no doubt that poverty is a rural phenomenon in Ghana by looking at figure 2.3 above. This is observable from the poverty figures when the index is decomposed across the rural and urban sub samples. Together with the high incidence, the depth of poverty is also most severe in the rural savannah area. With regard to socioeconomic grouping, poverty is a major problem for food crop farmers (mostly subsistence farmers cultivating below 1.6 hectares a year) and the non-farm self-employed. With a population share of 46% to 50%, food crop farmers represented 54.4% of the national poor in 1992, while the non-farm self-employed accounted for 22.7%. The poor have little or no access to basic services such as health, education, water and sanitation. These poverty trends are linked to occupational patterns, illustrating the poorest group was food crop farmers. Moreover, their contribution to the national incidence of poverty was found to be greater than their population share, with almost 58% of those identified as poor coming from households whose main economic activity was food crop farming. The incidence of morbidity is higher among the poor, while literacy levels are very low compared to the better-off households. For instance, the GLSS (2006) survey found that in 1992 13% of rural households lived in communities without a primary school and 36% without a secondary school; 84% of rural households had no access to pipe-borne water, while 52% of villages had no mother and child health or family planning services. Survival and coping strategies have included, for the rural north, out-migration in search of employment; for the rural south, reducing expenditures (e.g., taking children out of school) and changes in household patterns; and, for the urban south, reducing expenditures, and diversifying sources of income GLSS (2005/2006).

Studies by Boateng (1971) and Dutta Roy (1968) on income distribution in the 1960s and 1970s showed that incomes in rural Ghana were generally lower than incomes in the urban areas (Boateng et al, n.d.; Rourke, 1971; Dutta Roy et al., 1968). According to them as the incidence of poverty is higher in rural areas those areas start to be considered as potentials for environmental degradation. On one hand the rural population relies to survive on environmental utilization. On the other hand these natural

resources are considered as public goods, have common access and non defined property rights and therefore some people tend to overuse it and thereby accelerate its degradation and exhaustion (Finco, 2002).

2.6.3. Rural Poverty Reduction in Northern Ghana.

The over-riding aim of Government is the reduction of poverty through economic growth, integrated rural development, expansion of employment opportunities, and improved access by the poor to basic public services (Government of Ghana, 2002).

A number of government-led policy initiatives implemented over the past years have focused attention and resources towards poverty reduction. After a decade of economic decline during which Ghana's real gross domestic product (GDP) dropped by 10% and the per capita GDP by 27% by 1983, the introduction in 1983 of an Economic Recovery Programme (ERP), followed by a Structural Adjustment Programme (SAP) led to the resumption of growth in the economy. As a part of the Government's efforts to alleviate the hardship of marginal, poor and other vulnerable groups disadvantaged by the process of economic reform, in 1988 the Government initiated the Programme of Actions to Mitigate the Social Costs of Adjustment (PAMSCAD), with donor support of about 84 million dollars. Some 24 projects, with a strong focus on poverty, were implemented by the Government under the programme, including four WFP-assisted programme components on school feeding; priority works schemes, supplementary feeding and assistance to re-deployees (Government of Ghana, 2002).

In addition, the Government has developed a framework for future poverty reduction activities in the country. The key objectives of the framework include the promotion of rapid growth in productivity by focusing on smallholder agriculture; increasing access of the poor to social services; removing

constraints that affect the living standards of poor women and vulnerable groups; and minimizing the effects of environmental degradation (Government of Ghana, 2002).

Ghana Vision 2020, developed in 1995 as an over-arching national development policy framework, aims to achieve a balanced economy and a middle income status and living standard for Ghanaians by the year 2020 (Vordzorgbe, 2001). Alongside Vision 2020, the Ghana Poverty Reduction Strategy (GPRS 1) was developed in 1995/96 to increase the Government's emphasis on economic growth, integrated rural development, improved access of the poor to basic economic and social services, expanded employment for urban poor, and, family planning.

2.7. Empirical Literature on Environmental Degradation

In Ghana, forest is cleared for various purposes including agriculture, mining, timber and energy. As remarked by Songsore (2003), this is one major hidden cause of ecological degradation because of the lack of access of urban households to clean energy sources such as LPG and electricity (Songsore, 2003).

2.7.1. Causes of Environmental Degradation in Ghana

A UNDP report (2003) estimated that the country had lost about 79% of its forest cover since the beginning of the 20th century. A rapid increase in livestock is a major contributor to environmental degradation in Ghana. In the rural areas, the major land use practices are farming, grazing of livestock, wood cutting for fuel (firewood and charcoal), and construction purposes. These land use practices

sometimes initiate bush fires. Fire is used by some farmers in clearing their land, by livestock herders to regenerate fresh grasses for their animals to graze and for harvesting wood and burning charcoal.

2.7.1.1. Fuel wood Harvesting and Uses

According to Miller (1991), Fuel wood, including charcoal, is a major source of energy for many households in developing countries (Miller et al., 1991). This is one human livelihood activities that greatly causes environmental degradation. Fuel wood is harvested for domestic purposes such as cooking, lighting and heating.

In Ghana, wood cutting for firewood and charcoal has drastically reduced the tree cover of some areas. According to the Environmental Protection Authority, major charcoal production areas of Donkorkrom, Kintampo, Jirapa, Wenchi and Damongo show physical signs of depleted wood fuel resources. People thus have to travel long distances in order to get wood for charcoal production. A research conducted by the EPA (2002) in forty communities in the Upper West Region revealed that 80% of charcoal produced came from shea trees and the remaining 20% from the dawadawa and neem.

A questionnaire survey by Songsore (2003) in Ghana revealed about 60% of households use wood fuel as their main source of fuel for cooking, 26% use charcoal and only 3.2% use electricity or gas. In the rural areas, wood fuel is the main energy source, used by 92% of households. In the urban centres, majority (62%) use charcoal. In the Brong Ahafo, Eastern and the three regions in the North, over 50% of urban households still use wood fuel although charcoal in all cases is the next important source of cooking fuel (Songsore, 2003).

Apart from domestic energy purposes, charcoal and firewood is a major source of income for many rural people especially in the savannah area. The Ghana Energy Commission has reported that, 80% of the population in Bolgatanga depends on firewood and charcoal from the urban markets respectively. This is estimated at 31,270m³ of fuel wood equivalent annually. In Wa, 90% of the population on aggregate depends on wood fuels, an estimate of 50,946 m³ of solid wood equivalent annually (Ghana Energy Commission, 2002).

It is estimated that 79% of the country's charcoal supply comes from the ecologically more fragile Savannah zones, 15% from the semi deciduous zone and only 6% from the rainforest zone (Songsore, 2003). Should the Ghana Poverty Reduction Strategy (GPRS) medium term targets of reaching a middle income level with a per capita of US\$1,000 in 2012 be realized, the Commission projects that demand for wood fuel could reach 38-46 million tones by 2012, and 54-66 million tones by 2020. This, the Commission believes would result in serious deforestation, if no significant action is taken.

2.7.1.2. Grazing

Livestock production is a major source of livelihoods for many Ghanaians, providing income, protein, animal power and many other benefits. It is estimated that about one and a half million households in Ghana keep livestock. The livestock raised include cattle, sheep, goats, pigs, rabbits, poultry and draught animals. According to the Ghana Statistical Service (2000), these livestock are predominantly in the rural forests and the rural savannah areas. Whereas the rural forest has 99% of all sheep and goats, the rural

savannah keeps 96% of all draught animals, 71% of cattle and 61% of all pigs (Ghana Statistical Service, 2000). These animals, particularly the cattle, sheep, goats and draught animals graze extensively.

The savannah area with vast expanse of grassland, free from animal killing insects, favours livestock production. Due to overstocking and overgrazing and environmentally unfriendly practices such as burning of grasslands to get fresh grasses for animals, the grassland is greatly degraded Nsiah-Gyabaah (1994).

2.7.1.2. Bush Fires

Bush fires are another devastating phenomenon that destroy vegetation and degrade the environment. These fires destroy the vegetation; deprive the soil of organic matter and thus fertility. Even though the ash produced through burning of the vegetation increases nutrients such as calcium, magnesium, potassium and phosphorous, the effect is transient.

Bush fires have also been noted as the main cause of acute scarcity of firewood in many parts of northern Ghana (Nsiah-Gyabaah, 1994). Exposed land surfaces caused by bush fires are further degraded by wind and water erosion. Plant and animal species are also lost and the entire habitat supporting wildlife and large numbers of ecologically interdependent species is destroyed through bush fires.

In the Savanna region, soil and vegetation deterioration is caused by human activities especially bushfires. At the beginning of the dry season, herders often start fires to stimulate the growth of young shoots. According to livestock farmers, the re-growth or young offshoots are more palatable and contain

more nutrients. Burning improves ranges because grazing animals frequently are found concentrated on burned areas where the herbage is more accessible, palatable and nutritious (Nsiah-Gyabaah, 1994). The importance of grazing is particularly significant in this region. Therefore the need for fresh green grass leads to the tendency of herders to burn off dry and undesirable vegetation (grasses) and to promote the growth of pasture.

2.7.2. Effects of Environmental Degradation in Ghana

Poor households dependence on environmental resources for their livelihoods has posed a threat on the quality of the environment. This is through their activities for survival such as bad farming practices, firewood cutting for cooking, lighting and heating at home and bush burning. Also when the environment is degraded as a result of over dependence, it leads to low productivity and therefore further poverty. The long-term results of short-term exploitation are devastating, often increasing rather than alleviating poverty. Some of the effects of environmental degradation that are of great concern to the livelihood of many households who depend on the environment for survival explained below (Young, 1998).

2.7.2.1. Wood Scarcity

Wood, apart from being the main source of fuel for domestic and rural industrial purposes, is also a source of income for many through charcoal and fuel wood sale. It is also a raw material for construction of buildings. Deforestation resulting from farm clearings, direct indiscriminate wood harvesting and bush fires has brought about wood scarcity in most communities. Women and children (who usually fetch wood) have to walk long distances to get wood for the various purposes, especially fuel and sale. Wood scarcity thus adversely affects economic activities such as pito brewing and gardening (Nsiah-Gyabaah, 1994).

Between 1990 and 2000, Ghana lost an average of 135,400 hectares of its forest cover per annum, representing an average annual deforestation rate of 1.82%. This however increased to 1.89% between 2000 and 2005, accounting for 115,400 hectares of forest lost per annum. Primary forest cover accounted for 353,000 hectares in 2005, while plantation cover amounted to 160,000 hectares. The total forest area (including both conserved area and degraded section) as well as plantation cover amounted to 5,357,000 hectares in 2005. The impact of deforestation is widespread, affecting the livelihoods of local people, disrupting important environmental functions and severely disturbing the biological integrity of the original forest ecosystem. There is a serious concern in the region about climatic change, soil erosion and large-scale desertification (UNDP, 2003).

2.7.2.2. Poor Crop Yield

Crops require a certain amount of nutrients to give a good yield. Soil erosion washes away these nutrients exposing the infertile hard pan. Some of the plant nutrients are also destroyed by bush fires. This then affects crop yield. The worsening nature of the rainfall pattern also adversely affects plant growth and thus yield. Occasional short period droughts in the course of the rainy season wither crops and reduce productivity. Late starting and or early stopping of rains in some seasons greatly result in crop losses (Nsiah-Gyabaah, 1994).

2.7.2.3. Poor Livestock Production

The three northern regions are characterized by erratic and intermittent rainfall and poor soils. This therefore affects the quality of pasture and for that matter the quality of the livestock. In the dry

season, the situation is worse. There is very little or no green grass for animals. The dry grass and little green shrubs are also destroyed by bush fires. Many valley areas usually still possessed some green grass at the time the main land is completely dry. Unfortunately, the drying up of many streams and water courses deprive animals of green grass and water especially during the dry season. During this season, animals are lean and hungry looking. Some animals die of hunger and thirst and others get lost in search of feed and water (Nsiah-Gyabaah, 1994).

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2.8. Poverty-Environment Nexus

Many studies like (Cavendish, 2000) and (Rao, 1994), have established the link between poverty and environment by analyzing the dependence of rural households in developing countries on the natural resources – especially the common property or open access resources. Such studies have been done using data from India (Rao, 1994; Jodha, 2000; Narain, Gupta & Veld, 2005), Zimbabwe (Cavendish, 2000), Peru (Escobal & Aldana, 2003). Other studies have analyzed the effect poverty or income levels of rural households have on the resource management practices or environmental degradation in developing countries like Chile (Bahamondes, 2003), Peru (Swinton and Quiroz, 2003; Escobal & Aldana, 2003), Cambodia and Lao PDR (Dasgupta et al., 2003), Guatemala and Honduras (Nelson and Chomitz, 2004). Most of these studies have focused on forest as the measure of environment; a few studies have also analyzed various other aspects of environmental degradation like fragile soil, water quality, indoor and outdoor air pollution (Nelson and Chomitz, 2004).

The Ghana Poverty Reduction Strategy (GPRS 1) recognizes that there is a strong link between the natural resource and environmental conditions and poverty. The poverty situation in the Upper West Region of Ghana for instance, is partly attributable to the fragile natural environment of the area which is the result of insufficient protection in the past (Government of Ghana, 2002).

According to Mathews (1991), there are indeed intimate connections between environmental degradation and poverty. These connections run in both directions. That is, impoverished people generally have no other option but to overstress the environment, even when they are fully aware of the fearsome long term effects. By the same token, environmental decline creates poverty. The two problems are so deeply intertwined that successfully addressing one demands a simultaneous attack on the other (Mathews, 1991).

The connection between environmental degradation and poverty has also been noted by the EPA (2002). Poverty has been seen as the main underlying socio-economic cause of environmental degradation and combating this should therefore be directed at interventions for poverty reduction (EPA, 2002). Farming, particularly on subsistence basis is the main stay of Ghanaians, most especially the rural folk. Most farming practices, however involve the cutting of vegetation and burning. In many parts of the country, slash and burn as a practice in farm land preparation is common. This makes the land prone to erosion and loss of productive potential. In areas where the population density is very high especially in the Upper West Region, people are compelled to continuously cultivate the same parcel of land year in year out.

There is no doubt that population growth and poverty in the savannah area play a chief role in the rate and manner of environmental resource degradation in the Lambussie-Karni District. According to the Ghana Statistical Service, the three northern regions are within the savannah zone and in the recent past, have been experiencing increasing population. Between 1984 and 2000, the population of Northern Region more than doubled (56.3%). The population increase in the Upper East and Upper West Regions within the same period was 19.0% and 31.6 % respectively (Ghana Statistical Service, 2005). This

gives an average population rise of 32.3% in the entire northern savannah zone. This increase means an increase in the amount of land cleared for farming, wood fuel, construction works and other purposes.

In terms of poverty, the three northern-most regions are the poorest in the country according to the Ghana Living Standards Survey (GLSS, 2006). Also the Ghana Poverty Reduction Strategy had attested to this when it revealed that as at 1999, Upper East, Upper West and Northern Regions were the poorest regions in the country. In Upper East, 9 out of every 10 people were poor; 8 out of every 10 in Upper West and 7 out of every 10 in the Northern Region fell within the poverty class (Government of Ghana, 2002). A more recent report by IFAD still noted the Upper East, Upper West and the Northern Regions as the poorest in the country (IFAD, 2008).

The symptoms of poverty are apparently high in the area as well; there is high prevalence level of undernourishment, infant mortality and other consequences of deprivation. In this situation, inhabitants of the area have no option than to mercilessly exploit the available environmental resources for their livelihoods.

CHAPTER THREE

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METHODOLOGY

3.0. Introduction

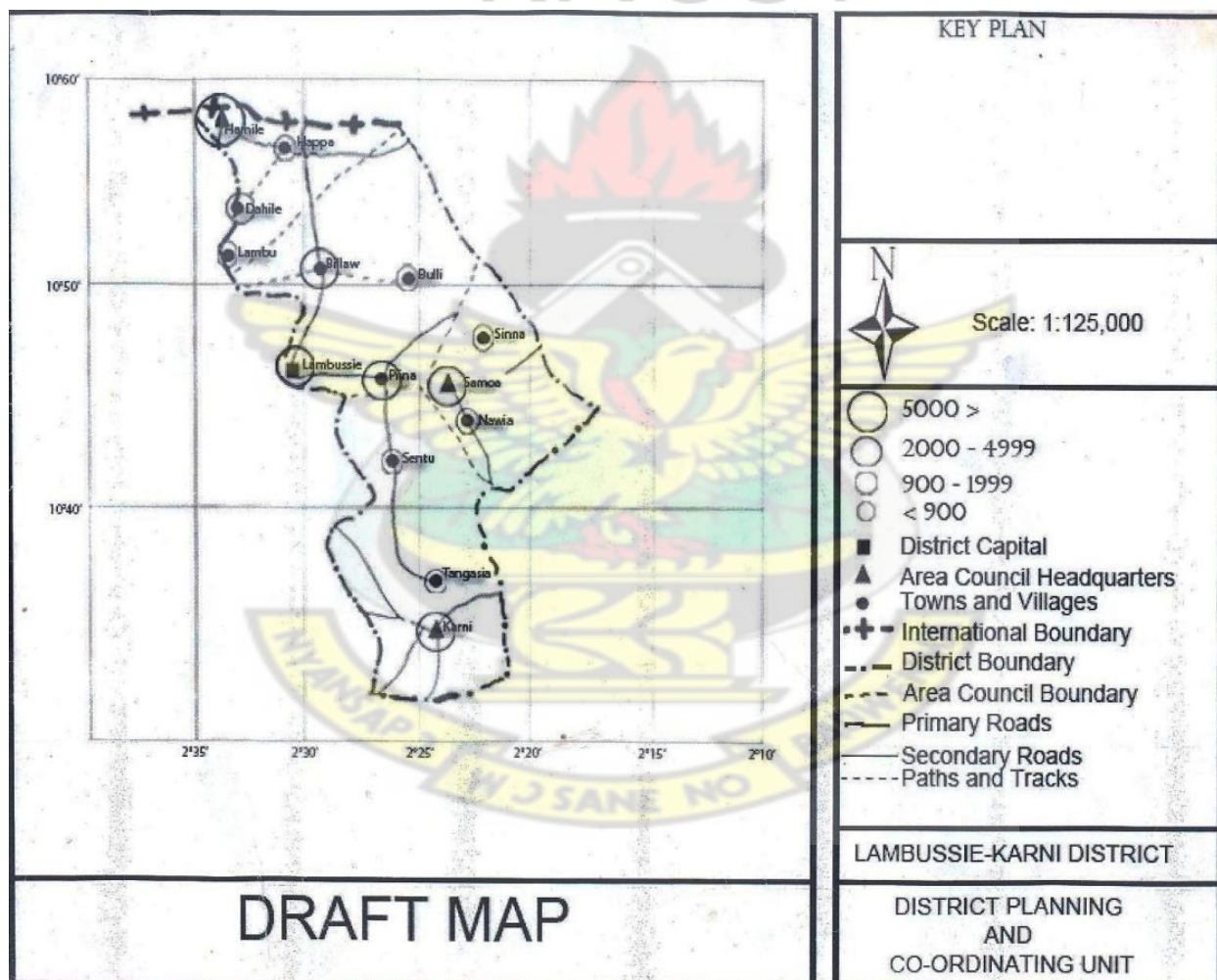
This section provides a description of Lambussie-Karni district in Ghana and the methodology used in carrying out the research work. The sources of data, both primary and secondary are all specified in this chapter. The sampling design, models and analysis are also discussed.

3.1. The Study Area (Lambussie- Karni District)

The Lambussie-Karni District is one of the nine Districts of the Upper West Region of Ghana. It lies in the north western corner of the Upper West Region in Ghana between Longitude 2°25 W and 2°45W and Latitude 10°20 and 11°00. It shares boundaries to the south with Jirapa District, to the east with Sissala West District, to the west with Lawra District and to the north with Burkina Faso (ghanadistricts.com). With a population of 43417 and a total area of 833.5 square kilometers, it translates into a population density of 58 of persons per square kilometer. This figure is almost double the regional density of 31.2 and therefore means that there is emerging pressure on land and other resources. About five percent (5%) of the people live in major towns of the District while a significant ninety-five percent (95%) live in rural settlements. The District is therefore considered as a rural district. The major tribes are the

Dagaabas and Sissala. However, at Hamile other minority tribes such as Moshi, Wangara, and Walla among others can be found. About eighty percent (80%) of the people are engaged in agriculture and other related activities. The major crops are millet, maize, cotton and groundnuts. Livestock farming is practiced throughout the district (ghanadistricts.com).

Figure 3.1: District map of Lambussie-Karni



Source: District Planning Office, 2010.

3.2. Data Needs for the study

The data that is needed for this study is obtained from primary and secondary sources. The primary data is needed in the chapter four which is the discussion and analysis while secondary data is needed in the review of the literature.

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3.3 Data Sources for the Study

Most of the data for the study came from primary sources. Primary data was collected through questionnaire survey that was administered face-to-face in the study area. Also secondary sources came from the publications of the World Bank, the Environmental Protection Agency International Fund for Agricultural Development (IFAD) and the Ghana Living Standards Survey of the Ghana Statistical Service.

3.3.1. Primary Data

The main data for the study was obtained from primary sources. A survey was conducted in the form of structured questionnaire administered in the district to elicit personal data, economic data, natural resource use and dependence, as well as willingness to pay values. The administration of the questionnaire was done by means of face-to-face interviews since other forms of interviews were difficult as a result of illiteracy. The Contingent Valuation Method was used to assess the willingness to pay for environmental deterioration since environmental resources do not attract market value. A number of formats have been used to elicit the value of environmental goods with the CVM technique. This study employed the open ended and iterative bidding format (Duan and Clark, 2000). The merit and

rational for choosing this format is that, it involves a straightforward estimation, and that the maximum willingness to pay is obtained. Contingent valuation is a survey technique that is primarily used to place monetary values on products and services for which market prices do not exist or are not reflective of the goods' actual social value (Swallow et. al., 1994). In this method, questionnaires are usually sent to the general public who benefit from the environment so as to ask directly how much they are willing to pay (WTP) for the improvement of the environment. CVM developed through gradual acceptance and use by the US government agencies (Hanley, 2000). The most relevant event in CVM development was the oil spill case pursued at the state of Alaska and the federal government in the US against Exxon (Bateman and Willis, 1999).

Direct Observation

By observing the environment, one can better appreciate the nature of the deterioration in the area caused by bushfires, wood exploitation. The use of this method was to get a quick visual impression of the nature of livelihood activities and their impact on the environment in the area.

3.3.2. Secondary Data

Secondary data were collected by reviewing literature on issues relating to the study from published, unpublished documents, books and theses; journals; news papers; and statutes. However data source for information on poverty in Ghana is the Ghana Living Standards Surveys (GLSS), which were conducted in 1987/88, 1988/89, 1991/92, 1998/99 and 2005/2006.

3.4 Data Collection Procedure

Data was collected in the Lambussie–Karni District to examine the poverty-degradation relationship. The primary data was collected by face-to-face field interviews, based on structured questionnaires, conducted in six selected communities in the district. The survey instrument was evaluated for face validity and pilot tested before use.

3.4.1 Sampling

According to Singh and Chaudhary (1986), the simplest and most common methods of sampling are the simple random sampling and multi-stage sampling. The first stage of sampling was the choosing of the district. The Lambussie-Karni District was chosen as the study area for this study because it is located in the guinea savannah belt characterized by low rainfall and high population densities. The heterogeneous collection of trees provides all domestic requirements for fuel wood and charcoal. The shorter shrub and grass provides fodder for livestock. Also the Lambussie-Karni District is entirely a rural district. A rural community as defined by the Ghana Statistical Service (2005) is one that has a population of less than 5000 people. By this standard the Lambussie-Karni District is entirely rural because all the communities have an estimated population of less than 5000. The major economic activity in the area is subsistence farming.

In the second stage of sampling, the communities to be considered for the study were selected. In all six communities were selected based on the ethnic groups living in the district. These communities are selected because they are some of the electoral areas in the district. Also these communities represent the two major ethnic groups in the district, the Dagaabas and the Sisaalas. Communities such as Cheboggo and Tapumu are located in the northern part of the district and inhabited by the Dagaabas while communities like Billow and Lambussie are occupied by the Sisaalas in the middle and southern part of the district. The rest of the communities selected are a mixture of both ethnic groups. Respondents were drawn as shown in the table 3.1 below.

Table 3.1: Survey of Communities Interviewed.

communities	Number of households interviewed
Lambussie	16
Piina	23
Cheboggo	32
Tapumu	14
Karni	20
Billow	5
Total	120

Source: Field Survey, March, 2010

The simple random sampling method was used to select respondents from the selected communities where each household had equal chance of being selected for the interview. The random selection was based on the estimated number of households in each community. A random selection of every third household was made. The respondents were selected from the communities in the district to help gather accurate and relevant information on the issue. The respondents were mostly heads of households. In the case that respondents could not communicate as a result of language barrier, close relatives were asked to respond on their behalf. A total of 120 respondents were interviewed.

3.4.2 Sample Size

A sample size of one hundred and twenty (120) respondents was drawn from the target population of six thousand, five hundred (6500) households who are users of environmental resources in the Lambussie-Karni District. In all, respondents each had an equal chance of being interviewed in each community. There are enough similarities in terms of levels of income, uses of fuel and educational levels among the elements in the population in the Lambussie-Karni District that a sample of the hundred and twenty (120) adequately represents the characteristics of the population.

3.4.3 Survey Instruments

The study made use of face to face self-administered questionnaire since other instruments such as the mail shot and telephone interviews were difficult as a result of illiteracy of residents. The questionnaires were administered to residents in the six selected communities in the Lambussie-Karni district. The questionnaires administered were divided into three parts as follows:

1. Socio-economic factors- namely age, gender, marital status education, household size etc.
2. Economic livelihoods: these included the primary occupation, employment status, income levels, ability to cater for basic household needs etc.
3. The state of the quality of the environment: This gathers information on the impact of households' livelihood activities on the environment and the extent of environmental degradation in the district in the areas of fuel wood harvesting and bush burning.

3.4.4 Pilot Study

The researcher undertook a pilot survey of 10 questionnaires in two of the selected communities. This was done to enable the researcher explore issues that was important to the intent of the study but might not have been included. This was done to avoid biasness and preconditioned thought about the study. The questionnaires were modified as initial problems were identified before the actual survey took place. This pilot survey proved to be useful as it exposed the researcher to pertinent issues which were not included initially.

3.5 Data Analysis

The poverty-environmental degradation nexus was analyzed by examining spatial relations between poverty at Lambussie-Karni District with environmental degradation to establish any existing linkage. The analysis was in two parts; descriptive and regression. In the descriptive part, characteristics of the study sample were described, and then frequency distributions were used to highlight the socio-economic characteristics of respondents and impacts of respondent's activities on the environment. Primary data obtained from the field was edited, all corrections made and coded. After which it was fed into the Statistical Package for Social Sciences (SPSS) version fifteen (15) for processing the primary data. In analyzing the data, frequency tables, bar chart, and regression analysis were used as analytical

techniques. Moreover, cross-tabulation was employed to analyze the relationships between income levels and food consumption, type of fuel used for cooking, lighting and heating.

3.6. Econometric Model Specification

To estimate the relative impacts of income level on the quality of environment and also relative impact of environment quality on income level, the study adopts the model of Alvarez and Glasgow (1999) the non-recursive two- stage linear regression model specified as follows;

$$SF = \beta_0 + \beta_1 INC + \beta_2 EDU + \beta_3 FAM + \beta_4 OCCUP + \beta_5 BUSH + \beta_6 UP + \beta_7 PNM + \beta_8 WTP + \varepsilon \dots\dots 1$$

$$INC = \alpha_0 + \alpha_1 SF + \alpha_2 EDU + \alpha_3 FAM + \alpha_4 OCCUP + \alpha_5 BUSH + \alpha_6 UP + \alpha_7 PNM + \alpha_8 WTP + \varepsilon \dots\dots 2$$

Where *SF* denotes environmental degradation was proxied by households' sources of fuel wood. *INC* as an index of poverty was proxied by households' monthly incomes. *EDU* denotes level of educational attainment while *FAM* denotes household size and *OCCUP* represents occupation of respondents. Also *BUSH* denotes bush burning, *UP* for usage pattern of fuel wood and *PNM* for percentage of needs met and *WTP* for willingness to pay. Income levels have an inverse relation with poverty. When households incomes increase it leads to an increase in consumption and therefore a decline in consumption poverty. Also the relationship between poverty and environmental degradation is positive. Higher poverty levels of households cause them to depend more on the environment in the areas of farming and fuelwood harvesting for their livelihoods. This causes the environment to degrade more and vice versa. The coefficient of estimation is expected to be positive. Also the relationship between occupation on one

hand and poverty and environmental degradation on the other is positive. Also educational attainment, sources and uses of fuel wood on one hand and environmental degradation have an inverse relationship. A higher educational level means a high demand for a more quality environment because educated members have full knowledge about the dangers and effects of a degraded environment. Therefore the sign of the beta is expected to be negative.

In the second model, the relationship between environmental degradation and poverty is expected to be positive. Severely degraded environment causes low yields for farmers and as a result perpetuates more poverty. The regression coefficient is expected to be positive. Also educational attainment and poverty have an inverse relationship. Higher educational level implies high income levels and therefore households' heads are in the capacity to cater for the basic needs of its members. Therefore the sign of the beta is expected to be negative. Household size and poverty are positively related in the case where majority of the members are illiterates and also the dependency ratio is high. Also ϵ denotes the stochastic term and α, β denote the parameters to be estimated.

3.7. Variables Definition

In this study a range of variables are analyzed that aims at better expressing the poverty and environmental situation in the LKD. These include average monthly income, level of education, household size, bush burning, sources and uses of fuel wood, occupation and willingness to pay.

Income (Y)

One of the most frequent and conventional method of measuring the economic status of people is their incomes. The effect of income on poverty and environmental degradation is expected to be negative. It is measured as the total monthly income of the household. When households monthly income increases, rural poverty and environmental degradation are expected to decrease as dependence on forest resources is reduced and therefore the relationship is inverse. Average monthly incomes of respondents were coded as >GH50 for those whose incomes fall below 50 Ghana Cedis, GH76 for those whose incomes were between GH50 - GH100, GH201 for the range of GH101 -GH300, GH401 for the range of GH301-GH500 and GH500 for those whose incomes were above GH500.

Willingness to Pay (WTP)

It is known that majority of the population especially in the rural areas depend heavily on firewood and charcoal for their energy needs. It is expected that as they increase their consumption of firewood by cutting the forest, environmental degradation would increase. In some cases, poor households themselves may be the cause of environmental degradation. As a result respondents were asked how much they were willing to pay for the damage that they have caused to the environment. The responses are used as a proxy for the rate of degradation in the econometric analysis.

Household size (FAM)

Average household size is a socioeconomic variable that can affect poverty as larger household size is expected to increase the severity of poverty. This argument is based on the evidence of

positive correlation between larger family size and high dependency ratio (i.e. larger family sizes

indicate larger proportion of household members are children and elderly who are dependent on the minority of the working age members.

Education of Respondent (EDUC)

It is expected that, the higher the educational attainment of the household head or a respondent, all things being equal the greater the value he will place on environmental issues. Education is expected to expose a person to a lot of environmental issues particularly, the dwindling of nature's resources and its implications. In effect, the educational attainment of the household heads and other respondents interviewed should have a negative correlation on the quality of the environment. Educational attainment here refers to formal education and it is measured in number of years where: 0; no formal education, 1; primary school 2; middle school/JHS, 3; senior high school/technical/ vocational and 4; tertiary.

Main Occupation of Household Head (OCC)

The main occupation of the household head was coded as 1 if respondent is a farmer; 2 if an artisan and 3 if a public/civil servant. The a priori sign may be positive if majority of respondents are artisans or public servants however farmers are most likely to degrade the environment more than other users of the environmental resources since their livelihood activities have a direct bearing on the environment.

Bush burning (BUSH)

Bush fires are another devastating phenomenon that destroy vegetation and degrade the environment. Bush fires have also been noted as the main cause of acute scarcity of firewood in many parts of northern Ghana. At the beginning of the dry season, herders often start fires to stimulate the growth of young shoots. According to livestock farmers, the re-growth or young offshoots are more palatable and contain more nutrients. The a priori expectation is that bush burning has a negative effect on environmental degradation and poverty. Therefore the reasons for bush burning were coded as 1 for easy hunting, 2 for charcoal production and 3 for fresh grass to feed livestock.

Uses of fuel wood (UFW)

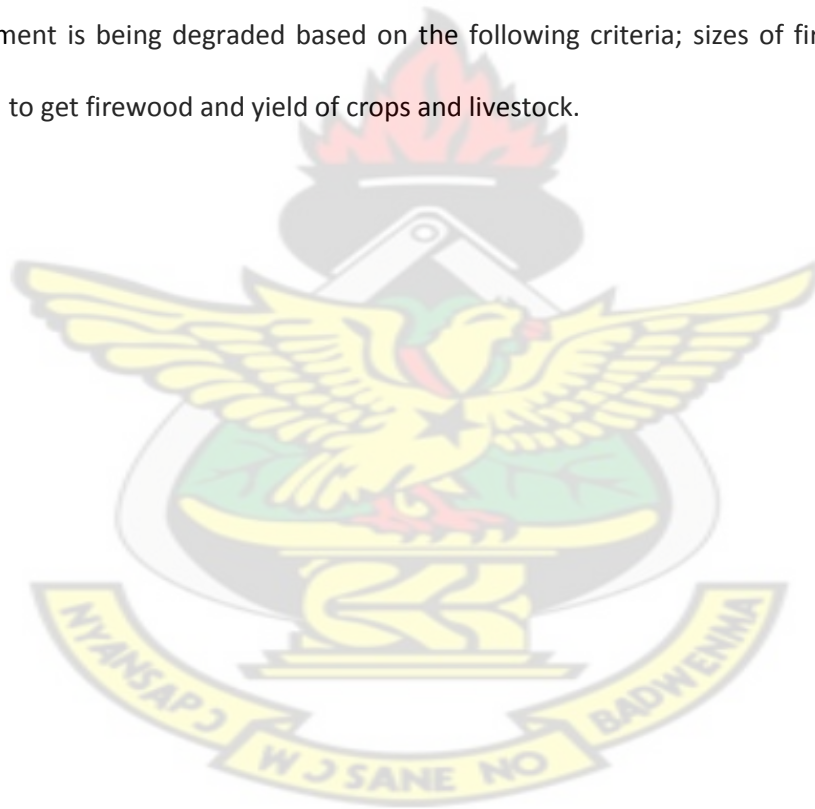
According to the Environmental Protection Agency (2002) majority of the population especially in the rural areas depend heavily on firewood and charcoal for their energy needs. As people fell trees for firewood and charcoal production, the environment is made bare. This is one human livelihood activities that greatly causes environmental degradation. Fuel wood is harvested for domestic purposes such as cooking, lighting and heating. Hence the various uses to which fuel wood are being coded as 1 for cooking, 2 for lighting and 3 for heating. The various uses have a negative impact on the environment and poverty as well.

Fuel Sources (FS)

According to the Ghana Living Standards Survey (2006) the main sources of lighting for households are kerosene and electricity (both at 49%). Kerosene is the main light source for households in rural areas (72%). More than half of households (54%) use wood as the main cooking fuel. Charcoal ranks second

(31%). In the rural areas, about four fifths of households use wood while 14% use charcoal. A larger proportion of urban households (20%) use gas for cooking than rural households (9.5%). Therefore the sources of fuel were coded as 1 for firewood, 2 for charcoal, 3 for kerosene, 4 for electricity and 5 for LPG. The a priori expectation is suppose to be negative where more households use more firewood and charcoal.

On the extent of environmental degradation in the district, respondents were asked their impression on how the environment is being degraded based on the following criteria; sizes of firewood harvested, distance travelled to get firewood and yield of crops and livestock.



CHAPTER FOUR

ANALYSIS AND DISCUSSION OF EMPIRICAL RESULTS

4.0 INTRODUCTION

This chapter deals with the analysis and discussion of findings. The analysis was based on self-reported data by respondents, who were all residents of six selected communities in Lambussie-Karni District. A total of 120 respondents were interviewed. This chapter is moreover divided into two main sub headings: descriptive and econometric analyses.

4.1. DESCRIPTIVE ANALYSIS

4.1. 1. Socio-economic Characteristics of Respondents

As shown in the methodology of this study, the socio- economic characteristics of the respondents in the Lambussie-Karni District were considered under: gender, age, marital status and educational level.


Out of the 120 respondents interviewed, 82 representing 68.3 % of respondents were males. The remaining 38 respondents forming 31.7% were all females. With regards to age of respondents, the minimum age and the maximum age captured by the survey were 18years and 65years respectively with the mean age of 42.607. Kalirajan and Shand have found that age has a positive effect on productivity (Kalirajan and Shand 1985, Stefanus and Sexena 1998) since age has a direct bearing on the availability

and mobility of agricultural workers, the ease with which improved practices are adopted, and the size of farm area cultivated by the households at any given time. On marital status, most of the respondents were married, they were 83 representing 69.2%, 20 constituting 16.7% were single. The remaining were widowed/widower (17 representing 14.2%).

A larger proportion of the respondents interviewed had no education and this constituted 46.7% of the total respondents followed by those with S.S.S/technical/ vocational education (15.8%), primary education (12.5%) middle/ J.S.S (10.8%) and tertiary education (14.2%). Education could help rural households manage their environment far better than those without education, and this could have a toll on their livelihoods. The low educational levels in Lambussie-Karni District may account for the predominance of farming as the primary occupation. Educational status and household income also have a strong correlation. The implication is that educated members of the households earn relatively higher incomes than those members that are not educated.

On the size of households, the minimum and maximum size of household was 2 and 25 respectively with mean household size of 9.2333. According to the 2000 population and Housing Census classification, the Lambussie-Karni District had a mean household size of 7.1 members (GLSS IV). This therefore means that the Lambussie-Karni District has very large households. The socio-economic characteristics of respondents in the survey are presented in Table 4.1.

Table 4. 1: Socio- Economic Characteristics of Respondents

Factors	Sample size (N= 120)	percent
		

Gender:

Males	82	68.3
-------	----	------

Females	38	31.7
---------	----	------

Age:

minimum	18
---------	----

maximum	65
---------	----

mean age	42.607
----------	--------

Marital status:

Single	20	16.7
--------	----	------

Married	83	69.2
---------	----	------

Widowed/ Widower	17	14.2
------------------	----	------

Educational level:

No education	56	46.7
--------------	----	------

Primary education	15	12.5
-------------------	----	------

Middle J.S.S	13	10.8
--------------	----	------

S.S.S/Tech./ Voc.	19	15.8
-------------------	----	------

Tertiary	17	14.2
----------	----	------

Household size:

Minimum	2
Maximum	25
Mean	9.2333

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Source: Field Survey, March 2010

4.1.2 Economic Livelihoods of Respondents

This section seeks to find out the primary occupations, employment status and income levels of respondents in the district. The poverty condition has been defined on a broad concept as a phenomenon of multiple dimensions with economic, cultural and social aspects and it is characterized by: (a) insufficient income; (b) limited access of basic needs and (c) social exclusion and discrimination due the ethnic or gender origin (Quijandría et al., 2000).

4.1.2.1 Primary Occupation of Respondents

It is often assumed that the poor, with their concomitant low levels of formal education, do not have the requisite technical knowledge for efficient environmental management. The profession of the respondents, to a large extent, would determine the amount of natural resources that they would require for their livelihood. For example, farmers would require more natural resources for their activities than a salaried worker who might only require these resources for constructional purposes.

From table 4.2 and figure 1, out of 120 respondents interviewed, 88 forming 73.3% of the respondents were farmers while the remaining respondents were traders (2.5%), teachers (14.2%), nurses (0.8%) and others comprising carpenters, electricians and masons constituted 9.2%. Farming, teaching, nursing and others were dominated by males with 67.0%, 70.6%, 100% and 81.8% respectively. However, trading activity is dominated by females with 66.7%. Farming, especially crop production in the area, is rain fed and as such most of the farmers idle in the dry season. This is shown in the cross tabulation of primary occupation and gender in Table 4.2. Figure 4.1 also shows the distribution of respondents into various occupations in bar chart form.

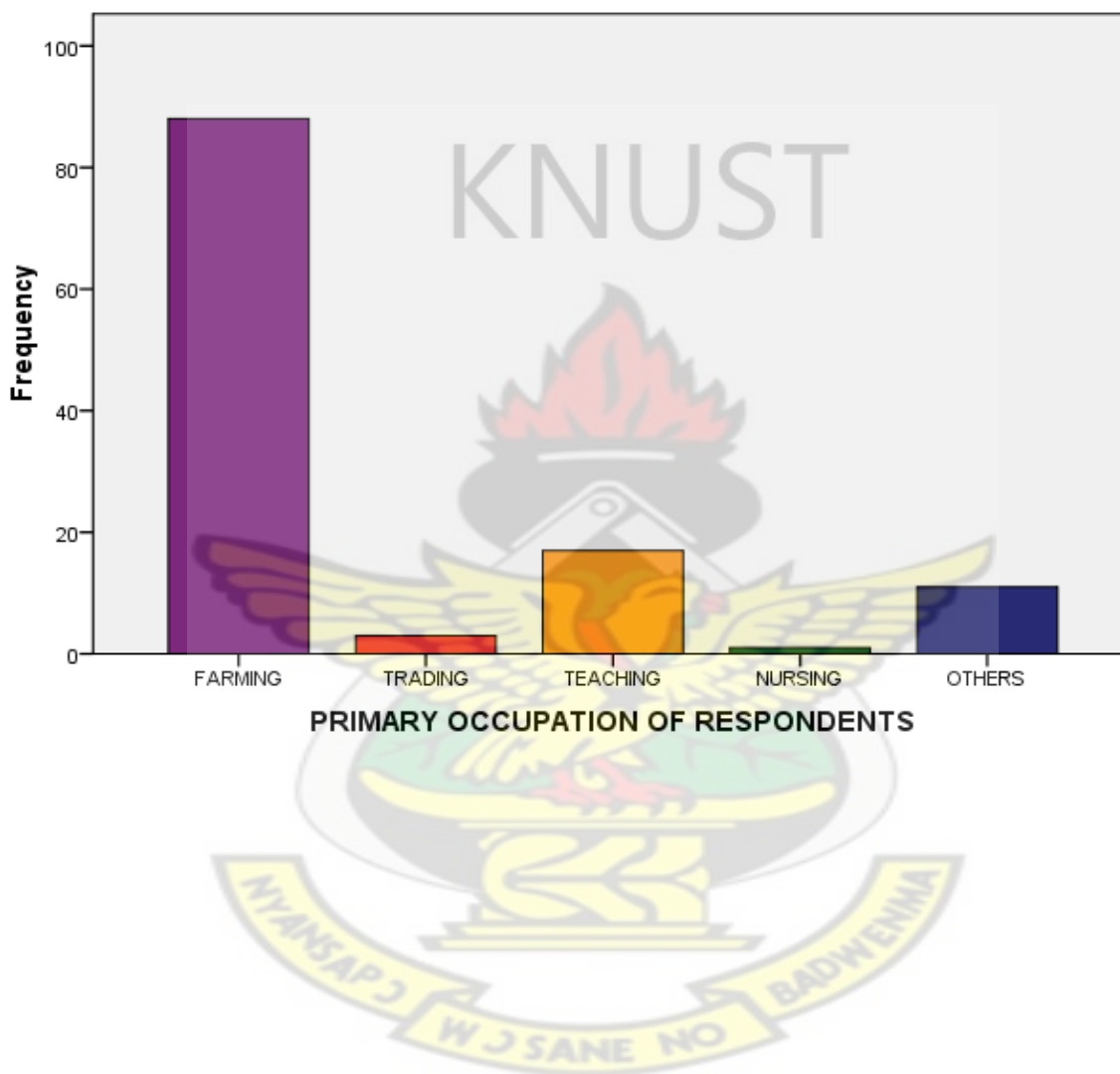
Table 4.2: Primary Occupation and Gender of Respondents

		GENDER OF RESPONDENTS		Total
		MALE	FEMALE	
PRIMARY OCCUPATION OF RESPONDENTS	FARMING	59	29	88
		67.0%	33.0%	100.0%
	TRADING	1	2	3
		33.3%	66.7%	100.0%
	TEACHING	12	5	17
		70.6%	29.4%	100.0%
	NURSING	1	0	1
		100.0%	.0%	100.0%
	OTHERS	9	2	11
		81.8%	18.2%	100.0%
Total		82	38	120
		68.3%	31.7%	100.0%

Source: Field Survey March, 2010

From the table, majority of both males and females have their occupation as farming. These are people who engage in subsistence farming primarily for household consumption. Small scale farming does not bring any significant income to the family. Also the quality of the environment is affected significantly since subsistence type of farming involves the slash and burn method with indiscriminate tree cutting.

Figure 4.1: Bar chart Showing Primary Occupation of Respondents



4.1.2.2 Employment Status of Respondents

Being a farming district, the need for more hands on the farm could be a contributory factor to the generally large households in the area. The major economic activity of the people, i.e. agriculture, in addition to wood harvesting activities have some effects on the environment and consequently on the economic lives of the people.

From table 4.3 and figure 4.2, the unpaid family workers dominated in the district with 47.5%, followed by self employed (25.0%), paid employees (20.8%), employers (3.3%) and not employed (3.3%). Majority of females (21 out of 38 female respondents, constituting 55.3%) were unpaid family workers while only 43.9% of males were unpaid family workers. The majority of males (52.4%) were paid employees, employers and self-employed with only 39.5% of females as paid employees, employers and self-employed. This is shown in cross tabulation in table 4.3.

Table 4.3: Employment Status and Gender of Respondents

		GENDER OF RESPONDENTS		Total
		MALE	FEMALE	
EMPLOYMENT STATUS OF RESPONDENTS	PAID EMPLOYEE	20	5	25
		80.0%	20.0%	100.0%
	EMPLOYER	3	1	4
		75.0%	25.0%	100.0%
	SELF-EMPLOYED	20	10	30
		66.7%	33.3%	100.0%
	UNPAID FAMILY WORKER	36	21	57

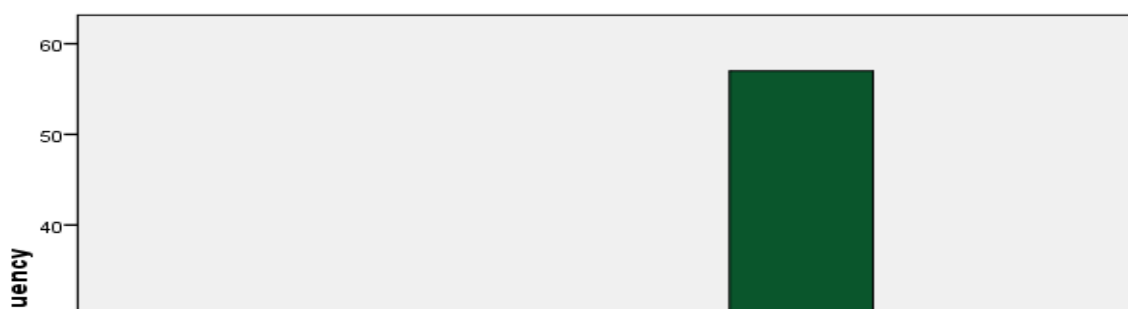
	63.2%	36.8%	100.0%
NOT EMPLOYED	3	1	4
	75.0%	25.0%	100.0%
Total	82	38	120
	68.3%	31.7%	100.0%

Source: Field Survey March, 2010

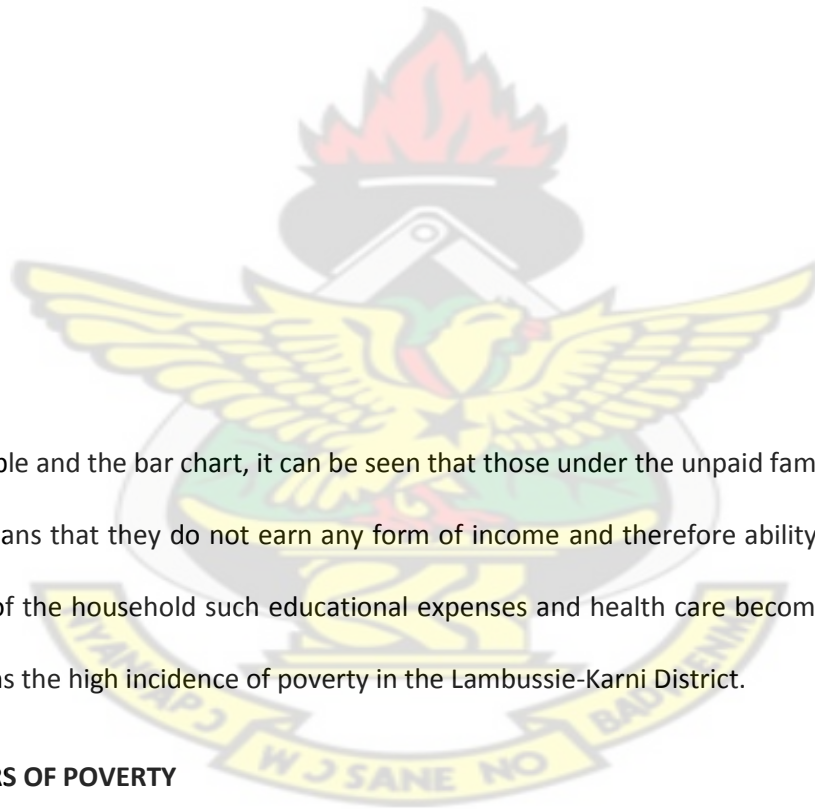
From the table, majority of both males and females workers fall under the unpaid family worker column. These are people who engage in subsistence farming primarily for household consumption. Also those under the self-employed column are small scale artisans such as carpenters, masons, craftsmen and pito brewers who do not earn much income and therefore their inability to take care of their families.

Moreover, the frequency distribution of respondents into various employment status is pictorially shown in figure 4.2.

Figure 4.2: Bar chart Showing Distribution of Employment Status of Respondents



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From both the table and the bar chart, it can be seen that those under the unpaid family workers are the majority. This means that they do not earn any form of income and therefore ability to cater for other non food needs of the household such educational expenses and health care becomes a problem. This therefore confirms the high incidence of poverty in the Lambussie-Karni District.

4.1.3. INDICATORS OF POVERTY

4.1.3.1 Access of Basic Family Needs

The World Bank (1992) argued that poor families who have to meet short-term needs mine the natural capital by excessive cutting of trees for firewood and failure to replace soil nutrients. In this study, the percentage of household expenditure being met was used as a major component in the measure of household welfare. While consumption is the preferred measure of income (Deaton 1980), the research

expects that the difference between household income and consumption is relatively small since there is high dependence on own-collected and own-produced goods. Own-produced and own-collected products together made up a very significant percentage of household income in the Lambussie-Karni District according to the respondents.

In order to check the severity of poverty and how much rural households depend on the environment for their livelihood, there was the need to find out how well they are able to cater for their basic family needs such as food, health, clothes, shelter, education etc. In that regards, a large proportion of household heads that is 62 households (55%) said they are able to meet less than 10% of their household needs that is both financial and material needs. They tie these difficulties to the reduction in farm produce and general difficulties of the economy. That is they do not have any form of employment where they can derive some permanent income.

Also, 28 households (25%) acknowledge the fact that they do cater for between 10-49 percent of these needs. Only 1% of the total households interviewed were able to meet between 90-100 percent of their household requirements. It can therefore be said that the general over dependence on the natural resources, leading to poor soil nutrients, resulting in poor yields has a major impact on the condition of living of the people in the district, and for that matter, their livelihoods. Details of their responses are presented in the table 4.4 below.

Table 4.4. Ability to Cater For Basic Family Needs

Percentage of needs met	frequency	Percent
>10	79	65
10-49	28	23.3

50-89	12	10
90-100	1	0.8
Total	120	100

Source: Field Survey, March 2010

4.1.3.2. Income Levels of Respondents

Average monthly income from primary occupation was used as a proxy to represent respondent's income. The majority of respondents 29.7% had monthly income below GH¢50 with only 2.5% having average monthly income above GH¢500. Also, 37.5%, 17.6% and 13.7% had average monthly income of GH¢50-GH¢100, GH¢101-GH¢300 and GH¢301 - GH¢500 respectively. Also, 81.6% of females respondents earn GH¢100 and followed with only 18.4% earning above GH¢100 per month. With regards to males, 75.6% of them earn GH¢100 and below with remaining 24.4% earning above GH¢100 per month.

Table 4.5. Income Levels of Respondents

Income Brackets (Monthly Income)	Percentage
< 50	29.7%
50 -100	37.5%
101 -300	17.6%
301 -500	13.7%
> 500	2.5%

Source: Field Survey, March 2010

4.1.3.3 Food Consumption

Availability of food for household consumption or otherwise is an important factor to determine the number of people who fall below the consumption poverty line.

The respondents were asked the number of times their household members consume food within a day and the responses are summarized in the table 4.5 below.

Table 4.6: Number of Times Households are Fed in a Day

Food consumption	Sample size (N)	percent
Ones a day	88	73.3
Twice a day	21	17.5
Thrice a day	11	9.2

Source: Field Survey March, 2010

From table 4.6, 88 respondents forming 73.3% feed their families ones a day while 21 (constituting 17.5%) and 11 respondents (representing 9.2%) feed their families twice a day and thrice a day respectively. The cause of this could be that those household heads that can not provide the food needs of their members required for their wellbeing are subsistence farmers who form the majority. This could be as a result of the low income levels of majority of respondents and also a large proportion of these respondents under the unpaid and unemployed brackets.

To find out whether number of times households consume food in a day depends on income level, a chi-square test for independence was conducted and the result is represented in table 4.6.

The test in table 4.7 proves that number of times household consume food in a day is independent of income level.

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Table 4.7: Relating Income Levels to Food consumption

Food intake	income level					total	chi. Sq	p-value
	>50	50-100	101-300	301-500	>500			
Ones	60	16	9	2	1	88		
	68.2%	18.2%	10.2%	2.3%	1.1%	100.0%		
Twice	9	5	6	1	0	21	42.854%	0.000
	42.9%	23.8%	28.6%	4.8%	0.0%	100.0%		
Thrice	2	1	3	1	4	11		
	18.2%	9.1%	27.3%	9.1%	36.4%	100%		

From the table above, the chi-square which shows the independence or otherwise of income levels and food consumption. It shows that income level does not contribute significantly to the number of times households are fed in a day in the Lambussie-Karni District as the value of the chi-square is 42.9%. The consumption of own produced food account greatly to food intake in the district and therefore income levels do not contribute to food consumption.

4.2.1 State of the Environment in the Lambussie-Karni District

This section seeks to find out the impacts of the livelihood activities of the residents in the district on the environment. This moreover was done by finding out the kinds of fuel used for cooking, lighting and heating in the district and the extent of environmental degradation in the district.

4.2.1.1 Fuel used for Cooking, Lighting and Heating

There is a high expectation that rural households in the study site depend on natural resources to complement or supplement their earnings from farming activities. In the study area, households depend on a wide range of natural resources. These include a wide variety of food stuff such as edible fruits, vegetables, and oils; a large number of uses for wood, including fuelwood for domestic energy; other tree uses such as livestock fodder and medicinal plants.

The demands for fuelwood are for cooking, lighting and heating. Some economic factors that influence households demand for fuelwood include price and availability of substitutes. The demand for fuelwood is influenced by its price relative to the price of substitute fuels, such as, kerosene, cooking gas, and

electricity. Household income levels determine the type of fuel to be used in cooking. As a result, reliance on fuelwood therefore continues to be very high. Fuelwood's relatively low price encourages its use compared to other fuel substitutes.

On fuel usage for cooking, out of the 120 respondents, 96 representing 80.0% used firewood for cooking while 19.2% and 0.8% used charcoal and LPG respectively for cooking. The major reasons accounting for these are non-affordability of other sources.

With regards to lighting, 20.0% of the respondents used firewood for lighting, charcoal for lighting (0.00%), kerosene for lighting (67.5%) and electricity for lighting (13.3%).

Also on heating, 76.7% of the respondents used firewood for heating, charcoal for heating (20.0%), LPG for heating (1.7%) and electricity for heating (1.7%). The table 4.7 below gives the frequency and percentage distribution of usage of fuel for cooking, lighting and heating.

Table 4.8: Sources and Uses of Fuel in the Lambussie-Karni District

Fuel	Sample size(N)	percentage
Cooking :		

Firewood	96	80.0
Charcoal	23	19.2
LPG	1	0.8
Lighting :		
Firewood	24	20.0
Charcoal	5	4.2
Kerosene	75	62.5
Electricity	16	13.3
Heating:		
firewood	92	76.7
charcoal	24	20.0
electricity	2	1.7
LPG	2	1.7

Source: Field Survey March, 2010

4.2.1.2 Income Levels and Sources of Fuel for Cooking, Lighting and Heating

This section seeks to find out whether level of income of respondents is associated with the sources of fuel for cooking, lighting and heating. The result below indicates that the type of fuel used for cooking,

lighting and heating in the district does not strongly depend on level of income. Those who have higher income are less willing to use firewood or charcoal for cooking, lighting and heating. The result are shown in tables 4.9, 4.10.and 4.11 below.

Table 4.9: Income Levels and Sources of Fuel for Cooking in the Lambussie-Karni District

Income level (GH ¢)	Sources of fuel					total	chi-sq	p- value
	Firewood	charcoal	kerosene	LPG	Electricity			
> 50	64	7	0	0	0	71		
	90.10	9.90	0.00	0.00	0.00	100		
50-100	18	4	0	0	0	22		
	81.80	18.20	0.00	0.00	0.00	100	40.63	0.000
101-300	11	7	0	0	0	18		
	61.10	38.90	0.00	0.00	0.00	100		
301-500	2	2	0	0	0	4		
	50.00	50.00	0.00	0.00	0.00	100		
< 500	1	3	0	1	0	5		
	20.00	60.00	0.00	20.00	0.00	100		

Source: Field Survey March, 2010.

From the table above it can be seen that over 90% of respondents who earn income below 50 Ghana Cedis resort to the use of firewood for cooking. This is as a result of the non availability other sources of fuel in most of the communities in the district. There are no LPG stations and electricity in the district. This accounts for the over dependence of households on firewood for cooking.

Table 4.10: Income Levels and Sources of Fuel for Lighting in the Lambussie-Karni District

income level (GH ¢)	sources of fuel					total	chi-square	p-value
	Firewood	charcoal	kerosene	LPG	Electricity			
> 50	18	0	48	0	0	66		
	25.40	0.00	74.60	0.00	0.00	100		
50-100	3	0	17	0	2	22	53.193	0.000
	16.70	0.00	38.90	0.00	9.10	100		
101-300	3	0	7	0	8	18		
	16.70	0.00	38.90	0.00	44.40	100		
301-500	0	0	1	0	3	4		
	0.00	0.00	25	0.00	75	100		
< 500	0	0	2	0	3	5		
	0.00	0.00	40	0.00	60	100		

Source: Field Survey March, 2010.

From the table above it can be seen that over 60% of respondents who earn income below 50 Ghana Cedis resort to the use of kerosene for lighting. This is as a result of the non availability other sources of fuel in most of the communities in the district. Those who earn higher incomes stay in the towns and therefore have access to electricity. There is no electricity in most communities in the district. The chi-square value (53.193%) also show that income contributes less significantly to the source of fuel that households use since kerosene is not obtained from the environment.

Table 4.11: Income Levels and Sources of Fuel for Heating in the Lambussie-Karni District

income level (GH¢)	sources of fuel					total	chi-sq	p-value
	Firewood	charcoal	kerosene	LPG	Electricity			
> 50	61	9	0	0	1	71		
	85.90	12.70	0.00	0.00	1.40	100		
50-100	18	4	0	0	0	22		
	81.80	18.20	0.00	0.00	0.00	100		
101-300	10	7	0	1	0	18		
	55.60	38.90	0.00	5.60	0.00	100	40.76	0.000
301-500	2	1	0	0	1	4		
	50	25	0.00	0.00	25	100		

< 500	1	3	0	1	0	5		
	20	60	0.00	20	0.00	100		

Source: Field Survey March, 2010.

From the table above it can be seen that over 85% of respondents who earn income below 50 Ghana Cedis resort to the use of firewood for heating. This is as a result of the non availability other sources of fuel wood in most of the communities in the district. There are no LPG stations and electricity in the district. This accounts for the over dependence of households on firewood for heating. The chi-square value (40.76%) also show that income does not contributes significantly to the source of fuel that households use.

Fuel wood dependency also has important implications for labor allocation and household welfare. The rural poor must either find low-cost fuel or do without. Those who collect fuel wood must walk ever farther in search of new supplies. The task of gathering fuel wood is predominately done by women. In the survey the households were asked the reason for their choice of the source of fuel, 88% responded they could not afford other sources of fuel because they are expensive to them. The rest based their choices on non-availability of other sources of fuel such as LPG and electricity as the LKD is rural most social amenities are lacking. They therefore rely on the environment for their livelihood.

4.2.1.3 Bush Burning

Bush fires have become a seasonal phenomenon in the Lambussie-Karni District. It occurs between October and March. The phenomenon may be regarded as an environmental problem, but more of a

cause of environmental problems in the district. Deforestation and biodiversity depletion, soil erosion, and their multiplier effects are attributable to bush fires. By December/January, vast expanses of land are already left with roasted trees and black ashes.

Bush fires are caused mainly by human activities including farming, hunting, grazing, wood harvesting and charcoal production Nsiah-Gyabaah (1994).

Out of the total respondents who confessed they burn the bush for various reasons, 45.8% of households said that they specifically burn the bush to regenerate fresh grasses to feed their livestock while 17.5% of households burn the bush for easy hunting. The most accused group of people as the chief cause of bush fires is hunters, followed by cattle herdsman. Hunting activity has become a kind of a sport or customary activity in some areas in the district. This activity sometimes makes use of fire to catch game. In some cases these fires get out of control and destroy large expanses of land. However 36.7% households engage in bush burning for charcoal production.

4.2.1.4 Wood Harvesting

Another factor that causes a decline in environmental quality and therefore has a great effect on the livelihood of the people in the area is wood harvesting for various uses – construction, charcoal, firewood, gardening etc. Wood is the major source of fuel in the District. Every responsible woman/mother/wife thus has a store of fuel wood for domestic purposes. It is not impossible to tell the number of women or mothers who live in a house by counting the piles or stores of fuel wood placed a few meters away from the house. Most of these piles of wood are cut green and left to dry. Fuel wood

harvesting is an exercise in many places which is done in groups of women and or girls just as hunting for men and boys.

The respondents were asked whether they cut trees or wood or burn bush for any economic activity. It was revealed that out of the 120 respondents interviewed, 23.4% of the respondents said they cut trees for charcoal, 55.8% cut trees or burn bush for farming activities while the remaining 20.8% said they do not engaged in tree cutting or bush burning in the district. However, only 19.2% of those who cut trees replant trees in the forest to replant those cut. The table 4.11 gives details of this information.

Table 4.12: Uses of forest for economic livelihoods in the Lambussie-Karni District

forest use	Sample size (N)	percent
Cut trees for charcoal	25	23.5
For farming purposes	62	41.8
Fresh grass to feed livestock	44	36.7

Source: Field Survey March, 2010

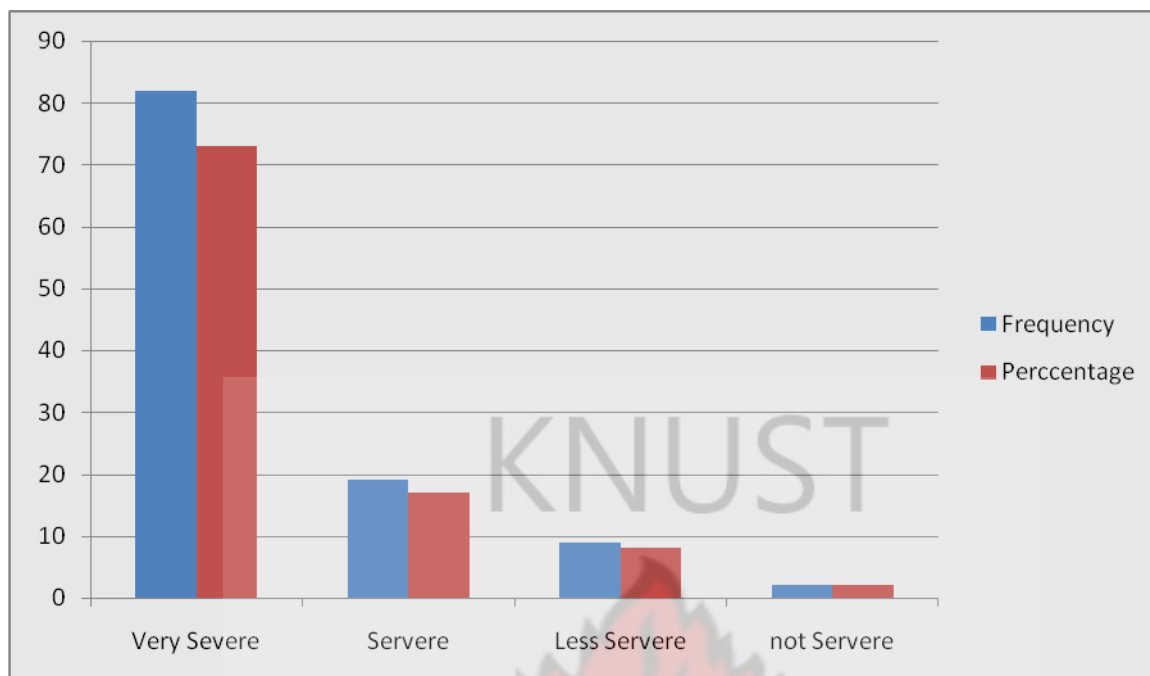
From the results presented on the table above, it can be seen that those who burn the bush or clear trees for farming purposes form the majority. This further goes to confirm the fact that majority of the respondents who are farmers have to depend on the land for their livelihood activities such as farming.

On the issue of where they obtain their major sources of fuel, that is firewood, 98% of the respondents said they usually obtain them from the bush. Only a hand full of 2% said they usually buy firewood from women and girls who cut for sale mostly during the dry season at a very low price. Also those people are salaried workers may either for lack of time or convenience resort to buying. When those who harvest firewood for sale were asked how the firewood is harvested, all the respondents confessed that they use the cutlass for harvesting green as well as dry wood. They were quick to add that they could not afford other harvesting tools such as the chainsaw.

4.2.1.5 Extent of Environmental Degradation.

A very large proportion of 84% respondents said they used to get abundant firewood and other wood products for various household uses such as cooking, lighting and building materials which they no longer get in greater quantities. They complained that the sizes of the wood have also been reduced drastically. In harvesting dry wood, fire is sometimes used to bring down dry trees to facilitate collection. When respondents were asked to assess the quality of the environment, they responded as seen below. The very severe environmental degradation was the highest and accounted for 74.2%. The remaining were severe (18.3%), less severe (5.0%) and not severe (2.5). This therefore suggests that the quality of the environment in the district is very severely degraded. The figure below shows the extent of environmental degradation in the district.

Figure 4.3. Extent of Environmental Degradation in the Lambussie-Karni District



Source: Field Survey, March 2010

From the figure above it can be seen that the quality of the environment has declined dramatically. This could be as a result of the occupation of most households' heads which is farming and sources and uses of fuel that households depend on for their livelihoods. Over 90% of households use firewood for cooking and heating. The result is over exploitation of the resources. Also re-forestation does not take place. Therefore extent of environmental degradation in the LKD is very severe based on the views sampled on households in the district.

To ensure sustainable rural environmental sustainability and poverty reduction, the knowledge or awareness of the stakeholders (environmental resources users) about the effect of their practices on the environment is key. When people are aware of the environmental consequences of their activities and that these consequences in turn affect their economic life, they are in a better position to finding solutions to the problems.

4.3 REGRESSION ANALYSIS RESULTS

Regression analyses were conducted using two equations on the relationship between poverty and environmental degradation and the results are presented below.

4.3.1 Model one (impact of environmental degradation on poverty)

The ordinary least squares (OLS) model results is presented in table 4.12. The estimates of the coefficients that provide the best fit between the data and the assumed theoretical model. Variables were included on the basis of a priori logic in economic theory and common sense but the model reports are considered for only those variables which are significant at 5% statistical significance level.

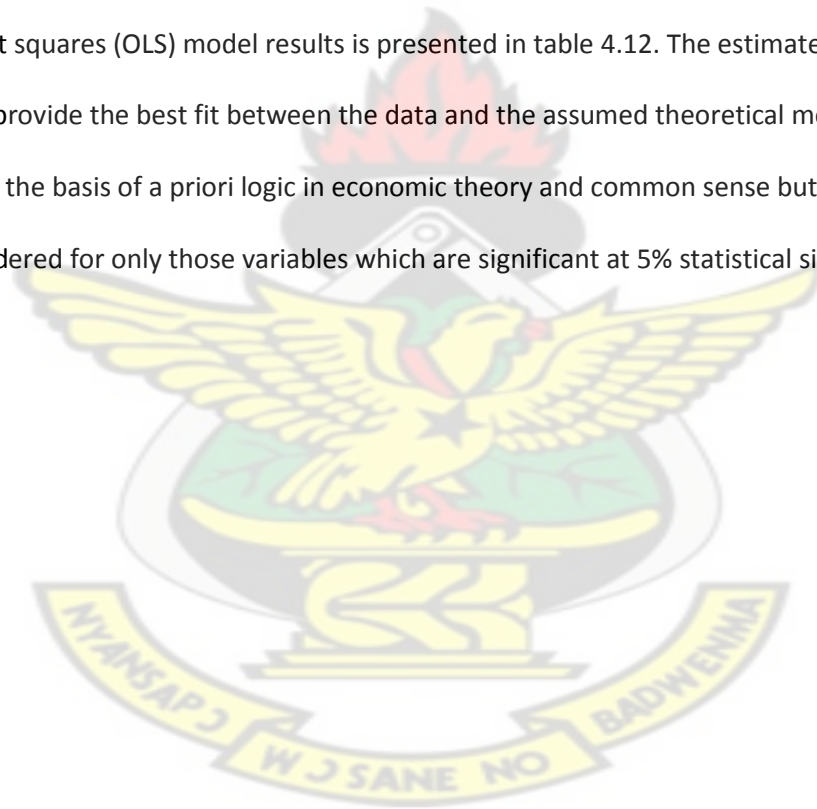


Table 4.13: SPPS results on impact of fuel sources and other explanatory variables on income

VARIABLES	PARAMETER VALUES (COEFFICIENTS)	STANDARD ERRORS	t- VALUES
CONSTANT	1.810	0.000	4.559
FUEL SOURCES	0.044	0.000	1.523
HOUSEHOLD SIZE	0.014	0.000	2.243
EDUCATION	-0.005	0.000	-2.104
OCCUPATION	0.069	0.009	.717
FUEL WOOD USAGE PATTERN	-0.024	0.001	-3.283
WTP	0.083	0.457	.523
% OF NEEDS MET	0.063	0.130	.640
R ² = 23%	ADJUSTED R ² = 20%	DW = 2.014	

The model meets the guidelines for validity testing (Mitchell and Carson, 1989). Rowe and Chestnut (1983) in their description of what constitutes a “good” model CVM study recommend in agreement with Mitchell and Carson (1989) a minimum R² of 0.15, which is satisfied in the Model.

The relationships set out by each of the explanatory variables had the expected signs. However all the variables were statistically significant at the 5% level of significance except WTP and percentage of needs met.

Household size, occupation, fuel wood usage pattern, education and fuel sources which is a proxy for environmental degradation are the most statistically significant variable determining poverty at the 5% significance level.

The relationship between fuel sources and income was negative which means that as environmental degradation decreases income level increases and that implies a decrease in poverty or the environment quality improves and as poverty levels increase, the environmental degradation is found to increase. Severely degraded environment causes low yields for farmers and as a result perpetuates more poverty. The implication of the results is that as income increases the dependence on natural resource exploitation falls. This is so because with rising incomes rural dwellers are able to take advantage of other economic opportunities other than natural resource exploitation, in order to improve their well-being. The findings are similar to findings by Cavendish (2000) and Jodha (2000).

Family size and occupation were positively related to income. This means that as the size of the household increases, especially where majority of the members are illiterates and are engaged in farming activities and earn low incomes as pertains in the Lambussie-Karni District, poverty is bound to be high. This has been observed previously by Allen and Barnes (1985), Ehrhardt-Martinez (1998), Rudel (1989), Rudel and Roper (1997).

Also education had the expected negative sign. Higher levels of educational attainment makes forest products harvesting unattractive to the local elites, who rather buy from the poor and unemployed. Since education improves the wealth status of literate rural families, they tend to concentrate on more profitable activities, in the face of increasing overexploitation and degradation of the natural resources. This is consistent with the findings by Moran (1994) who had a negative sign in his estimation.

The adjusted R^2 of 0.20 is reasonable considering the recommendation of a minimum value of 0.15 by Rowe and Chestnut (1983) and Mitchell and Carson (1989). This shows that not up to 50% of the variations in fuel source (proxy for environmental degradation) are explained by the model. Such a phenomenon is typical of many CVM studies as a result of elicitation of market values through WTP measures which can hardly be explained quantitatively (Desvousges et al.,1987).

The Durbin-Watson statistic of 2.014 suggests that to a large extent autocorrelation does not exist in the data. From the results on table 4.12 the null hypothesis which says that environmental degradation does not increase the severity of poverty in the Lambussie-Karni District is rejected.

4.3.2 Model two (impact of poverty on environmental quality)

Below are the OLS estimates for impact of poverty on environmental degradation. The low value of the R^2 is as a result of the fact that the data tested was cross section data involving several qualitative values. This means that there are other important variables such as rainfall, soil erosion, bush fires etc that have a very significant influence of environmental degradation in the district which were not being considered in the regression.

Table 4.14: SPSS results of impact of income and other explanatory variables on environmental degradation

VARIABLES	PARAMETER VALUES (COEFFICIENTS)	STANDARD ERRORS	t- VALUES
CONSTANT	2.331	0.000	5.626
INCOME	-0.082	0.001	-1.773
EDUCATION	-0.094	0.000	-1.779
HOUSEHOLD SIZE	0.161	0.000	2.587
OCCUPATION	0.141	0.009	1.746
FUEL WOOD USAGE PATTERN	0.072	0.005	1.634
WTP	0.083	0.168	1.388
% OF NEEDS MET	-0.136	0.204	-1.277
R ² = 22%	ADJUSTED R ² = 19%	DW= 1.636	

The model meets the guidelines for validity testing (Mitchell and Carson, 1989). Rowe and Chestnut (1983) in their description of what constitutes a “good” model CVM study recommend in agreement with Mitchell and Carson (1989) a minimum R² of 0.15, which is satisfied in the Model. It is important to

emphasize that, the results obtained are consistent with common sense as can be seen in table 4.13 and table 4.14.

The relationships set out by each of the explanatory variables have the expected signs. Income, household size, education, fuel wood usage pattern and occupation are the most statistically significant variables determining environmental degradation at the 5% significance level. There exists a negative relationship between income and fuel sources.

The relationship between income and fuel sources was negative which means that as income level increases and that implies a decrease in poverty, environmental degradation decreases or the environment quality improves and as poverty levels increase, the environmental degradation is found to increase. Severely degraded environment causes low yields for farmers and as a result perpetuates more poverty. Thus as the socio-economic conditions like income get better and therefore alleviate the poverty situation, the probability that an individual adopts environmentally friendly practices increases thereby decreasing the environmental degradation scenario. This is consistent with the findings Cavendish (2000) and Jodha (2000).

Family size was positively related to fuel sources. This means that as the size of the household increases, especially where the members are farmers as pertains in the Lambussie-Karni District, reliance on the resources of the environment for livelihood activities is bound to be high. Therefore dependence on the natural resources increases since they do not have alternative sources of livelihoods. The above findings are consistent with that of Ekbon and Bojo (1999) and also Duraiappah (1998).

Also education had the expected negative sign to fuel sources. A higher educational attainment means a high demand for a more quality environment because educated members have full knowledge about the dangers and effects of a degraded environment. This is consistent with the findings by Moran (1994) who had a negative sign in his estimation.

The relationship between occupation and usage pattern on one hand and environmental degradation on the other is positive. This is consistent with a priori expectation. One reason for this relationship could be that majority of the respondents' livelihood activities impact negatively on the quality of the environment. This is consistent with what pertains in the Lambussie-Karni District since most of the residents are farmers and their livelihood activities impact negatively on the environment.

The adjusted R^2 of 0.19 is reasonable considering the recommendation of a minimum value of 0.15 by Rowe and Chestnut (1983) and Mitchell and Carson (1989). This shows that not up to 50% of the variations in fuel usage (proxy for environmental degradation) are explained by the model. Such a phenomenon is typical of many CVM studies as a result of elicitation of market values through WTP measures which can hardly be explained quantitatively (Desvousges et al., 1987).

The Durbin-Watson statistic of 1.64 suggests that to a large extent autocorrelation does not exist in the data. From the results on table 4.13 the null hypothesis which says that higher poverty does not lead to environmental degradation in the Lambussie-Karni District is rejected in acceptance of the alternative hypothesis.

The findings are consistent with the findings by Okwi *et al.* (2006) and Dasgupta (2003). This finding is also consistent with the downward spiral hypothesis that maintains that poor people and environmental damage are often caught in a downward spiral. In summary, the results support the downward spiral hypothesis and by implication, alleviating absolute poverty would be likely to reduce poverty-induced environmental degradation in Lambussie-Karni District.

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CHAPTER FIVE

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CONCLUSION AND RECOMMENDATION

5.0. Introduction

This chapter outlines the main findings of the research, draws conclusions based on these findings. It gives recommendations on how best to manage natural resources in the district and tackle some of the issues identified. It ends with recommendations for further research.

5.1. Conclusion

The aim of the study was to empirically test the bi-directional relationship between rural poverty and environmental degradation. Poverty and environmental degradation are linked in a vicious cycle in which the poor people cannot afford to take proper care of the environment since they have no alternative but to use environmental resources unsustainably for their basic survival. The main objective of this study was to examine the nature of poverty-environment relationship. The study is narrowed down to the inter-relationship between poverty and environmental quality in the areas of wood harvesting, sources and uses of fuel wood and bush burning. Also poverty is

narrowed down to consumption poverty. The study made use of both primary and secondary data. In analyzing the data, frequency tables, bar chart and regression analysis were used as analytical techniques.

5.2. Summary of Major Findings

From the analysis and discussion of the data, the following findings were obtained which answer the research questions.

The results provide evidence in consonance with the dominant view in the literature that environmental degradation spurs rural poverty and vice versa. Hence the results indicate that environmental degradation spurs rural poverty and rural poverty spurs environmental degradation – thereby providing evidence in support of the poverty - environment nexus in the study area. Furthermore the results indicate that the impact of poverty on environmental degradation is greater (2.331) than the impact of environmental degradation on poverty (1.810).

The results show that, mean incomes are below the national average in the LKD, thus confirming the fact that rural households are strongly dependent on environmental resources. On aggregate, a significant proportion of household incomes come from environmental resources, confirming the frequently cited result that environmental degradation have a greater impact on the poor than on the rich.

On the issue of how well rural households are able to cater for their basic family needs such as food, health, clothes, shelter, education etc, a large proportion of households (55%) said they are able to meet less than 10% of their household needs that is both financial and material needs. On the issue of the reason for their choice of the source of fuel, 88% responded they could not afford other sources of fuel because they are expensive to them.

Moreover, the environment has been severely degraded according to the findings. The chi-square results also showed that income is a strong determinant (53.193%) of the source of fuel used for lighting but not significant in terms of cooking and heating. With regard to gender, females were relatively poorer.

5.3. Recommendations

This section makes recommendations based on the findings of the study to stakeholders involved in socio-economic empowerment of people. One of the objectives of this research was to recommend measures that will reduce poverty and improve the quality of the environment for sustainable development.

5.3.1. Diversification of income sources for the poor

Diversification of income sources for the poor to improve their resilience and decrease their vulnerability to environmental degradation. Income diversification is an important aspect of poverty alleviation, and environmental resources can play an important role in providing a greater diversity of options to all users. The study showed that residents in the areas are absolutely poor and this is basically due to low non-farm income generating activities. Government and NGO into poverty reduction should

establish agro industries in the area. Moreover, the government through the Ministry of Agriculture should subsidize farm inputs for farmers and also buy farm produce from farmers during bumper harvest to help increase and stabilize incomes of farmers.

5.3.2. Development of Alternative Sources of Energy

From the study, it was seen that the people heavily rely on firewood and charcoal for cooking and heating and this is environmentally unfriendly. The government and environmentally friendly NGOs should promote the use of Liquefied Petroleum Gas (LPG) and its cooking stoves by making them more available and affordable in the district. This would greatly reduce the rate of indiscriminate tree cutting and thus greatly sustain the environment.

The unfavorable hot and sunny weather of the savannah zone favourably supports the supply of solar energy. The government and other well meaning organisations should pool resources to harness this rich natural resource. Solar energy would be a substitute for wood for cooking and other light industrial activities.

5.3.3. Intensification and Modification of Environmental Education

The study showed that only few people (19.2%) who cut trees for their economic livelihood activities replant trees. To inculcate the culture of tree replanting into users of forest, the district assembly and environmental institutions should intensify their environmental education and sensitization programmes with particular emphasis on replanting of trees. Moreover, the users of forest should be

made to pay for the damage caused to the environment through their activities since they are more willing to pay for the damage caused.

5.4. Limitations of study and indication for further research

This dissertation faced limitations as a result of financial and time and financial constraints. This resulted in the use of random sampling rather than simple random sampling. Nwabi (1998) explains that this limitation is common to most surveys in developing countries.

The poverty, environment linkages are very complex. It was therefore not possible for a study like this one to deal with all the aspects of poverty and environmental degradation in detail to cover all geographical areas. Therefore a few and focused issues were selected for this study.

The translation of questionnaire into different local languages also made quite difficult for some words to have exact equivalence in the questionnaire. Therefore interviewer bias can not be ruled out of the data collection procedure. However this bias was reduced to the barest minimum possible by making the questionnaire simple enough to ease translation into any local dialect. Policy formulation for the effective management of environmental resources in the Lambussie-Karni District and the savannah area at large would be better informed by quantitative data on the contribution of individual factors to environmental degradation, the rate of environmental degradation and the quantification of the environmental effects on the livelihood of the people. It is thus recommended that further research on the subject be done by paying attention to these quantitative variables. In addition, the role of women, in particular the dependency of female-headed households on natural resources needs to be investigated further since the present study was unable to do justice to this important issue.

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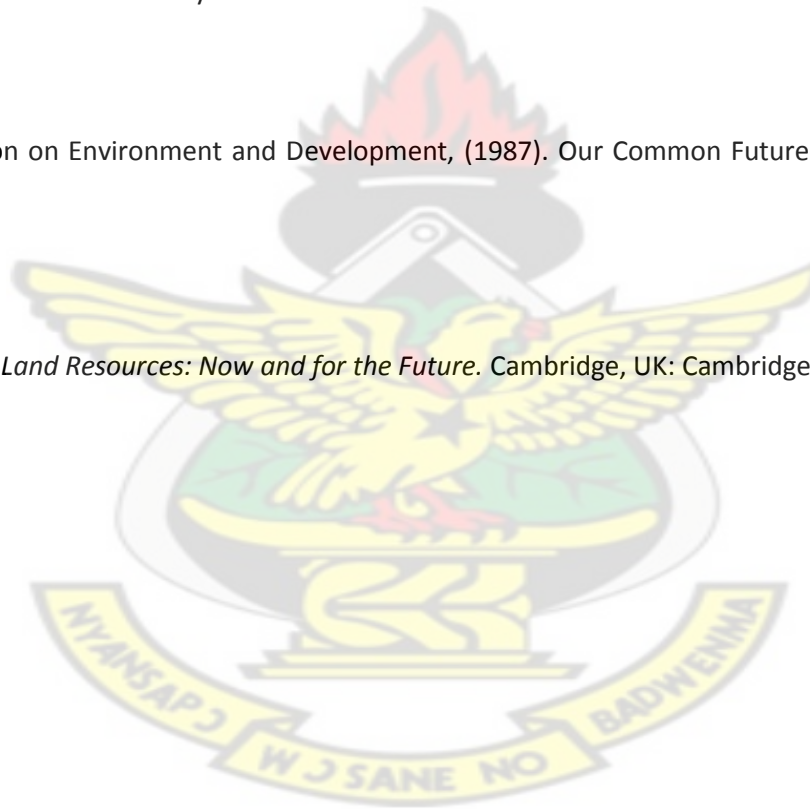
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Appendix 1: Questionnaire

KWAME NKUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF ECONOMICS

This questionnaire is to enable me collect necessary information to complete my research on the topic:

**‘ECONOMIC ESTIMATION OF POVERTY –ENVIRONMENTAL DEGRADATION NEXUS IN RURAL GHANA: A
case study of Lambussie-Karni district.**

All information provided in this study will be treated as confidential and your anonymity is assured.

Community

PART I: SOCIO- DEMOGRAPHIC FACTORS

1. **Gender :** 1= male () 2= female ()
2. **Age:**
3. **Marital status :** 1= Single () 2= married () 3= divorced/ separated () 4=widowed/
widower ()
4. **Education:** 1= no education () 2= primary () 3= middle/ J.S.S () 4=
S.S.S / Tech./ Voc. () 5= Tertiary ()
5. Number of people in the Household.....

PART 2: ECONOMIC LIVELIHOOD ACTIVITIES AND ENPOWERMENT

6. What is your primary occupation?
7. What is your employment status in this occupation? 1= paid employee
2= employer () 3= self- employed () 4= unpaid family worker ()
8. Do you have any other source(s) of income? 1= Yes () 2= No ()
9. What is your average monthly income from your primary occupation?
1= > Gh¢50 () 2= Gh¢50- Gh¢100 () 3= Gh¢101 – Gh¢300 () 4= Gh¢301 –
Gh¢ 500 () 5= > Gh¢500 ()
10. How many times does your family feed on food in a day? 1= ones ()
2= twice () 3= Thrice ()

11. By what percentage of household needs are you able to meet? (i) >10 () (ii) 10-49 () (iii) 50-89 () (iv) < 90 ()

PART 3: ENVIRONMENTAL DEGRADATION

12. What are the main source of fuel for each of the listed activities:

Cooking: 1= firewood () 2= charcoal () 3= kerosene ()

4= electricity () 5= LPG ()

Lighting: 1= firewood () 2= charcoal () 3= kerosene ()

4= electricity () 5= LPG ()

Heating: 1= firewood () 2= charcoal () 3= kerosene ()

4= electricity () 5= LPG ()

13. Why does **your** household use these sources of fuel? (i) Can not afford other sources [] (ii) non availability of other sources. []

14. What is it that you used to get from the forest that you no longer get in greater quantities? (i) bush meat ii) good yield [] (iii) abundant firewood []

15. How will you describe the extent of environmental degradation in the district?

1= not severe () 2= less severe () 3= severe () 4= very severe ()

16. Do you directly cut trees or burn bush for your activities? 1= Yes () 2= No ()

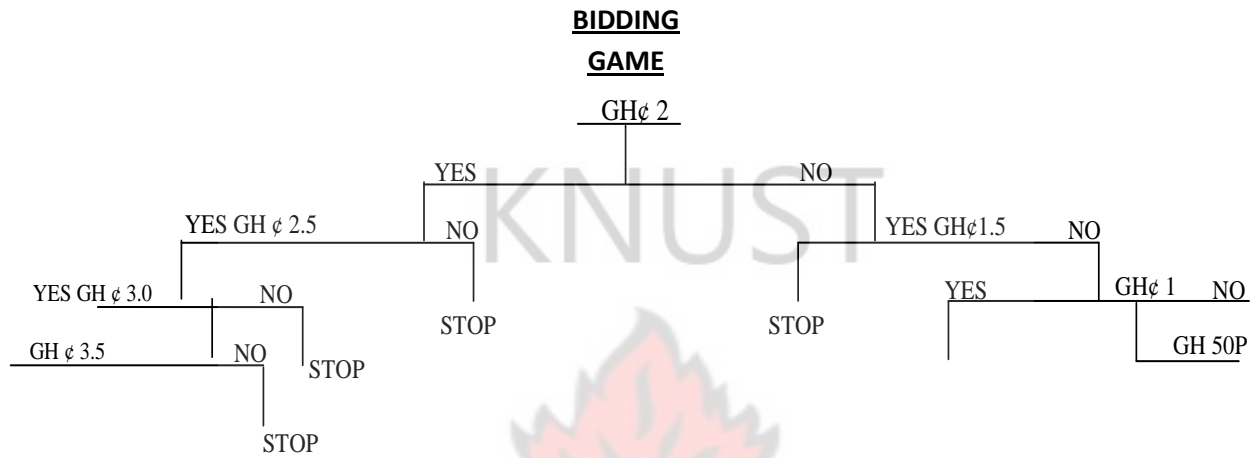
17. If yes to question 14, do you replant trees after cutting them? 1= Yes ()

2= No ()

18. If you are asked by the District Assembly to pay some money for each tree you cut down to maintain the value of the forest will you be willing to pay? 1= Yes ()

2= No ()

19. How much are you willing to pay in a month



Appendix 2: Regression results

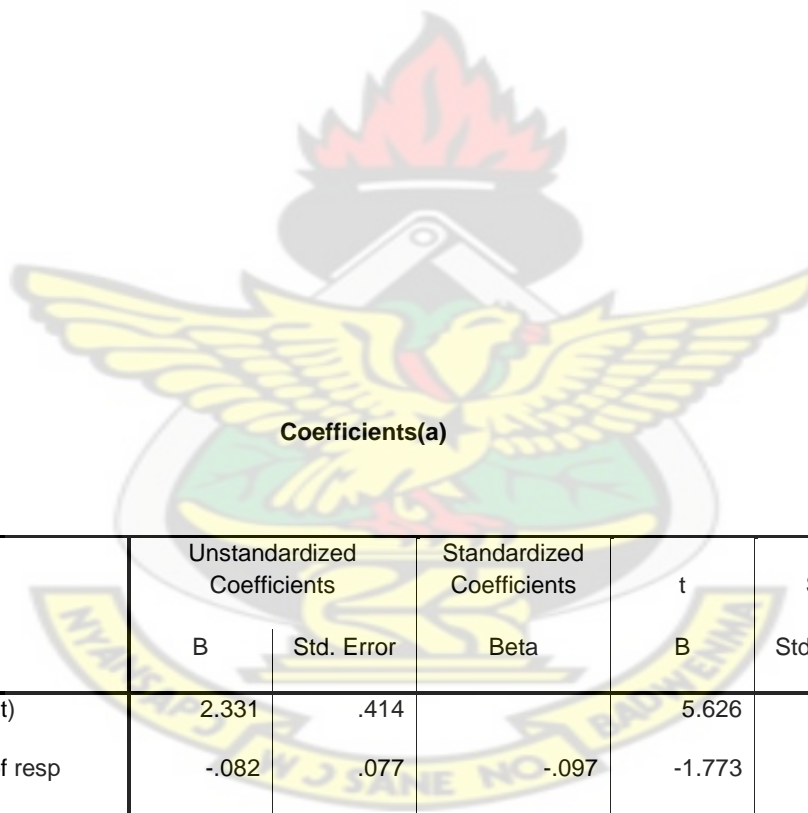
Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.331(a)	.219	.185	.81239	1.636

a Predictors: (Constant), per. of needs met, Occupation, usage pattern, income of resp, household size, WTP, Education of Resp

b Dependent Variable: fuel source

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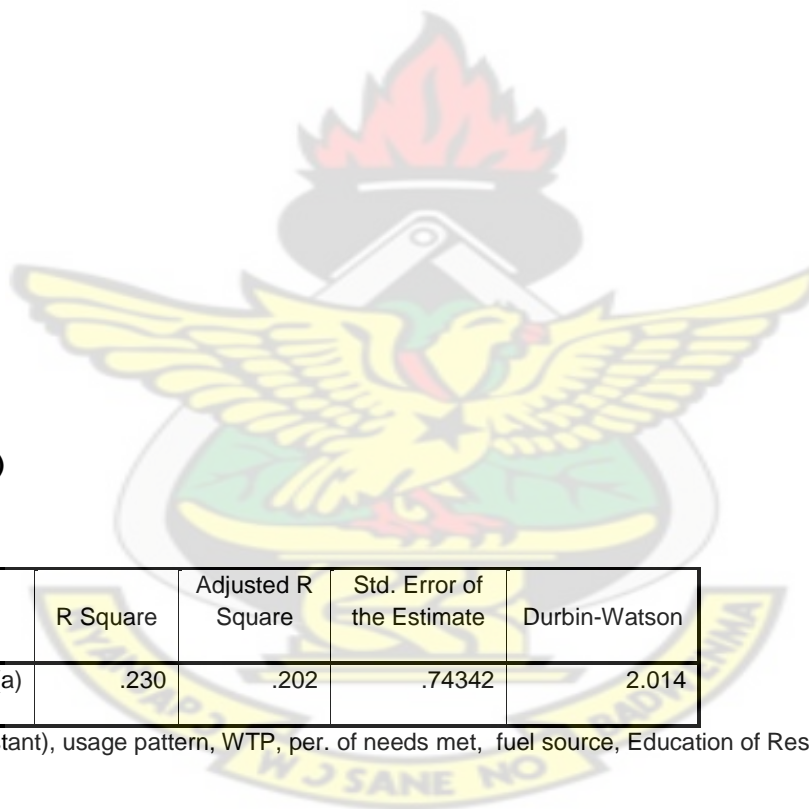
Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t		Sig.
		B	Std. Error	Beta	B	Std. Error	
1	(Constant)	2.331	.414		5.626		.000
	income of resp	-.082	.077	-.097	-1.773		.001
	household size	-.161	.062	-.243	-2.587		.000
	Education of Resp	-.094	.053	-.168	-1.779		.000
	Occupation	.141	.105	.128	1.746		.009
	Usage pattern	.072	.064	.102	1.634		.005
	WTP	.083	.060	.131	1.388		.168
	percent. of needs	-.136	.107	-.116	-1.277		.204

met					
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a Dependent Variable: fuel source

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Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.350(a)	.230	.202	.74342	2.014

a Predictors: (Constant), usage pattern, WTP, per. of needs met, fuel source, Education of Resp, Occupation, household size

b Dependent Variable: income of resp

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	1.810	.397		4.559	.000
	household size	-.014	.059	-.024	-2.243	.001
	Education	-.005	.049	-.010	-2.104	.000
	Occupation	.069	.096	.071	.717	.009
	Fuel sources	.044	.059	.070	1.547	.000
	WTP	.083	.055	.149	.523	.130
	per. of needs met	.063	.098	.061	.640	.524
	usage pattern	-.024	.086	-.028	-3.283	.000

a. Dependent Variable: income of resp



Appendix 3: Raw Data from the Survey

Income GH¢	Household size	Education	WTP	Occupation	% of needs met	Domestic fuel	Usage pattern	Bush burning
GH 76	3	none	2	farmer	29.5	firewood	cooking	charcoal
GH 50	6	none	3	farmer	5	firewood	cooking	hunting
GH 50	4	tertiary	2	artisan	5	electric	lighting	fresh grass
GH201	3	shs/tech/voc	2	pub/ civil	5	firewood	cooking	hunting
GH 50	4	none	2	farmer	5	charcoal	cooking	fresh grass
GH 76	6	tertiary	3.5	farmer	5	charcoal	cooking	fresh grass
GH 76	3	tertiary	2	artisan	5	electric	lighting	hunting
GH 76	1	none	2	pub/civil	5	charcoal	heating	charcoal
GH 76	3	none	2.5	farmer	5	firewood	cooking	fresh grass
GH 76	6	shs/tech/voc	3	farmer	5	charcoal	cooking	hunting
GH201	3	tertiary	3	farmer	5	charcoal	cooking	charcoal
GH 76	4	middle/jhs	2	farmer	5	charcoal	heating	fresh grass
GH 50	6	shs/tech/voc	2.5	artisan	29.5	electric	lighting	hunting
GH201	3	none	2	farmer	29.5	LPG	cooking	fresh grass
GH401	6	none	3.5	farmer	5	firewood	cooking	charcoal
GH201	4	shs/tech/voc	2.5	pub/ civil	29.5	charcoal	cooking	hunting
GH 76	6	none	2.5	farmer	5	firewood	cooking	fresh grass
GH 50	3	middle/jhs	2	farmer	5	kerosene	lighting	charcoal
GH 76	1	none	2.5	farmer	29.5	firewood	cooking	fresh grass
GH 76	3	none	2	farmer	5	firewood	cooking	fresh grass

GH 50	4	none	2.5	farmer	5	charcoal	cooking	hunting
GH201	3	none	3	farmer	29.5	kerosene	lighting	charcoal
GH 76	3	none	3	farmer	5	charcoal	heating	fresh grass
GH 50	3	tertiary	2	pub/ civil	5	firewood	cooking	hunting
GH201	2	none	2	artisan	5	firewood	cooking	fresh grass
GH201	1	shs/tech/voc	2	farmer	29.5	charcoal	cooking	hunting
GH 50	4	none	2	farmer	5	charcoal	heating	fresh grass
GH 76	2	none	2.5	farmer	5	kerosene	lighting	fresh grass
GH 50	3	none	2.5	farmer	29.5	firewood	cooking	charcoal
GH201	2	shs/tech/voc	2.5	farmer	69.5	LPG	cooking	fresh grass hunting
GH 76	1	none	2	farmer	5	kerosene	lighting	fresh grass
GH 76	1	none	2.5	farmer	5	charcoal	heating	charcoal
GH 50	2	none	2.5	farmer	5	firewood	heating	fresh grass hunting
GH201	6	none	2	farmer	5	kerosene	lighting	charcoal
GH 76	4	none	2.5	farmer	69.5	charcoal	cooking	fresh grass
GH201	4	middle/jhs	2.5	artisan	5	electric	lighting	fresh grass
GH 76	2	none	2.5	farmer	69.5	charcoal	heating	fresh grass
GH 76	4	primary	2	farmer	69.5	charcoal	cooking	charcoal
GH 76	4	primary	2.5	farmer	5	LPG	cooking	fresh grass
GH 76	2	none	2	farmer	5	firewood	cooking	hunting
GH 76	1	shs/tech/voc	2.5	pub/ civil	69.5	firewood	heating	charcoal
GH 76	4	none	2	farmer	29.5	kerosene	lighting	fresh grass
GH 76	3	tertiary	2	farmer	5	charcoal	cooking	fresh grass
GH 76	4	none	2.5	farmer	5	charcoal	cooking	charcoal
GH201	1	none	2.5	farmer	69.5	electric	lighting	hunting

GH 76	2	none	2	artisan	5	LPG	heating	hunting
GH201	6	none	2	pub/ civil	5	firewood	heating	charcoal
GH201	3	none	2	farmer	5	kerosene	cooking	fresh grass
GH 76	6	none	2.5	farmer	5	firewood	cooking	charcoal
GH201	3	none	2.5	artisan	29.5	firewood	cooking	fresh grass
GH201	4	tertiary	3	pub/ civil	5	charcoal	cooking	hunting
GH 76	6	none	2.5	farmer	29.5	firewood	heating	fresh grass
GH 76	4	primary	2	farmer	5	charcoal	cooking	charcoal
GH201	4	none	3	farmer	29.5	charcoal	cooking	fresh grass
GH201	4	none	2	farmer	69.5	charcoal	cooking	hunting
GH 76	2	tertiary	3	pub/ civil	5	firewood	heating	charcoal
GH401	6	none	3.5	farmer	5	kerosene	lighting	fresh grass
GH201	6	none	9	farmer	5	charcoal	cooking	charcoal
GH 76	2	tertiary	2	pub/ civil	29.5	charcoal	cooking	fresh grass
GH201	6	none	9	farmer	5	charcoal	lighting	charcoal
GH201	4	none	9	farmer	29.5	charcoal	heating	fresh grass
GH 76	6	none	3	pub/ civil	5	LPG	heating	fresh grass
GH201	4	none	9	farmer	5	kerosene	lighting	charcoal
GH 50	6	none	9	farmer	5	charcoal	cooking	charcoal
GH 50	4	none	9	artisan	5	kerosene	lighting	charcoal
GH201	4	none	9	farmer	69.5	firewood	heating	fresh grass hunting
GH 76	2	tertiary	3	pub/ civil	5	charcoal	cooking	charcoal
GH 76	1	primary	2	farmer	29.5	firewood	cooking	fresh grass
GH 76	6	none	9	farmer	5	charcoal	cooking	charcoal
GH201	3	none	2	farmer	5	charcoal	heating	hunting

GH 50	3	shs/tech/voc	2.5	farmer	29.5	electric	lighting	charcoal
GH201	6	shs/tech/voc	2	farmer	29.5	firewood	cooking	fresh grass
GH 50	6	none	9	farmer	95	firewood	cooking	fresh grass
GH 76	4	none	9	farmer	5	electric	lighting	charcoal
GH 76	6	none	3	farmer	5	charcoal	heating	fresh grass
GH 76	4	none	2.5	farmer	29.5	charcoal	heating	charcoal
GH 76	2	primary	2	farmer	5	electric	lighting	hunting
GH 76	3	none	3	pub/ civil	29.5	LPG	cooking	charcoal
GH201	3	shs/tech/voc	2	artisan	29.5	firewood	cooking	hunting
GH401	3	middle/jhs	9	farmer	5	kerosene	lighting	fresh grass
GH 76	2	none	9	farmer	29.5	firewood	heating	charcoal
GH 76	4	none	2.5	farmer	5	firewood	cooking	charcoal
GH 76	3	none	3	farmer	69.5	charcoal	cooking	fresh grass
GH201	3	none	2	farmer	5	firewood	cooking	charcoal
GH 76	1	tertiary	2	pub/ civil	29.5	charcoal	heating	fresh grass
GH 50	6	none	2	artisan	5	kerosene	lighting	fresh grass
GH 76	3	shs/tech/voc	3.5	artisan	29.5	firewood	cooking	fresh grass
GH 76	6	tertiary	2	farmer	5	charcoal	cooking	charcoal
GH201	2	none	9	farmer	5	kerosene	lighting	fresh grass
GH 76	3	primary	3.5	farmer	5	charcoal	heating	hunting
GH201	3	shs/tech/voc	3	farmer	5	charcoal	heating	charcoal
GH201	3	primary	3	pub/ civil	5	electric	lighting	fresh grass
GH 76	2	shs/tech/voc	3	farmer	69.5	charcoal	cooking	charcoal
GH201	3	middle/jhs	2	artisan	69.5	kerosene	lighting	fresh grass
GH 76	1	tertiary	2	farmer	5	firewood	heating	fresh grass

GH 50	2	middle/jhs	2.5	artisan	5	charcoal	cooking	charcoal
GH 50	6	none	2.5	artisan	29.5	firewood	cooking	charcoal
GH 76	6	none	2.5	pub/ civil	5	firewood	cooking	fresh grass
GH 50	3	none	2.5	farmer	29.5	charcoal	heating	fresh grass
GH 76	4	none	2.5	farmer	5	electric	lighting	charcoal
GH 76	6	none	2	farmer	5	charcoal	cooking	fresh grass
GH 76	6	none	2.5	artisan	5	charcoal	cooking	charcoal
GH 76	6	none	2.5	pub/ civil	29.5	electric	lighting	fresh grass
GH 50	4	none	2	artisan	5	firewood	heating	fresh grass
GH 76	2	primary	3	farmer	5	firewood	heating	charcoal
GH 76	3	shs/tech/voc	9	farmer	5	kerosene	lighting	fresh grass
GH 76	2	none	2	artisan	5	charcoal	cooking	fresh grass
GH 76	4	shs/tech/voc	2.5	artisan	5	charcoal	cooking	charcoal
GH 76	2	primary	2.5	farmer	5	electric	lighting	fresh grass
GH201	3	none	2.5	artisan	5	LPG	heating	charcoal
GH 76	6	shs/tech/voc	2.5	farmer	5	firewood	cooking	fresh grass
GH201	2	none	2	pub/civil	69.5	charcoal	cooking	fresh grass
GH 76	4	none	2	farmer	29.5	firewood	cooking	fresh grass
GH 76	2	none	2	artisan	5	firewood	heating	charcoal
GH201	6	none	2.5	pub/ civil	5	electric	lighting	charcoal
GH201	6	primary	3	artisan	5	firewood	cooking	fresh grass
GH 50	3	none	3	farmer	5	charcoal	cooking	charcoal
GH 76	3	none	2	farmer	5	kerosene	lighting	charcoal
GH201	4	none	2	farmer	5	firewood	heating	
GH201	6	middle/jhs	2.5	pub/civil	29.5	firewood	heating	

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