UNIVERSITY FOR DEVELOPMENT STUDIES

MANAGING LAND DEGRADATION FOR FOOD SECURITY IN THE LAWRA DISTRICT

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2015

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BY

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(BA. INTEGRATED DEVELOPMENT STUDIES- ENVIRONMENT AND RESOURCE MANAGEMENT)

(UDS/MEM/0026/13)

A THESIS SUBMITTED TO THE DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES, FACULTY OF INTEGRATED DEVELOPMENT STUDIES, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILMENT OF THE

REQUIREMENT FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN ENVIRONMENT AND RESOURCE MANAGEMENT

SEPTEMBER, 2015

DECLARATION

Student

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere:

Candidate's Signature: ..... Date:.....

Name:.....

Supervisors

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Principal Supervisor's Name: Dr. Kanton I. Osumanu,

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ABSTRACT

The agricultural sector plays a fundamental role in Ghana despite the recent transition to an industry and service-led economy. However, land degradation could potentially inhibit the growth of the agricultural sector if measures are not put in place to arrest this phenomenon. This study investigated the nature and causes of land degradation in the Lawra District. The study explored the impact of land degradation on food security as well as the land management practices to improve food security in the study area. A mixed method approach was adopted which combined both quantitative and qualitative approaches to data collection of which questionnaires were used. Satellite images and other secondary data were also used. The study revealed that the major cause of land degradation in the area of study is bushfires and deforestation. Majority of the respondents said they experience transitory food insecurity between the months of May and August every year. The main causes of food insecurity identified in the Lawra District are post-harvest losses lack of storage facilities and low crop yield. The land management practices adopted by most respondents from the GERMP communities were water and soil conservation methods such as stone bunds, zai and half-moon and composting while the non-GERMP communities adopted application of chemical fertilizer, manure application, zero tillage and cover cropping. Land degradation in the study area is a serious challenge to farmers despite the various land management practices adopted to help curb the phenomenon. The study recommends that efforts towards proper land management practices should include provision of drought resistant and early maturing seeds and skill training for farmers on reducing the impact of land degradation.

ACKNOWLEDGEMENT

I am highly indebted to my supervisors, Dr. Osunanu Issaka Kanton, Head of Department for Environment and Resource Studies (ERS) and Mr. Enoch Kosoe a Lecturer in the Department of (ERS) in the University for Development Studies, whose guidance, encouragement, suggestions and constructive criticism have resulted in this piece of work. My gratitude also goes to all the lecturers in the faculty especially those in the Department of Environment and Resource Studies, Integrated Development Studies and my mates such as Romanus Baayakuu, Apuri Isaac and Tioh Julius for their encouragement inspiration and support during my period of study.

I am very grateful to the respondents whose knowledge and experience have contributed immensely to this work especially officers of EPA, GERMP, FAO District Assembly and the household respondents.

I would like to express my heart-felt appreciation to my husband for his love, support, encouragement and sacrifice, and for persuading me to enroll in the graduate programme. My love goes also to my children Antoinette, Aubyn and Austin Bayaa. I acknowledge with deep appreciation the immense love, care, material and spiritual support and sacrifices made by my parents and siblings towards my education. Thank you and God richly reward you all. My compliments go to Nyaaba Akongbangre Joseph for working on the map of the study area to suit my need, Mr. Abu Salia Raqeeb and Mr. Seidu Abduliah Jamatutu who helped in gathering literature for my research, I say thank you. I acknowledge with deep appreciation the contributions of Mr. Eric Kaliebo the GERMP Consultant for Lawra District, Jerry John Gerald, Fred and Peter all of Lawra District who helped me to gather data. To all who contributed in diverse ways to making this work a success, I say thank you and God richly bless you.

DEDICATION

This work is dedicated to my lovely husband Mr. Bayaa Bieranye Sixtus my children,

Antoinette Austin and Aubyn, parents and siblings

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LIST OF ACRONYMS

AGDP	Agro-gross Domestic Product
CCAFS	Climate Change Agriculture Food Security
CGIAR	Consultative Group on International Agricultural Research
CO_2	Carbon dioxide
CSIR	Council for Scientific and Industrial Research
DPCU	District Planning Coordinating Unit
FAO	Food Agriculture Organisation
FASDEP	Food and Agriculture Sector Development Policy
GDP	Gross Domestic Product
GEF	Global Environment Facility
GERMP GIS	Ghana Environment al Resource Management Program
GNA	Ghana News Agency
GLASOD	Global Assessment of/on Soil Degradation
GSS	Ghana Statistical Service
IFAD	International Fund for Agricultural Development
ISRIC	International Soil Reference and Information Centre
LADA	Land degradation Assessment in Dry lands
MoFA	Ministry of Food and Agriculture
SADA	Savannah Accelerated Development Authority
SLM	Sustainable Land Management
SSA	Sub-Saharan Africa
UNCCD UNDP	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UWR	Upper West Region
WFP	World Food Programme

CHAPTER ONE

BACKGROUND TO THE STUDY

1.1 Introduction

The agricultural sector plays a fundamental role in Ghana despite the recent transition to an industry and service sectors-led economy. The sector comprises approximately 30 percent of the country's Gross Domestic Product to date and employs approximately 50 percent of the population (Kolavalli *et al.*, 2012). The agricultural sector is believed to have the potential to grow at rates as high as 6 percent (Breisinger *et al.*, 2008), but climate change leading to land degradation could potentially inhibit such progress in the long run, given that the sector is particularly vulnerable to these ongoing phenomena. Land degradation, for example, decreases crop yields and thus financial returns to agricultural production, thereby threatening food security, environmental quality and agricultural sustainability. In the past decade, food insecurity and hunger in rural households in the northern regions of Ghana have been on the rise due to general climatic changes and the resultant land degradation (Dasgupta and Baschieri, 2012).

Land degradation has become an acute problem in Africa, especially sub-Saharan, where deforestation, overgrazing and mismanagement of land resources and soil erosion have rendered over 320 million hectares of land unsuitable for any meaningful agriculture (Sant, 1993, 2001) and making it impossible to sustain agriculture land. The nature and type of soil found in sub-Saharan Africa makes it easier for erosion to take place.

In Ghana, the most vulnerable agro-ecological zone to degradation is the interior savanna, which covers about 50% of the land area of the country (Asiamah *et al.*, 2000). In this environment, traditional systems of soil fertility restoration, such as shifting cultivation and nomadic grazing, have broken down because the carrying capacity of the land has been exceeded (Asiamah *et al.*, 2000; Sant, 2001). This has resulted in the use of minimal and non-

productive agricultural lands with serious degradation problems (Asiamah and Quansah, 1992) for food crop production.

Land degradation tends to be accelerated by rapid urbanization, deforestation, poor agricultural practices, pollution and overgrazing, leaving arable lands bare, degraded and unproductive. Degradation of land and vegetative resources has threatened agricultural productivity, biodiversity, and water quality and availability in many parts within the developing world (Scherr and Yadav, 1996). The root causes of land degradation in Ghana are the tremendous pressures from the human populations growing at 2.6 percent yearly (GEF, 2004). These pressures are compounded by mass poverty which prevents subsistence farmers from applying chemical fertilizers making agriculture viable and profitable as well as the conspicuous consumption of expanding elites.

According to FAO (1984), land degradation leads to the deterioration in the quality and productive strength of the land. This results in reduction of land based livelihood opportunities which push rural youth to migrate to urban centers thereby denting the economic capacity of rural communities. Land degradation therefore deprives these communities the active youth needed for self-sufficient sustainable development founded on land resources, which helps agriculture, the pivot of the national economy. Land degradation processes such as water erosion, wind erosion and sedimentation, cause long term destruction of vegetation and diminution of many plants and animal populations. Universally, about 80% of agricultural land is degraded by either water or wind erosion but the most prominent one is water erosion which affects agricultural lands (Angima *et al.*, 2003). Also, decrease in crop yields, where relevant, destruction of soil crust formation, and salinization of soils occur as a result of land degradation. The long-term effect of land degradation is the loss of ecosystem function and productivity caused by disorders from which the land cannot recover unaided

(Bai *et al.*, 2008). The process of land degradation occurs slowly and cumulatively but has long term effects on rural people who become helpless in terms of food (Muchena, 2008).

Food security is dependent upon agricultural systems which are resilient to land degradation and extremes in climate. Food security includes at a minimum, the ready availability of nutritionally, adequate and safe foods and an assured ability to acquire acceptable foods in socially acceptable ways (that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies. A household is considered food secured when its occupants do not live in hunger or fear of starvation. Stages of food insecurity range from food secured situations to full-scale famine (Coleman-Jansen *et al*, 2011)

- There are several factors that affect food security today and these factors include the following: Global Water Crisis - Water table reserves are falling in many countries (including Northern China, the US, and India) due to widespread over pumping and irrigation.
- Climate Change - Rising global temperatures are beginning to have a ripple effect on crop yields, forest resources, water supplies and altering the balance of nature.
- Land Degradation - Intensive farming leads to a vicious cycle of exhaustion of soil fertility and decline of agricultural yields (Disabled World, 2015).

In Ghana about 2 million people, representing 5 percent of the population, are food insecure. Thirty-four percent of this population is in the Upper West Region, followed by Upper East with 15% and Northern Region with 10%, amounting to approximately 453,000 people (WFP, 2009). Furthermore, food insecurity in the Upper West, especially Lawra, is usually experienced during the lean season for about five months. This happens in months of inadequate household food provisioning which is defined as the time between stock depletion and the next harvest (Bilinsky and Swindale, 2007). It is usually a measure of food insecurity

in a highly subsistence-oriented area where production is primarily for home consumption and households who do not make significant sales or purchases in the market.

1.2 Problem Statement

Land degradation is a major driver of poverty, preventing smallholder farmers from making agriculture viable and profitable. In Africa, land degradation affects 67% of agricultural land, with about 490 million hectares showing erosion and declining vegetation (Nabhan, 1997).

It has generally been observed that natural forces, such as relief, temporal distribution of rainfall and drought coupled with human activities, such as population pressure, annual bushfires, over-harvesting of wood and unsustainable cultivation practices, are responsible for the accelerated land degradation in Ghana (GPRS, 2006).

The Ghana Poverty Reduction Strategy document (GPRS, 2006) notes that lack of systematic policy of conserving and utilizing ample rainfall in all parts of the country, lack of access to high yielding crops as well as poor management strategies are attributable to the nations incapability to meet the food necessities of its inhabitants because all these will lead to the depletion of the quality of land. Statistics gathered by Northern Region Agricultural Development Unit (2010) indicates that about 507,000 (40%) people are vulnerable of becoming food insecure in the rural areas of Upper West, Upper East and Northern regions. Nationally, about 1.2 million people, representing 5% of Ghana's population, are food insecure. Out of this number 34% are in the Upper West and Upper East regions and 10% are in the Northern region (WFP, 2009).

The high incidence of food insecurity in the Upper West Region is due to the semi-arid conditions which make the Lands prone to degradation (Kusimi and Yiran, 2011). In the Upper West Region, Lawra district suffers severely from the effects of land degradation leading to low crop yield, migration, low income and economic growth. As a result, EPA

through the implementation of GERMP in Lawra seeks to strengthen communities to enable them reverse land degradation trends by adopting sustainable land management practices.

This study sought to assess the impact of interventions such as the GERMP project in managing land degradation and improving food security in the Lawra district.

1.3 Research Questions

The main research question which the study seeks to address is: how are land degradation and food security related?

1.3.1 The specific research questions are

i. What are the nature and causes of land degradation?

ii. What are the nature and causes of food insecurity?

iii. How do land management practices influence food production?

iv. How does education level influence land management practices?

1.4 Research Objectives

The main objective of the study is to unfold the relationship between land degradation and food security.

Specifically, the study seeks to:

i. Ascertain the nature and causes of land degradation in the study area.

ii. Examine the nature and causes of food insecurity.

iii. Assess good land management practices for food security.

iv. Assess the relation between educational levels and land management practices.

1.5 Justification of the Study

The significance of any academic work is seen in the light of its linkages to larger, important or theoretical problems, social policy issues or concerns of practices (Marshall and Rossman, 1999).

Agriculture and other related activities which continues to be the bedrock of Ghana socioeconomic development is a factor that constrains the effective development of agriculture and derails the sustainability of the country's development.

Land degradation which is identified by the government of Ghana as a developmental issue requires sustained solution. Agriculture, the leading sector in terms of employment in the study area, serves as the food basket in the district and the nation as a whole. The GSS, (2010) indicates an increase in the total population of the study area as against the fixed nature of the land and the rise in the poverty level of the people within the district.

The verge for these people to meet their needs such as food, shelter, health has compelled them to undertake activities such as unsustainable farming practices, deforestation, overgrazing, and bush burning which smoothens the way for soil erosion to take place causing land degradation.

Land degradation which is seen as a global problem and a mammoth challenge to sustaining the biological, economic and social services provided by various ecosystems (Banadda, 2010) is not peculiar to Sub-Saharan Africa (SSA) because of the continuous destruction, extraction, over-exploitation and inadequate conservation practices carried out by the citizens (Tenywa and Bekunda, 2009) which threatens agricultural productivity, biodiversity, water and soil quality (Scherr and Yadav, 1995) as well as the livelihoods of the poor. A Report of the World Bank (2008) shows that 90% of the rural poor depend on natural environment for

their survival leading to 65% of agricultural lands affected by Land degradation (CGIAR, 2003).

It is on this back drop that several researchers have tried to dig in to the situation to find an ending solution to the problem. Yengniben (2009) carried a research on land tenure and sustainable livelihood in the district. From his research it was found out that as population grows land keep decreasing because lands inherited are shared among family members and people with large household size turns to get smaller portion of lands which affects their livelihoods due to the fragmentation of the land.

In terms of the fight against food insecurity, Bagson and Naamwintome, (2012) carried out a research on home gardening as a source of improving food security in Nandom formally part of the Lawra district which revealed that home gardening enhances food security.

Based on the various researches conducted in the study area, the present study looks at the relationship between managing degraded land and food security where the GERMP project was used as a reference point to find out whether tremendous changes have taken place in terms of food security. This was done by taking into consideration the causes and impact of land degradation in terms of food security and measures put in place to fight land degradation. Three GERMP and three non-GERMP communities were used to ascertain the facts.

Centered on this background, the study seeks to provide information on the main causes of land degradation, the nature of food insecurity in the study area, the mitigation/adoptive measures carried out by the various communities. Interested individuals, organizations and policy makers such as Ground well, EPA, MEDA, who are into assuring food security within farmers will benefit from the research.

1.6 Scope of the Study

The research was conducted in the Lawra district which lies in the North Western corner of the Upper West Region in Ghana between Latitudes 2 25W and 2°45"W and Longitudes 10°20" N and 11°00"N. The District shares boundaries with Nandom District to the North, to the South with Jirapa District, to the west with Ivory Coast and to the East with Lambussie-Karni. The district has a total land area of about 975.5 km^2 (GSS, 2000). The study was done in six communities with a total population of 3,859.

The study was based on the causes and impacts of land degradation and measures adopted to make degraded land arable for cultivation of crops in order to bring about food security in the district. Information on land management practices was collected from the two different groups to identify the various management practices carried by them and to also see whether there is a drastic change in their food production.

1.7 Organization of the Report

The research thesis is written in five chapters. Apart from the introduction which forms the first chapter, four other chapters have been dealt with in this study. Review of relevant literature on land degradation and food security and conceptual framework forms chapter two. The third chapter focuses on the study methodology. The fourth and fifth chapters take care of the analysis and explanation of the data collected. Chapter four specifically focuses on the findings of the respondents on land degradation its causes, food security and it causes and how farmers are the degraded land to improve food security. Chapter five contains the summary of the study, conclusions drawn and finally recommendations.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

Literature review is always conducted because it captures a cross section of views and position on the subject matter by different people and contextualizes the study (Oquaye, 2004). It is based on this reason that literature is being reviewed.

2.2 Land

Land is argued to include not only the soil resource, but also the water, vegetation, landscape, and microclimatic components of an ecosystem (Scherr and Yadav (1996). Land tenure in Ghana, especially in the rural areas, is predominantly communal. Communal land ownership is the expression used to describe the system whereby land is collectively owned by an extended family, clan or community of ancestrally related people with the control or administration of the land vested in the leader or his appointee (Gyasi, 1995).

Land is owned by families in rural Ghana and this means that family members can only have access to a piece of land left behind by their forefathers for cultivation or it is bought (Yengnibeh, 2009). The population of the study area is found to be increasing as against the static nature of the available land and this has put an enormous pressure on farm lands which is a mainstay of the district (Kees, 2002). These farms left behind are always scattered around in small sizes which affect the overall crop yield as a result of the kind of farming practices adopted by farmers of these lands. This scenario observed in the study area is the case in the northern parts of Ghana as observed by Songsore (1996) when he stated that the economic

base of northern Ghana relies on smallholder agriculture. The scattered nature of these lands force farmers to intensively cultivate the same land every year causing depletion of soil nutrients and land degradation (Yengnibeh, 2009).

2.3 Degradation

Degradation by definition is a process of change over time. Land degradation refers to a temporary or permanent decline in the ecosystem function productive capacity of the land, or its potential for environmental management (Scherr, 1996:16). Bai *et al*, (2008:50), defined land degradation as the long-term loss of ecosystem function and productivity caused by disturbances from which the land cannot recover unassisted.

Land degradation has negative connotations that imply the loss of something of value within the environmental economic system (Gretton and Salma, 1997). The lost value may be related to the productivity of the land for agriculture, the environment as a host to naturally occurring species of Flora and Fauna or to the environment as a place for other human activities such as mining, secondary industries, human habitation and waste assimilation.

Land degradation as defined by (Abdi *et al*, 2013), is the result of complex inter-relationships between biophysical and socio-economic issues which affect many people and their land, especially in the tropics and developing countries. According to the authors, the term land degradation involves both soil and vegetation degradation. Soil degradation refers to negative changes in the physical, chemical and biological properties of the soil, whereas vegetation degradation is the reduction in the number of species and the vegetation composition hence, land degradation is usually described in terms of the loss in natural resources (soil, water, fauna and flora) or in the biophysical process by which it functions.

However, a number of theories have been put forward as the fundamental cause of land degradation. McConnell (1983) asserts that soil erosion is a result of rational farm decision

making. A rational producer, maximizing the discounted net revenue from land over time would not respond to soil loss until the present value of marginal private returns obtained from additional soil loss goes below the implicit marginal private cost of soil loss.

FAO, (1984), also described land degradation as the aggregate diminution of the productive potential of the land, including its major uses (rain-fed, arable, irrigated, rangeland, forest), its farming systems (e.g. smallholder subsistence) and its value as an economic resource. Again, the World Bank (2007) perceived land degradation to be a reduction of resource potential, the loss of utility or potential utility resulting in temporary or permanent lowering of current or future productive capacity of land.

UNCCD, (1994), also defined land degradation as a reduction or loss of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation.

Summarily, land degradation entails deterioration in the productive capacity and other qualitative aspects of land, including its aesthetics and, above all, natural attributes such as soil, water, and vegetation.

LADA Secretariat (2007) defined land degradation as "reduction in the capacity of land to perform ecosystem functions and services that support society and development." In more elaborate terms, land degradation is "any form of deterioration of the natural potential of land that affects ecosystem integrity either in terms of reducing its sustainable ecological productivity or in terms of its native biological richness and maintenance of resilience" (GEF, 2003a: 1). An alternative to the above definitions of land degradation could be the loss of

utility or potential utility through the reduction or damage to physical, social, cultural or economic features and/or reduction of ecosystem diversity as well as the temporary or permanent decline in the productivity of land (Ezeaku and Davidson, 2008, Rosister 2001). In terms of geographical locations, land degradation is called desertification if it occurs in arid and semi-arid areas.

Based on the various definitions given by researchers, land degradation is difficult to understand. The productive capacity of land cannot be assessed simply by any single measure. Therefore, numerous indicators have to be used when describing or attempting to define land degradation. Indicators are variables which may show that land degradation has taken place. They are not always necessarily the actual degradation itself. Examples of the indicators include exposed plant roots, the piling up of sediment against a downslope barrier, decline in yields of a crop may be an indicator that soil quality has changed, which in turn may indicate that soil and land degradation are also occurring.

The condition of the soil is one of the best indicators of land degradation. The soil integrates a variety of important processes involving vegetation growth, overland flow of water, infiltration, and land use and land management (Stocking and Murnaghan, 2001).

Land degradation is a global problem and an immense challenge to sustaining the biological, economic and social services provided by various ecosystems (Banadda, 2010). Land degradation occurs slowly and cumulatively and has long lasting impacts on rural people who become increasing vulnerable (Muchena, 2008).

Agricultural production and land conditions are affected by land management practices, including both private decisions made by farm households and collective decisions made by groups of farmers and communities. For example, farm households make decisions about land use (whether, for example, cropland or grazing land), the crop types to plant, the amount

of labour to use, and the types and amounts of inputs, investments, and agronomic practices to use to conserve soil and water, improve soil fertility, reduce pest losses, and so on. Communities also can influence land management through their collective decisions. They may make investments on communal land areas (e.g., erosion controls on degraded lands, tree planting) or private lands (e.g., drainage investments as part of watershed conservation and development efforts) or regulate use of communal land (e.g., restrictions on use of grazing areas) or private lands (e.g., by-laws limiting burning or cutting of trees). As argued above, these household and collective decisions affect current agricultural production and income and affect the condition of land resources, thus influencing potential future agricultural production and income.

2.4 Causes of land degradation

Considering the various definitions given by different scholars, degradation processes cannot occur without interference by man which is broadly balanced with the rate of natural rehabilitation. Various views have been expressed about the causes of land degradation in the world. The wide diversity of identified or suspected factors of land degradation are commonly categorized into natural ones marked by 'natural' events such as landslides resulting from earthquakes, and anthropogenic ones marked by 'human or artificial' events such as deforestation to make room for farming (Gyasi *et al.* 1995). GEF (1999) identified the natural factors of land degradation to be mainly catastrophic whereas the anthropogenic ones tend to be relatively slow even though the two categories interrelate.

2.4.1 Natural causes of land degradation

Natural causes determine the inherent capacity of the ecosystem to provide goods and services. These include those that are climatic that determine the capacity to generate biomass and provide ground cover, water quantities and biodiversity. Examples of natural causes

include slope, soil vulnerability to water as well as soil erosion which also influence the degradation processes (Nachtergael *et al.*, 2011).

Also, GEF 2003a and 2003b; identified earthquakes, aridity and floods associated with climate variability and climate change as natural causes of land degradation which manifest itself in the form of soil erosion, salinization of water bodies, devegetation and others.

2.4.2 Human induced causes of land degradation.

Human-induced causes of land degradation processes can either be direct or indirect causes. The indirect causes are largely determined by land use and land-use change, economic factors relating to the possibility of investing in the land and access to markets; and social factors that assure the availability of infrastructure, and farmers' accessibility to land that allows them to produce at maximum capacity. A number of direct causes may seem natural but have human causes wholly or partly. Indirectly behind factors such as bush invasion, forest fires, floods, landslides and droughts could be human involvement, while deforestation, over cutting of vegetation, shifting cultivation without adequate fallow period, overgrazing are classified as direct human induced factor (FAO, 1999). Deforestation is considered to be a type of degradation and at the same time a cause of other types, principally water erosion. Deforestation becomes a cause of degradation first, when the land that is cleared is steeply sloping, or has shallow or easily erodible soils; and secondly, where the clearance is not followed by good management.

The destruction of the forests is mainly a result of clearance for agriculture. The search for fuel wood, as well as the growing frequency and severity of forest and bush fires, are also taking their toll. Deforestation has led to a severe shortage of fuel wood and building materials in many areas. Crop residues and animal manure, such as the cow dung which were previously returned to the soil to add valuable nutrients, are burnt for fuel (FAO, 1999).

Deforestation and forest degradation is the leading cause of water erosion in steeply sloping humid environments. It is also a contributory cause of wind erosion, soil fertility decline and salinization (GLASOD, 1988). The land becomes degraded when the cutting exceeds the rate of natural regrowth exposing the land bare for erosion to take place. This takes place in semi-arid environments, where fuel wood shortages are often severe. Impoverishment of the natural woody cover of trees and shrubs is a major factor in causing both water erosion and wind erosion. In the GLASOD assessment it is cited as a cause for 98% of the area affected by wind erosion. This assessment also cites it as a contributory cause to salinization.

The GLASOD assessment identified shifting cultivation to be a sustainable form of land use in the past, because the population density was low and allowed forest fallow periods of sufficient length to restore soil properties. Population increase, cost involved in clearing land and among other factors has led to the shortening of fallow periods thereby making it non-sustainable. The long fallow periods of 5 to 15 years or more associated with traditional shifting cultivation have now been reduced to 1 to 3 years (Appiah, 1996). Shifting cultivation is practiced by subsistence farmers, where it becomes cause of water erosion and soil fertility decline. For instance, in Ghana where population growth outweighs availability of land, people are forced to reduce the period for fallowing thereby making farmers to put more pressure on the available land causing depletion of soil nutrients (FAO, 2014).

According to Baartman *et al.* (2007), overgrazing is an excessive grazing by animals that leads to degradation of plant and soil resources. Thus it involves the grazing of rangelands by animals at stocking densities above the carrying capacity. This mismatch leads to direct decline in the quantity and quality of the rangeland vegetation cover (Ahmad *et al.*, 2012). Reduction in rangeland vegetation cover eventually leads to wildlife habitat destruction and soil erosion.

Apart from these causes of land degradation, there are some that are classified as deeply rooted drivers and they include population pressure, poverty, (Lambin, *et al.*, 2003) migration (Van der Geest, 2011) lack of markets and infrastructure, poor governance and weak institutional frameworks and inadequate education (Nachtergael *et al.*, 2011). An attempt made by subsistence farmers in responding to declining land productivity has led to the abandonment of existing degraded pasture and cropland and the move to new land for grazing and cultivation. Barbier, (2000), stated that the process will continue to repeat itself in a vicious circle with overgrazing and cultivation causing land degradation, and then the search for new pasture and cropland.

Within these broad categories a wide variety of individual causes are incorporated. These causes may include the conversion of unsuitable, low potential land to agriculture uses, the failure to undertake soil conserving measures in areas at risk of degradation and the removal of all crop residues resulting in 'soil mining' (i.e. extraction of nutrients at a rate greater than replenishment). The individual causes enumerated above are often centered on social and economic conditions that encourage land users to overgraze, over-cultivate, deforest or pollute (Stocking *et al.*, 2001).

Accelerated land degradation is mostly fuelled by human intervention within the environment. The effects of this intervention are determined by the natural landscape. The most frequently recognised main drivers of induced land degradation include: overgrazing of rangeland, over-cultivation of cropland, waterlogging and salinization of irrigated land, deforestation drought, leaching, floods (Dregne, 1982).

Estimates made by UNEP (1992), show that 23% of all usable land (excluding mountains and deserts, for example) has been affected by degradation to a degree sufficient to reduce its productivity. In the 1990s, about 910 million ha of lands were classified as 'moderately

degraded', with greatly reduced agricultural productivity. Out of this total of 305 million ha of soils which ranges between 'strongly degraded' (296 million ha) and 'extremely degraded' of which more than 5 million ha are in Africa (Oldeman *et al.,* 1990).

Soil erosion is a major factor in land degradation and has severe effects on soil functions such as the soil's ability to act as a buffer and filter for pollutants, its role in the hydrological and nitrogen cycle, and its ability to provide habitat and support biodiversity (CEO, 2002).

About 2 000 million hectares of soil, equivalent to 15% of the Earth's land area have been degraded through human activities and these activities include overgrazing 35%, deforestation 30%, agricultural activities 27%, overexploitation of vegetation 7% and industrial activities 1% (GACGC, 1994).

FAO, 1996 studies indicated that about 580 million hectares of vast reserves of forest are degraded by large scale logging and clearance for farm lands and urban use and in the tropical forest about 220 million ha of forest land was destroyed mainly for food production. About, 1,730 million m^3 fuel woods are harvested annually from forests and plantation because wood fuel is the primary source of energy in developing regions.

Overgrazing which is also classified as human activity was estimated to have resulted in the loss of about 680 million ha of world pasture and range lands. The catastrophic effects of overgrazing tend to more evident in Asia and Africa. Also, agriculture mismanagement makes it easier for water erosion to take place causing soil losses which is estimated to be about 25 million tons annually. Soil salinization and water logging affect 40 million ha of land globally (FAO, 1996).

According to reports by CGIAR, (2013), agriculture is a prime cause of land degradation and soil depletion in the Upper West Region. Soils in agro-ecosystems lose 25 to 75 percent of

their organic carbon during the initial conversion of ecosystems from natural to agricultural lands due to such soil degradation processes as erosion, salinization and nutrient depletion.

In a Ghana News Agency report in 2011, one Mrs Salifu Ayi identified poverty to be the main cause of land degradation in the Upper West Region which is coupled with human activities such as shifting cultivation, intensive farming on pieces of land, indiscriminate felling of trees for fuel and charcoal production, bush burning, over grazing and small scale mining (GNA, 2011).

Nsiah Gyabaah, (1996) was able to prove that there is high incidence of bush fires in Upper East and West Regions with 125 and 112 recorded per year. He attributed the causes of these bush fires to either natural or anthropogenic factors or both. Specific climatic factors, especially dry spells, nature of the vegetation, and wind speed play a role. When there is a prolonged dry season, and where the potential evaporation exceeds the rainfall during the year, the natural vegetation becomes dry and, therefore vulnerable to fire. But, human activities such as hunting land clearing and burning of the bush by herdsmen in order to stimulate germination of new grass are suspected to be the primary cause of the uncontrolled and indiscriminate bush fires in Ghana.

Kugbe and Henmi (2009), identified vegetation fires as a contributing factor to soil erosion and leaching which makes the surface of land bare for easy erosion by wind and water. Also, a study by Norman and Myers (1991), indicates that, policies, economic factors and population issues that contribute to land degradation classified as indirect causes of land degradation and these are facilitated by government policy failures and misdirected policies have in certain cases indirectly resulted in deforestation in developing countries.

Within the Sub-Saharan Africa, rapid population growth, poverty and migration

constitute the main driving forces of change in forest land use (Lambin, *et al.*, 2003). Rapid population growth coupled with poverty is responsible for the conversion of woodland and forest areas to cropland and pasture fields in southern Burkina Faso (Ouendraogo *et al.*, 2010) in order to increase food, fiber, and other resources such as fertile land, water and fuel wood, Diagana, (2003).

Estimates made by FAO shows that the actual supporting capacity of land ranges from 10 to 500 persons per square km. Population growth of Ghana is also responsible for land degradation in Upper East and West Regions (Songsore, 1976). The DPCU (2013), research show that an increase in population of the district has kept pressure on natural resources particularly land for agricultural production as well as socio-economic facilities which has led to land degradation.

A study by Millar *et al*, (2004), associates severe land degradation to high human population density and also high animal population density as causes of land degradation in the Upper East Region. In areas where cattle population is high excessive overgrazing takes place causing reduction in the biological productivity and carrying capacity of the land Gyasi, (1997). Looking at the population of cattle and sheep within the study area, there is an increase as against limited pasture of land for grazing causing which could cause overgrazing. According to Mutangadura (2007), most African economies are heavily reliant on agriculture and natural resources for their GDP, national food needs, employment and export revenues that require clearing forest lands, hence, the persistent land degradation challenges.

Geist and Lambin (2002) identified that land use activities such as agricultural expansion, wood extraction and infrastructure development have collectively contributed to loss of forest and woody vegetation covers as direct causes of land degradation. In most developing countries charcoal and firewood are considered as the basic energy

sources, yet inefficiency in charcoal and firewood production pose a challenge for sustainable land use in African countries (Wood Energy and the Environment, 2008). Fuel wood extraction, selective logging by commercial firms and extraction of construction materials also contribute to land degradation Backeus *et al*, (2006).

In Ghana, clearing of woody vegetation for agriculture and wood energy exploitation have contributed to 12% of the vegetation cover being converted from grass to cropland an indication of land degradation in Northern Ghana (Braimoh, 2006).

Furthermore, overgrazing, deforestation and inappropriate agricultural activities which are classified as human induced causes also pose a serious threat to land productivity. Response to declining land productivity has been the abandonment of existing degraded pasture and cropland and the move to new land for grazing and cultivation. Unless there are investments in soil conservation, the process will repeat itself in a vicious circle with overgrazing and cultivation causing land degradation, and then the search for new pasture and crop land (Barbier, 2000). IFAD, (2008) also identified population growth and shorter fallows in the upper regions as the causes of land degradation.

Nachtergael *et al.* (2011) argued that, agricultural lands used for cropping and livestock rearing are more susceptible to degradation than non-agricultural lands. Land use, and associated inputs and management, are indeed the main direct causes of land degradation. Land use in itself is determined by natural conditions, cultural and socio-economic aspects including institutional settings, infrastructure, education and market availability.

Soil mining leading to depletion of soil nutrient or the practice of growing crops with insufficient replacement of macro-nutrients removed from the soil is an important problem in low income countries (Bishop and Allen, 1989). This is a fundamental biophysical constraint to steady growth of food production and a very serious cause of

soil degradation Donovan *et al.*, (1998). Conclusive findings show that on per hectare of land basis, 22 kg N, 2.5 kg P and 15 kg K are being lost annually as a result of long-term cropping with little or no external nutrient inputs and returned crop residues (Weight and Kelly, 1998). When soil mining occurs unabated, processes of land degradation such as water erosion, wind erosion and sedimentation by these agents result in long term destruction of vegetation and diminution of many plants and animal populations, or decrease crop yields where relevant, soil crust formation, and salinization of soils.

2.5 Magnitude and Effects of Soil or Land Degradation

Land degradation has become an issue of worldwide concern as it threatens global food security and environmental quality. The GLASOD, (1988-91) indicates that South America croplands have declined at a rate that is slower than the global average, while African per capita croplands have declined at a rate greater than average rate.

It is an acute problem in Africa where bush burning, deforestation, overgrazing and mismanagement of land resources have rendered over 320 million hectares of land unsuitable for any meaningful agriculture (Sant' Anna, 2001; Sherr and Yadav, 1996). The most common form of degradation is soil erosion by water and wind, which results from vegetation removal with negative consequences for soil productivity (Oldeman, 1994).

In Sub-Saharan Africa, the majority of the soils in the arid and semi-arid areas are Arenosols, Lixisols, Regosols, Leptosols and Plinthosols, which are characteristically light- textured and inherently low in natural fertility, poor in structure, low organic matter and have low buffering capacity (Agboola & Aiyelari, 2000; Asiamah, Quansah and Dedzoe, 2000; Sant' Anna, 2001). These characteristics make more than 60% of the soils highly susceptible to accelerated erosion due to various types of soil mismanagement without any investment in improved conservation measures (Agboola and Aiyelari, 2000). Several studies[21] (Norton *et al.*, 1998; Lowery *et al.*, 1998;

Lal, Mokma and Lowery, 1998; Olson *et al.*, 1998) have shown that accelerated erosion has an adverse effect on soil quality and its agronomic productivity.

In a GLASOD study, Sherr, 1999 said soil chemical degradation occurs through loss of nutrients including organic matter, was ranked second to soil erosion. Nutrient depletion occurs mainly through crop removal in harvested crops and residues, leaching, erosion, burning and nitrogen volatilization.

The impact of land degradation is most felt in areas with a high incidence of poverty. Agricultural productivity and food security in SSA are being seriously threatened by the steady decline in soil fertility, defined as "a net decrease in available nutrients and organic matter in the soil" (Scherr, 1999), and caused by the continued nutrient mining of already degraded soils by farmers seeking to increase output.

According to Garcia (2008) and Helmer, *et al* (2000), disturbances of forests and woodlands can push ecosystems beyond their resilient points resulting in adverse hydrological and surface energy imbalances. Tree canopy removal affects the hydrology of forest ecosystems, for example, causing the water table to rise in areas receiving high annual rainfall leading to soil leaching and poor vegetation growth in certain cases (Roy, 1998). Within the northern savanna zone, cattle serve as the economic guarantee for households. Other livestock commonly kept are sheep, goats, guinea fowls and chicken. The number of livestock determines the wealth of a person. Problems associated with rearing livestock are lack of drinking water during the dry season, grazing areas and diseases. Farmers usually burn the land during the dry season and when the first rains start the grass begin to sprout hence providing food for their livestock. This practice however, leads to deforestation and low crop yields as a result of soil erosion which ultimately causes land degradation.

The low crop yields result in low income which increases poverty, which, in turn, promotes migration from rural to urban centers (Gyasi, *et al.*, 2009). In terms of climate change, trees are used as carbon sinks and clearing of trees and woody vegetation will lead to the release of carbon dioxide (stored in trees) into the atmosphere with consequences of global warming (Searchinger *et al*, 2008). Also, (FAO, 2005) study showed that greenhouse gas emissions from trees and soil account for approximately 2 billion tons of annual global CO_2 released into the atmosphere due to deforestation.

Batjes, (2001) reports that degraded soils amount to about 494 million ha in Africa. It is also estimated that 65% of SSA's agricultural land is degraded because of water and soil erosion, chemical and physical degradation (Oldeman *et al.*, 1991). Oldeman *et al.* (1999) identified causes of land degradation to vary and they include: loss of topsoil, terrain deformation, mass movement or overblowing (water and wind erosion), loss of nutrient and organic matter, salinization/alkalization, acidification, pollution (chemical deterioration), compacting/crusting, waterlogging, and subsidence of organic soils (physical deterioration). Out of the total degraded area, overgrazing, agricultural mismanagement, deforestation and overexploitation of natural resources are said to account for 49, 24, 14 and 13 percent respectively (Oldeman *et al*, 1999).

Analysis based on the GLASOD and Oregne and Chou data suggests that globally, there has been 17 percent cumulative productivity loss over 45 years (1945-90), due to degradation and this led to reduction in global food production and made the prices of grains unprecedented (Crosson, 1994).

About 8.7 billion hectares of land worldwide is used by humans, 3.2 billion hectares are potentially arable, of which a little less than half is used to grow crops. The remaining 1.7

billion hectares of potentially arable land, along with most non-arable land, function as pasture, forest, and woodland (Scherr, 1999).

It is also estimate that soil quality on three quarters of the world's agricultural land has been relatively stable since the middle of the twentieth century. The rest of the land however is degraded widely with overall pace of degradation accelerating in the past 50 years causing productivity to decline substantially on approximately 16 percent of agricultural land in developing countries, especially on cropland in Africa and Central America, pasture in Africa, and forests in Central America. Almost 75 percent of Central America's agricultural land has been seriously degraded, 20 percent of Africa's and 11 percent of Asia's (Scherr, 1999) causing cumulative productivity loss for cropland from soil degradation over the past 50 years is estimated to be about 13 percent, and for pasture lands 4 percent. A global agricultural model as mentioned in 2020 Vision Discussion Paper 27 (1999) shows a slight increase in degradation relative to baseline trends resulting in 17-30 percent higher world prices for key food commodities in 2020, and increased child malnutrition.

Agricultural lands in sub-Saharan Africa are prone to erosion and nutrient depletion due to soil degradation. The study reported yield losses range from 2 percent decline over several decades to disastrous (>50 percent), depending on crop, soil type, climate, and production systems. The annual reduction in total production for Sub-Saharan Africa due to erosion in 1989 is estimated at 3.6 million tons for cereals, 6.5 million tons for roots and tubers, and 0.36 million tons for pulses and that if erosion continues unchecked, yield reductions by the year 2020 may be 16.5 percent for the continent and 14.5 percent for Sub-Saharan Africa (Lal, 1995).

Crop yield losses in Africa from 1970 to 1990 due to water erosion alone are estimated to be 8 percent (Scherr, 1999). Sub- regional studies have acknowledged large aggregate

declines in crop yields due to degradation in many parts of Africa, China, South Asia, and Central America.

Besides affecting aggregate food supply, soil degradation also diminishes agricultural income and economic growth. In South and Southeast Asia estimates for total annual economic loss from degradation range from 1 to 7 percent of agricultural gross domestic product (AGDP) even though more than half of all land in this region is not affected by degradation, the economic effects in the degrading areas would appear to be quite serious (Kiernan, 2009).

Estimates for eight African countries show annual economic losses ranging from under 1 percent of AGDP in Madagascar to 9 percent in Zimbabwe. Country models simulating the effects of soil degradation in Ghana and Nicaragua find annual economic growth to be reduced by nearly a percentage point. Africa also experienced direct economic losses due to declining yields and lost nutrients are large in terms of the national economy. The model used by (Diao *et al*, 2007) predicts that land degradation is reducing agricultural income in Ghana by a total of US$ 4.2 billion over the period 2006-2015, which is approximately five percent of total agricultural GDP in these ten years.

Recently, estimated cost of degradation suggest that an equivalent of 10 percent of Ghana's GDP is lost annually through unsustainable management of the country's natural wealth (forests, wildlife, fisheries, and land resources), as well as from health costs related to urban environmental problems (water supply and sanitation, and indoor and outdoor air pollution) (CEA, 2006).

Five continental-scale studies have assessed the extent of soil degradation in Africa. A literature review studies conducted by Dregne (1990) on 33 countries found evidence of serious land degradation in sub- regions of 13 countries where Ghana is included. In another literature review, focused on dry lands only, Dregne and Chou (1992)

estimated that 73 percent of dry lands were degraded and 51 percent severely degraded. They concluded that 18 percent of irrigated lands, 61 percent of rain fed lands, and 74 percent of rangelands located in dry lands are degraded.

Also, GLASOD expert conducted a research and found out that 65 percent of soils on agricultural lands in Africa had become degraded since the middle of this century, of which 31 percent permanent pastures, and 19 percent of woodlands and forests (Oldeman *et al.*, 1991). A high proportion (72 percent) of degraded land occurs in dry lands. The most widespread cause of degradation was water erosion, followed by wind erosion, chemical degradation, three-quarters from nutrient loss, the rest from salinization, and physical degradation. Overgrazing accounted for half of all degradation, followed by agricultural activities, deforestation, and overexploitation.

Wong *et al.* (1991) said most cultivated lands in SSA regions are poorly endowed in macronutrients such as (nitrogen, potassium, sulphur, magnesium and zinc) and are heavily leached, acidic and have low soil organic matter which is being triggered by inappropriate management practices, wind and soil erosion organic and nutrient loss (soil degradation) leading to low soil productivity.

According to Obeng, (1971), water erosion has destroyed tracts of land throughout Ghana, as evidenced by the Erosion Hazard Map of Ghana. This map shows that many regions of Ghana contain land affected by severe sheet and gully erosion, with very severe erosion being particularly prevalent in the Upper West Region, Northern Region and Ashanti Region. Wind erosion is an important cause, particularly in dry lands and areas with landforms conducive to high winds. Participatory GIS and remote sensing investigations in Bolgatanga and Talensi-Nabdam Districts of northern Ghana by Agyeman (2007) reveals a decline of healthy

vegetation from 1990 to 2004 resulting in about 600 km^2 of land being degraded, hence, the decline in commercial food crop production.

Furthermore, research conducted by (Vagen, *et al*, 2005) indicates that in Sub-Saharan Africa, destruction of forests has the potential of increasing soil carbon in the atmosphere leading to global warming and that land degradation does not only affect the biophysical environment but also disrupts the livelihoods of millions of people as activities such as hunting and gathering, are becoming difficult, leading to violent conflicts (World Wide Fund, 2007). Land degradation in northern Ghana has resulted in fragile environmental conditions coupled with harsh climatic conditions of droughts and periodic floods (Care, 2008). Studies conducted shows that persistent drought has manifested in chronic malnutrition and wide spread poverty (Destombes, 1999). Osei (1999), also said rapid weather changes have severe impact on water storage capabilities as a result worsen the water stress situation in northern communities in Ghana.

A study by Van der Geest, (2004), indicates that effects of land degradation in northern Ghana has resulted in the migration of farmers from degraded regions to rural areas of the Brong Ahafo Region, that has more fertile agricultural soil unlike the impoverished agricultural lands at the origin of migrants as evidenced by low crop yields coupled with unreliable rainfall resulting in food insecurity problems.

Interestingly, there has been no global mapping of the relationship between poverty and soil quality or soil degradation. However, a number of factors suggest that soil degradation affects the rural poor in a negative way. Studies in Asia and West Africa in the 1980s (Malik, 1998) found that the rural poor were more dependent on agriculture than the non-poor. The poor depended more on annual crops, which typically degrade soils more than other crops. They

also relied more on common property lands, which tend to suffer greater degradation than privately managed land.

When the principal assets of the poor comprise low-productivity or degrading lands, and their ability to seek more remunerative livelihood options is restricted by economic, political, or social conditions, they may fall into a poverty "trap" in which they lack sufficient assets to undertake the land husbandry and investment necessary to maintain or increase productivity (Malik, 1998). The poor tend to be "pushed" to marginal lands by political forces, expulsion of squatters from higher-quality lands during modernization, or the inability to compete for higher-quality land, as a result, the poor use fewer inputs and rely on more intrinsic soil quality.

According to (GNA, 2011), the major cause of land degradation in the Upper West Region is poverty and other human activities such as shifting cultivation, bad farming practices, overgrazing and bush fire which cause land degradation in the region (Ghana news agency, August 2011).

Agriculture accounts for 80% of the District's economy and about 83% of the population are engaged in subsistence agriculture with the aim of producing food for family consumption and for sale, but this has not been the case due to the use of outmoded farming practices coupled with poor nature of the soil and unfavourable weather conditions which make the land prone to degradation thereby affecting food production. However, the total land area of the Lawra District as at 2004 was 105,102 hectares of land. Out of the total land area, 27,955 is under cultivation constituting 3% and for irrigation is eleven (11) hectares 0.01 % (MOFA, 2006).

The population of Lawra for the year 2000 was 87,525 and in 2010 the population increased to 100,929. This population increase has kept intense pressure on natural resources

particularly land for agricultural production as well as socio-economic facilities (GSSL, 2001). This has gone a long way to reduce farm lands which compel farmers to use farming practices that will lead to degradation of land. Such practices include application of chemical fertilizers with the aim of increasing productivity without considering its long term effect.

Tenywa and Bekunda, 2009 indicates that land degradation is threatening agricultural productivity, biodiversity, water and soil quality (Scherr and Yadav, 1995) as well as the livelihoods of the poor, of whom 90 % depend on natural environment for their survival (World Bank, 2008).

Also, studies conducted by Dregne and Chou (1992) show that 89% of global dry lands is rangelands (of which 73 percent is degraded); 8% is rain fed cropland (of which 47% is degraded); and 3% is irrigated cropland of which 30% is degraded. Other sources suggest that 5 to 10 million hectares are being lost annually to severe degradation and if care is not taken and this trend continues, 1.4 to 2.8% of total agricultural, pasture, and forestland will have been lost by 2020. Declining yields (or increasing input requirements to maintain yields) can be expected over a much larger area Scherr and Yadav (1996).

The GLASOD study estimates that of 8.7 billion hectares of agricultural land, pasture, forest and woodland, nearly 2 billion hectares (22.5%) have been degraded since mid-century. Also, CGIAR, (2003) findings show that about 65% of agricultural land in Africa; 45% in South America; 74% in Central America; and 35% in Asia are degraded. Soil erosion which is one of the causes of land degradation is estimated to damaging about $26 billion of productive soils in the continent annually (Lal, 2001); and in East Africa, soil erosion has been estimated to affect 50% of the total arable land area especially in the highland areas (Ovuka, 2000).

About 3.5% of the total has been degraded rapidly that it is reversible only through costly engineering measures, if at all. Over 10 percent has been judiciously degraded, and is reversible only through significant on-farm investments. Another nearly 9 percent is lightly degraded and easily reversible through good land husbandry practices.

Globally, it is estimated that nearly half of this vegetated area is under forest, of which about 18 % is degraded; 3.2 billion hectares are under pasture, of which 21 percent is degraded; and nearly 1.5 billion hectares are in cropland, of which 38 percent is degraded (GLASOD). Water erosion is the principal cause of degradation.

Chemical degradation, such as salinization and nutrient loss, is the result of cropping practices which accounts for a smaller proportion of degraded lands, but 5 more than 40 percent of cropland degradation. Physical degradation such as compaction accounts for a smaller proportion of degraded area. According to the GLASOD estimates, degradation of cropland appears to be most extensive in Africa, affecting 65 percent of cropland area, compared with 51 percent in Latin America and 38 percent in Asia. Degradation of pasture is also most extensive in Africa, affecting 31 percent, compared with 20% in Asia and 14 percent in Latin America.

Global estimations indicate that the impact of degradation on agricultural production is of the monetary value of productivity losses due to land degradation in dry lands ranges from US$13 billion to $28 billion per year (Yadav and Scherr 1995) indicating that soil erosion costs is $26 billion per year, and $12 billion of which is in developing countries (UNEP 1986). On the part of Ghana land degradation is exacerbated by traditional farming systems which is estimated to cost the nation around two per cent of the Gross Domestic Product annually (Diao and Sarpong, 2007).

The problem of degradation is often caused by land use practices and its effect on land use which is central to all published definitions of land degradation. The emphasis on land, rather than soil, broadens the focus to include natural resources, such as climate, water, Land forms and vegetation. The productivity of grassland and forest resources, in addition to that of cropland, is embodied in this definition.

2.7 Food Security.

Declining soil fertility jeopardizes the sustainability of farming systems in SSA, especially in arid and semi- arid areas that are ecologically fragile. Highly variable and declining rainfall patterns observed since the 1970s.

Food is a fundamental human need. Efforts to secure food have been intimately interwoven with the evolution of many societal structures such as our laws and regulations, our customs and ceremonies, and our trade and commerce arrangements (Ingram, 2011). In addition to serving nutritional needs, food is an important factor in cultural identity; food can reveal relationships between the past and the present, reflect epochal transformation, and mark changing identities of various groups of people through new ways of appropriations (Chan, 2010).

People today make vast efforts to secure food and this has dictated our everyday activities of hunting, gathering, and farming, ranching and fishing. Such efforts have motivated the way we have exploited to the extent of over-exploiting natural resources. The demand for food has been the main driver of land conversion (70% of Mediterranean forests, 60% of temperate broadleaved forests and 70% of tropical forests have been converted to agricultural/grazing land; MA, 2005a) and fisheries declines (25% of major fisheries have collapsed over the last 50 years (Mullon *et al.*, 2005). In 2010 about 925 million people had to go to bed hungry (FAO, 2010) and that production is not the only factor.

A major problem confronting many countries today is the inadequacy of food supply in the face of rapidly growing population. In many countries, the task of producing enough food for the teeming population has received considerable policy attention. Nevertheless, the growth rate of food production is still far below the population growth rate. This is brought about by land degradation.

Food security is a flexible concept as reflected in the many attempts at definition in research and policy usage (FAO, 2003), and numerous definitions of food security thus exist. The word food security originated with the aim of maintaining a constant sufficient food reserves to meet the total requirement of a country at the international and national level (Amanda, 2006).

Food security is access by all people at all times to the food required for a healthy life (Frankenberger, 1990; Von Braun, 1991). However, increasing food prices arising from declining farm productivity have reduced the economic access of the poor to the minimum quantity of food required. Consequently, 550 million people in the world were food insecure in 1989 (World Food Commission, WFC, 1990). This number increased to 800 million in 1994 (IFPRI, 1995), thereby making a 45 % increase in less than a decade. Worse still, it was realized that food insecurity, like malnutrition breeds at the highest rate in South Asia and the sub-Saharan Africa (SSA), thus indicating that hunger might remain a major challenge confronting the world by 2020 (Oyekale, 2001).

Possibilities for expansion of agricultural land are limited, this would imply taking in use marginal lands (Biswas, 1994). Therefore, an increase in food production is necessary per hectare of arable land. The issue of food security came to the fore in the early 1970s when a programme dubbed “Operation Feed Yourself” was launched. In the late 1970s, domestic food production and cocoa the major foreign exchange earner of the country, was badly

affected by a prolonged drought which consequently reduced the capacity of the country to import food (Nyanteng *et al*, 2003).

Food security in Ghana continues to be threatened, by the seasonal and unstable domestic production, high food prices and inflation, low household incomes, land degradation and persistent high level of unemployment. Effectively addressing the many causes of the food security problem in the country has been abstract. However, the role of agriculture to supply adequate food for the rapidly increasing population has remained high on the agenda of successive governments.

There are many definitions of food security that highlight different components. The Ministry of Food and Agriculture's operational definition of food security is "good quality nutritious food hygienically packaged, attractively presented, available in sufficient quantities all year round and located at the right place at affordable prices (FASDEP, 2003). Even though the country has faced chronic food insecurity in some periods in the past, such as the prolonged draught from 1978 to 1983, the transitory food insecurity is the major problem in most of the ecological zones in Ghana especially northern savannah zone.

Definition stemming from the 1996 World Food Summit states that food security is met when "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life". Food security includes at a minimum, the ready availability of nutritionally, adequate and safe foods and an assured ability to acquire acceptable foods in socially acceptable ways (that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies) (USDA, 2006). There are several factors that affect food security today and these factors include the following; population growth, availability of arable lands, water resources, climate change and food availability,

accessibility and loss (Premanandh, 2011). The global population rose to 6.9 billion in 2010, with 4.2 billion coming from developing countries with additional figure of 80 million to population every year worsening poverty and threatening the environment resulting in land degradation which affects food security (Population Bulletin, 2010).

On the part of arable lands 3 billion hectares out of 14 billion are arable on earth and these hectares of arable land area continues to decrease as a result of rapid population growth. For instance, there were about 12 acres per person worldwide in 1959, reducing to about 6 acres per person in 2006. A further reduction to as low as 2.8 acres per person is estimated by 2040 (Premanandh, 2011). The ratio of arable land to population declined by up to 55% in the developing nations from 1960-2000 (FAO, 2008). These declined is attributed to degradation serving as a threat to food production and rural livelihoods, especially in the poorest areas of the developing world.

Another factor that affects food security is water crisis. Although water covers 70% of our planet, the world's water resources are limited relative to human demand, resulting in a global water crisis. Demand has increased as a result of population growth, industrial expansion and irrigated agriculture, exceeding supply in developed and developing countries. There is no creation of new water on the planet. The available volume of water is recovered through a well-coordinated system between the earth and the atmosphere by hydrologic cycle. This means that, despite the growing population, the volume of available and accessible water remains roughly the same. Water pollution adds enormously to existing regional and global water scarcity by removing large volumes of water from the supply (WMO, 1997). Food production is dependent on water, so shortage of water will have a direct impact on food production. A clear example is Ghana were some of our water bodies are being polluted with cyanide which does not support aquatic lives.

Changes in the weather pattern distribution and their consequences have become the major focus of international concern. Climate change results from rises in average temperature, alterations in rainfall regimes, thawing of glaciers and other changes (Erwin, 2009). Rising temperatures lead to heat stress in plants, increasing sterility and lowering overall productivity, besides increasing evaporation from plants and soils and lowering water availability (Parris, 2008). An average temperature increase of 0.8 ^{o}C is observed today compared with pre-1900. It has been estimated that crop yields will decrease by approximately 5–15% per degree Celsius of global warming (NRC, 2010).

Finally, food availability and accessibility is another fact that affects food security. Food availability refers to the existence of sufficient quantities of necessary food types consistently for individuals, communities and countries. However, having enough food does not guarantee access to food, which is directly dependent on the level of income of an individual or family. For instance, rural countries with lower populations face the greatest challenges to food access (Blanchad *et al*, 2006). Nevertheless, availability and accessibility of food are not importance unless it meets daily dietary requirements. The combined effects of population growth, urbanization, climate change and reduced crops yield resulting in increased global food insecurity. Availability of food at higher prices that cannot be afforded by the poor citizens can cause food insecurity in that area, indicating that food is available but not accessible.

Food security for a household means access by all members at all times to enough food for an active, healthy life. Food security includes at a minimum:

- The ready availability of nutritionally adequate and safe foods.

- Assured ability to acquire acceptable foods in socially acceptable ways (that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies) (USDA, 2006).
- Food insecurity is limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (USDA, 2006).

In 2006, USDA introduced the new description "very low food security" to replace "food insecurity with hunger," recognizing more explicitly that, although hunger is related to food insecurity, it is a different phenomenon. Food insecurity is a household- level economic and social condition of limited access to food, while hunger is an individual-level physiological condition that may result from food insecurity.

2.7.1 How are Food Security and Insecurity Measured?

The food security status of each household lies somewhere along a continuum extending from high food security to very low food security. This continuum is divided into four ranges, characterized as follows:

- High food security: Households had no problems, or anxiety about, consistently accessing adequate food.
- Marginal food security: Households had problems at times, or anxiety about, accessing adequate food, but the quality, variety, and quantity of their food intake were not substantially reduced.
- Low food security: Households reduced the quality, variety, and desirability of their diets, but the quantity of food intake and normal eating patterns were not substantially disrupted.

- Very low food security: At times during the year, eating patterns of one or more household members are disrupted and food intake reduced because the household lacked money and other resources for food.

The USDA, (2006) introduced the labels for ranges of food security in 2006 and for their purpose of the study, USDA describes households with high or marginal food security as food secure and those with low food security are considered as food insecure. Placement on this continuum is determined by the household's responses to a series of questions about behaviours and experiences associated with difficulty in meeting food needs. The questions cover a wide range of severity of food insecurity.

2.8 Land Management Practices

Ghana has a relatively large amount of cultivated land per capita; however, most lands are characterized by poor fertility and are subject to degradation. To sustain crop production increases and ensure food security, soil, nutrient and water resources need to be properly managed and conserved (Quansah, 1996). Hence, soil management is crucial to Ghana's economic development in several respects.

In August 2009, Ghana launched the Agricultural Sustainable Land Management Strategy and the reason was that the productivity of most agricultural lands in Ghana was below average and there were indications that the situation would continue to deteriorate due to

increasing land degradation including soil fertility decline and erosion. This can be implemented by adopting both traditional and modern technologies. These technologies include mixed farming mixed cropping, composting, shifting cultivation and Sustainable land management practices such as soil and water conservation, soil fertility management, controlled-grazing. Other land management practices also introduced were applied by some Ghanaians farmers on their farm levels.

However, the impact of those efforts did not curb the impact of land degradation in a meaningful and sustainable manner. Various reasons are often given for the lack of success. Among these the most commonly cited factors include failure to consider indigenous land management practices, high initial costs which are not affordable to poor farmers and also trying to apply uniform techniques in different agro ecological regions (Aklilu, 2006).

An insecure land tenure system, difficulties in accessing credit, and poorly functioning output and input markets significantly lower the incentive for farmers to adopt such practices (Diao and Sarpong, 2007).

Moreover, limited knowledge on the extent, impact and costs of land degradation, and on the benefits of SLM, together with a lack of systematic information on the requirements of SLM practices and the applicability of such practices to the diverse agro-ecological zones of Ghana, further constrain the dissemination of suitable land management practices (World Bank, 2006).

The SLM techniques in soil and water conservation traditionally applied to degraded lands in Ghana have mostly involved moisture and fertility management measures including afforestation/agro-forestry, mulching, cover cropping and contour vegetative barriers, and relatively inexpensive physical structures such as ridge-furrow systems, stones lines, tied-ridging and contour bunds. These are used as control measures for run-off/erosion (Diao *et al*, 2007).

Mando (2000) said when stone bunding is properly installed, it can result in a tremendous positive impact on soil properties and on crop production. For instance, it is estimated that in Burkina Faso, stone bunds alone could increase sorghum yields on very degraded soil from 350 kg/ha to 515 kg/ha and that yields could be further increased to 630 kg/ha by adding 1.7

ton/ha of 23 organic manure, to 700 kg/ha by adding 150 kg/ha of inorganic fertilizers and to 850 kg/ha by adding both.

Mulching, cover-cropping and contour vegetative barriers, on the other hand, are soil structure/soil fertility improvement measures. For example, mulching, where leaves straw or some other organic matter are left on the field, is very effective in improving soil physical properties, obstruct water runoff and increase water infiltration, and also protects the soil against heavy rains, preventing land crusting and contributing to soil organic matter and nutrients (Diao and Sarpong, 2007).

There are several economic benefits associated with mitigating land degradation using these SLM techniques. Quansah (2001) has reviewed results of several studies on soil, water and fertility conservation practices in ameliorating soil loss in various agro ecological zones and their effects on crop yields in Ghana. Traditional SLM interventions can be used in various agro ecological zones of Ghana to enrich agricultural soil loss, and their effects on crop yields. For instance, the application of organic matter in the Guinea Savanna, Transition and Semi deciduous forest zones could reduce soil loss and increase crop yields by more than 50 percent. Again, zero tillage with herbicide application in various agricultural ecological zones could increase (crop) yields by more than 50 percent over the traditional slash and burn approach, increasing net financial benefits by between 58 and 98 percent (Amponsem *et al.*, 1998).

According to Agyenim (1997), leguminous crops such as mucuna, groundnuts and cowpea which can be used as cover crops in the various ecological zones to control weeds and increase soil nitrogen by 0.14% to 0.18%, can increase grains yield by 86%. He further added that groundnuts cultivated in guinea savanna zone will reduce soil loss by 94% and run off by 70%. Practicing strip cropping or mixed cropping is to increase

production from the land while providing protection of the soil from erosion. For example, maize-cowpea or millet groundnuts cultivated on the same piece of land will go a long way to reduce soil loss by 92% and run-off by 70% (Quansah *et al.*, 2001). The leguminous crop fixes nitrogen which becomes available to plants when the residue is incorporated in the soil. The multi- canopy structure of the intercrops provides protection of the soil against raindrop impact and reduces runoff and erosion (field survey, 2015).

Mulching which is also a sustainable land management practice when practiced in the guinea savanna will help reduce soil loss by 90% (Quansah *et al.*, 1997). According to Gyasi (2003) realized mulching reduces loss of water by evaporation; keeps down weed growth and dampen the surface temperature of soil. It controls erosion by protecting the soil against raindrop impact and reduces both the detachment and dispersion of soil particles and the flow velocity of runoff and also enhances soil productivity through increased organic matter content, soil moisture storage, soil aggregate stability and reduced nutrient loss. In addition, plant nutrients are improved through the use of manures which have a remarkable soil conserving ability. The organic matter improves soil aggregate stability and water holding capacity which also reduces soil erosion and enhance soil moisture conservation.

Lawra District which is noted to be one of the districts seriously affected by land degradation has led to the introduction of the GERMP in the district. This started five years ago by the EPA and the aim is to train smallholder farmers on sustainable land management practices such as the use of legumes as cover crops to retain soil moisture and prevent soil erosion, rearing of drought resistant animals such as goats, poultry, or drought resistant crops, early maturity and developmental projects given to communities as incentives for practicing SLM.

The implementation of the project brought about significant changes in the growing of crops for the past two years. Table 2.1 shows increase in crop yield and livestock after the project implementation.

Table 2.1 Targeted Crop Areas of Major Crops (2010)

CROP	CROPPED AREA (HA)	PRODUCTION (MT)	ESTIMATED YIELDS PER HECTARE	BENCHMARK DATA FOR CROPS
Maize	4,680	4.680	1.00	
Millet	25,088	17,920	1.40	
Sorghum	52,563	47,784	1.10	
Groundnut	38,861	24,288	1.60	
Cowpea	4,719	4,290	1.10	

Source: MoFA, (2015)

Table 2.2 Major Livestock Species and Population

LIVESTOCK	YEAR 2009	YEAR 2010	YEAR 2011
Cattle	5,451	5,723	6,009
Sheep	8,547	8,974	9,422
Donkey	213	217	221
Goats	20,849	21,891	22,985
Pigs	7,522	7,891	8,285
Poultry	43,260	45,423	47,694

Source: MoFA, (2015)

Increment of livestock numbers could be as a result of no major disease outbreak since 2009 and improved livestock health care delivery. The livestock sub-sector continues to make steady but moderate gains as it is now becoming the most lucrative investment in the midst of low income levels emanating from low crop production. Goat, Sheep and poultry production seem to lead the production level because these animals are said to be resistance to drought and it is easier feeding them during the dry season.

2.9 Theoretical Framework

Theoretically, a derivative of production function analysis was adopted to estimate the effects of land management practices on food security through crop yields. A basic practical assumption in the context of food production systems in Ghana is that farmers have a range of land management practices available to them, both within and across ecological zones. One way to measure the effects of such land management options is to include these management practices in the production function as variables, separate from physical inputs as postulated by Ali (1996).

The equation used for the estimation is given (in natural logarithm except the dummies) as: $Yi = 0 + LLi + K\,Ki + S\,Si + B\,Bi + P\,Pi + FFi + R\,Ri + AAi + M\,Mi$

Where Yi is the yield of crops (kg/ha), Li is Labour (man-days), Ki is Land size (ha), Si is Slash and burn (practice = 1, and 0 otherwise), Bi is bush fallow (i.e. if the farmer practices bush fallow; practice = 1, and 0 otherwise), Pi is the length of the bush fallow period (in years), Fi is fertilizer use (kg/ha), Ri is row planting technology (practice = 1, and 0 otherwise), Ai is practice of agro-forestry (practice = 1, and 0 otherwise), and Mi is practice of mixed-cropping (practice = 1, and 0 otherwise).

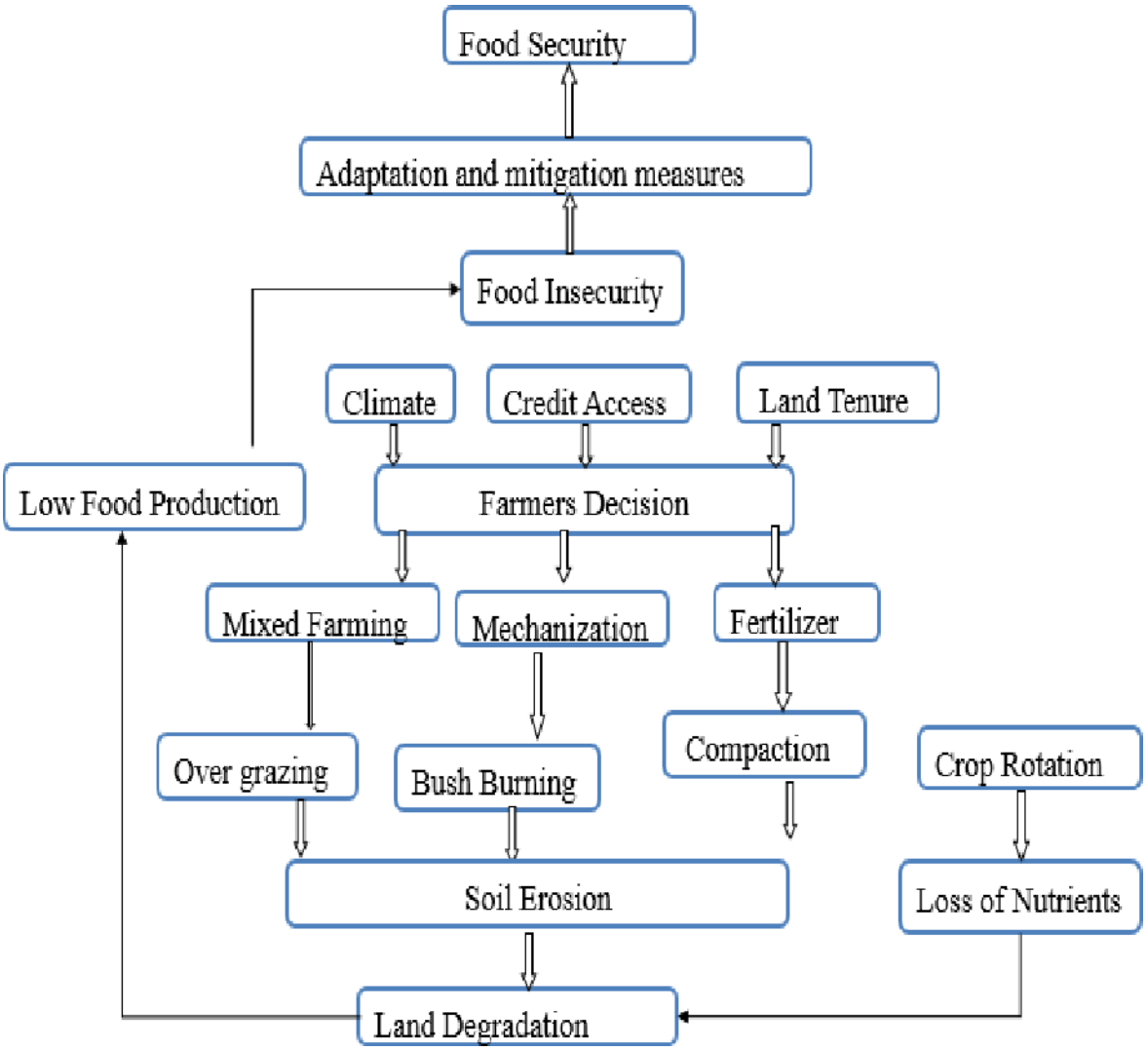

Figure 2.1: Conceptual Framework

Source: Adapted from Ali (1996), Boserup (1965), Ostrom (1990) and De Janvry *et al.* (1991)

To address the objectives and the research issues identified, figure 2.1 is developed as a conceptual framework that serves as a guide during the various research activities. The conceptual framework for this research on land management draws from theories of induced technical and institutional innovation in agriculture that explain changing management systems in terms of changing incentives facing farmers as a result of changing relative factor endowments (Boserup 1965). Additional variables that are also important determinants of

resource management have been included, inspired by theories of collective action (Ostrom 1990) and agricultural household models (De Janvry *et al.*, 1991). From Figure 2.1, climate, credit and land tenure in the district are the major issues that have force farmers to decide on the method of farming to bring about food security in their homes. Some of the decisions farmers make is either to practice mixed farming, mechanization, the use of chemical inputs and crop rotation to increase food production.

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 Introduction

This chapter comprises the profile of the study area, techniques and procedures employed in carrying out the study. It also gives a detailed description of the research design, data requirements for the study as well as sampling procedures for data collection and mode of analysis.

3.2 Profile of the Study Area

3.2.1 Location and size

The Lawra district is one of the Eleven (11) Districts in Upper West Region and derives its legal existence from Legislative Instrument (L.I) 1434 of 1988. It lies in the North Western corner of the Upper West Region in Ghana between latitudes 2º 25' W and 2°45' W and longitudes 10°20' N and 11°00' N (Figure 3.1). The District has its administrative capital at Lawra. The District shares boundaries with Nandom District to the north, Jirapa District to the south, Ivory Coast to the west and to the East with Lambussie-Karni (RCC-Wa, 2013).

The study was conducted in Furo, Kampouh, Kalsagri, Paavu, Zakpeh and Gbireh communities of the Lawra. Figure 3.1 represents the map of the Lawra District showing major villages and the five selected communities.

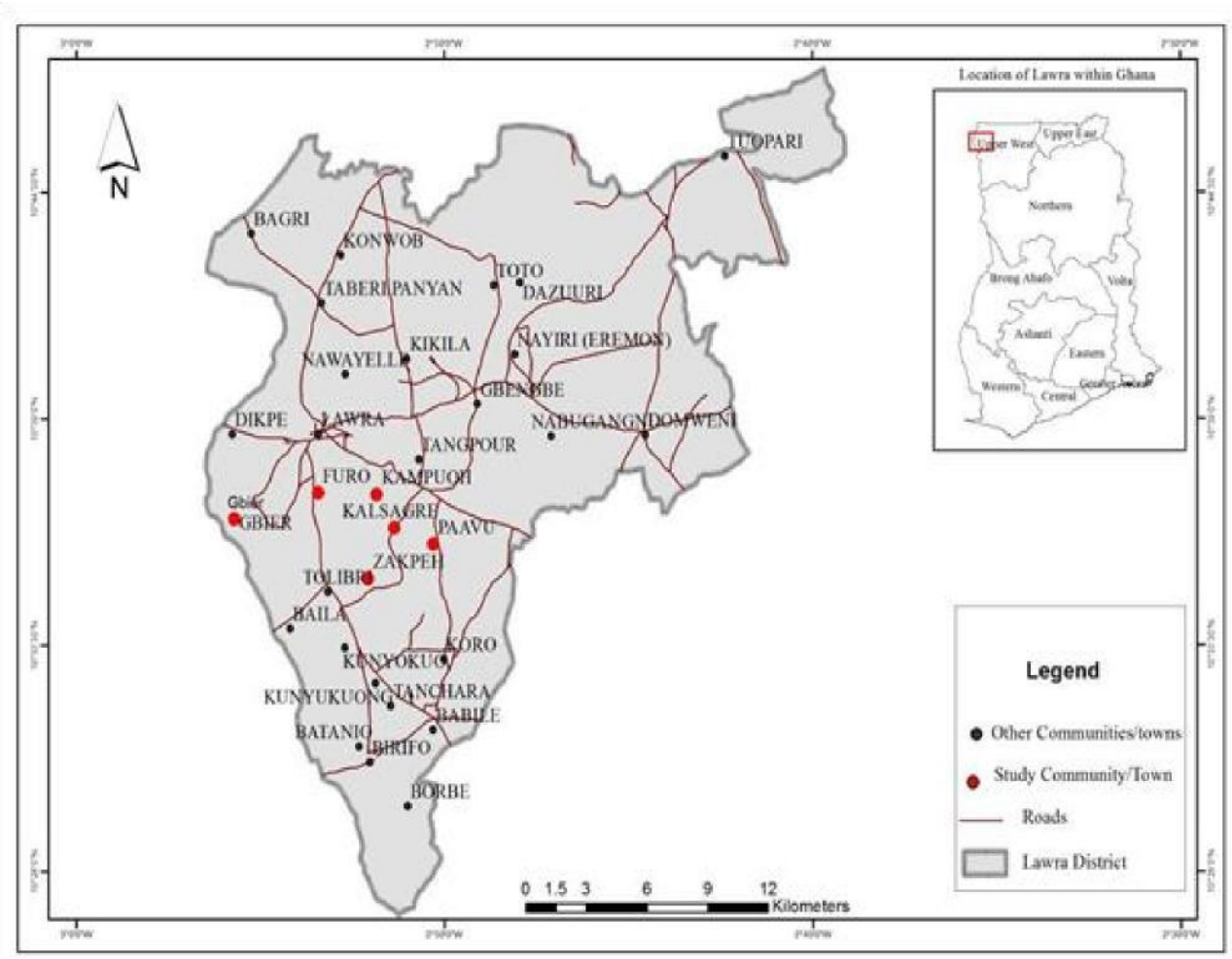

Figure 3.1: Map of Lawra District Source: Author (2015)

3.2.2 Population

The 2010 National Population and Housing census results show that Lawra has a population of about 100,929 with 48,641 and 52,288 with 157 communities in the district Ghana statistical services (GSS, 2010). There is increase in population of the district which has kept pressure on natural resources particularly land for agricultural production as well as socioeconomic facilities (DPCU, 2013).

The growth rate of the District is 1.7 %. This is however below the national growth rate of 2.7%. The current estimated population of the district as at December 2010 stood at 102,100 comprising 54,294 women and 47,806 men, (DPCU, 2010).

3.2.3 Topography and Drainage

The landscape of the district is generally flat and low-lying with few hills ranging between 180 and 300 meters above sea level with isolated round hills (inselbergs) dotting the landscape. This is a feature associated with the Lawra – Tumu high Plains. The area is underlaid by Birimian rocks high in minerals deposits with strips of alluvial soils along the flood plains. It is drained by the main river – the Black Volta, to the west making a boundary between the district and the Republic of Burkina Faso. The Black Volta has several tributaries in the district; notable amongst them are the Kamba/Dangbang, Nawer, Duodaa and Kokoligu-baa. These if utilized, could offer an agro-based employment for the youth who migrate to the south in search of non-existing jobs during the dry season.

3.2.4 Geology and Soil

Geologically, the rock formation in the District is essentially Brimian with dotted outcrops of granite. The District mineral potentials largely unexplored. However, recent mineral prospecting in the area indicates the presence of Gold in appreciable quantities worth mining. As a result of a well-developed fracture pattern in the rocks, the potential for obtaining ground water in the district is very high. This accounts for the 90% success in borehole drilling activities in the district.

The soils in the district consist mostly of laterite soils. There are also strips of alluvial soils along the flood plains of the Black Volta as well as sandy loams along some of its tributaries.

3.2.5 Climate

The climate of the district is tropical continental type with the mean annual temperature ranging between 27°C to 36°C. The period between February and April is the hottest. Climatic change of late, however affects the weather pattern. Between April and October, the Tropical Maritime air mass blows over the area which gives the only wet season in the year. This results in the district having one farming season and hence the migration of the youth to the south across the Black Volta during the dry season.

3.2.6 Vegetation

In terms of vegetation, the District lies within the Guinea Savannah Zone which is characterized by short grasses and few woody plants which makes the land very bare thereby promoting wind erosion which removes the top soil. Common trees in the District consist of drought and fire resistant trees such as Baobab, Dawadawa, (*Parkia clappertoniana*) and Shea trees (*Butyrospermum paradoxum* subsp. *parkii*), Ebony (*Diospyros mespilliformis*), Acacia and other trees of the berry family (Soil Conservation and Water Management Division, UWR, unpublished). As a result of annual bush fires, the vegetation has been degrading.

The vegetation is very friendly for livestock production, which contributes significantly to household incomes in the District. The greatest influence on the vegetation is the prolonged dry season. During this period, the grass becomes dry and the subsequent bush burning leaves the area patchy and mostly bare of vegetation. Consequently, the torrential early rains cause soil erosion. Bush burning reduces the vegetative cover and transpiration and this affects average annual rainfall totals.

3.2.7 Environmental Situation

Human activities such as bush burning, tree felling for fuel, sand and gravel winning and, of recent, small- scale mining, contribute greatly to the destruction of the vegetation and consequently the environment.

Furthermore, the poor farming practices such as slash and burn, shifting cultivation, and also farming along the banks of streams and other water bodies are being practiced by farmers in the Region. The impact of these human activities on the natural environment has been the loss of vegetation cover, soil erosion, and reduction in soil fertility, desertification and loss of wildlife.

Road and dam construction further increase the land degradation. The activities of Fulani herdsmen, through the open grazing of livestock, also affect the natural environment. The current urbanization and growth of existing and new settlements imply that agricultural and grazing lands are being used up (UWR-MOFA).

3.2.8 Agriculture

Agriculture accounts for 80% of the District economy. Commerce /service and industry account for about 18.2% and 0.8% respectively. It is estimated that 83% of the population are engaged in subsistence agriculture with the aim of producing food for family consumption and the surplus food for sale, but this has not been sustainable due to the poor nature of the soil and unfavourable weather conditions coupled with poor farming practices which leads to food insecurity in the district. Animal farming, especially poultry rearing is a lucrative venture in the District. Fishing also goes on along the Black Volta and its tributaries to supplement the meager income of the families of farming communities along the river. The crops suitable and cultivated in the district include maize, millet, sorghum, cowpea,

groundnuts and soya beans. In the animal sector, production and rearing of animals include cattle, sheep, goats, pigs and poultry. However, production can be best described as "large scale subsistence farming.

3.3 Research Methodology

Selecting the appropriate methodology for any research study is very critical to the researcher, this will help to evaluate the data source and detect inconsistent answers. In view of this, suitable methods were employed to improve the research process and data quality. These include the research design, sampling techniques, data collection techniques, data analysis and presentation. According to Burns and Grove (2003:488), methodology includes the design, setting, sampling, methodological limitations, and data collection and analysis technique in the study.

3.3.1 Research Design

The research design is a plan, structure and strategy of an investigation conceived to obtain answers to a research question or problem, the plan is supposed to be a complete program of the study and usually outlines carefully what the investigator intends to do from hypothesis to analysis (Kerlinger 1986). It is a "blueprint" for empirical research aimed at answering specific research questions or testing specific hypotheses (Bhattacherjee, 2012).

This study used cross-sectional field survey to collect data on managing degraded land for food security from respondents. Both qualitative and quantitative research designs are used in the study to enriched data collection and analysis.

Qualitative research methods were used as the tool for addressing the objectives of this study. The practice of qualitative research and the application of its diverse techniques do not privilege any particular methodological approach. Also, qualitative research is very interpretative in nature (Hesse-Bieber and Leavy, 2004; Denzin & Lincoln, 2005).

Interpretations are done through the observance of meaningful interactions that are created by the connotations social actors attach to their everyday interaction practices (Hesse- Bieber and Leavy, 2004). Qualitative research holds and thrives on this interpretative diversity resulting from the different backgrounds and worldviews that the various researchers and social actors possess.

Silverman (2005) proposed that qualitative methods are suitably placed to help answer questions that require in-depth explanations and description. The study accepts the qualitative approach since it seeks to offer detailed description and also find out how farmers managed land degradation to improve food security. It seeks to provide an understanding of the relationships between land degradation and food security and measures put in place. (Hancock and Algozzine, 2006).

A quantitative approach in general is a set of organized and controlled procedures, used to obtain information. The information gathered is generally (but not always) quantitative (that is, numerical information which results from formal measuring and which is analyzed through statistical procedures). Quantitative research is used to answer questions about specific relationships among observed variables (food security, land degradation and land management practices) with the intent of explaining, predicting, and controlling phenomena (Creswell, 2009). This type of research, although harder to design initially, is usually highly detailed and structured and results can be easily collated and presented statistically.

3.3.2 Data Collection Sources

Data collection techniques help researchers to effectively collect information on the research topic in order to achieve the set objectives. Millar (1991) listed primary and secondary source of data collection as the main approaches in gathering social research data.

The purpose of the study, available resources, and skills of the researcher, demographic characteristics of population and other socio-economic factors spells the choice of approach to command cooperation from respondents; the researcher needs to take into consideration the social and cultural dynamics of the study area.

This research work has combined the two types of data collection. Primary data collection techniques through the generation of data from the field included the useful available information, interviewing (face to face) and administering written questionnaire, focus group discussions and field visits and surveys.

The research relied on available literature which is relevant to the study so as to have understanding of the topic to enable effective data collection needed for the research. This was done by organizing interviews to respondents such as household respondents, and the key informants such as staff of the EPA, GERMP and FAO by using semi structured questionnaire which increased the comprehensiveness of the data that made the data collection more systematic. Face to face interview was also used for household respondents in administering the questionnaire verbally, whilst questionnaire was handed over to key informants to answer them at their free time to enable the researcher save time and energy. Some farm lands were surveyed to identify the methods adopted by farmers in managing a degraded area to increase food and also find out about the extent of degradation of their farm lands and type of erosion. Satellite images were also used to find out the extent of degradation within the study area and what the major causes were.

Satellite imagery provides a quick and cost effective way of detecting changes on the earth surface over time. It covers larger areas over several thousand kilometre squares and in different resolutions and in multi band form, which provides Users with choices as to the type of image to use. However, this depends on the purpose of work. For instance, using a low

resolution or high resolution image depends on the type of work one is using the image for. While large area observation such as monitoring forest cover of Nations or continents may require low resolution images, land cover change detection of towns and cities may require medium to high resolution images for analysis.

In this work, medium resolution Landsat thematic images bands 2, 3, 4 and 5 were acquired from www.usgs.gov, for the year 1991 and 2014 respectively. With Erdas Imagine 9.2 software, the different bands of the various years (2, 3 and 4) were stacked to form single multiband images for the respective years. After sub-setting Lawra District and performing contrast stretches on the images, supervised classification was performed for the respective images, using ground truth data to aid in selecting clusters for the various classes. The classification made use of the maximum likelihood classifier because it considers not only the cluster centre but also the shape, size and orientation. This is achieved by calculating a statistical distance based on the mean values and covariance matrix of the clusters. The statistical distance is a probability value: the probability that observation belongs to a specific cluster. The pixel is assigned to the class (cluster) to which it has the highest probability. Five different land cover/land Use classes were defined and used for the 1986 image: Water, Closed Savanna, Open Savanna, Bare ground and Settlement.

These classes are herein defined as follows: Water includes all open water bodies such as rivers (black Volta and its tributaries), Dams, streams among others; Closed Savanna is defined as a more uniform vegetation with high density of chlorophyll as can be seen in the greenness of the leaves; Open Savanna includes a less thick vegetation such as scattered trees and patches of grass; Bare ground refers to all bare fields which vegetative cover has been taken off such as playing fields, untarred roads, sand winning areas and barren lands that does not support the growth of vegetation. Settlement refers to all built-up area including residential houses, social infrastructure, markets and all

man-made structures within the

District. Accuracy assessment was performed on the 2014 image to determine the magnitude of error introduced by the producer in assigning various clusters to the respective classes and by the user in collecting ground truth data as reference. And overall accuracy of 75.78% was achieved after the accuracy assessment and a kappa statistic of 0.56. This informed the researcher to accept the results of the classification since the overall accuracy was far above average (75%). Finally, the classified images were exported to ArcMap 10.1 and a map layout (figure 4.2) was produced.

3.3.2.1 Secondary Data

Data from these sources were gathered from published journals, books, speeches, news papers and internet sources pertaining to subject area. Secondary data was collected from food and agriculture respondents in the study area. Data obtained from these respondents included causes of land degradation, the impact of land degradation on food security, sustainable land management practices adopted by farmers in the study area as well as the general food production in the study area. Journals also provided data on the population, types of land degradation, maps and the major food crops and livestock produced in the study area. Information on the activities of the GERMP project in mitigating the impacts of land degradation were also obtained from journals and the GERMP consultant. Satellite images showing the extent of the degradation were obtained using medium resolution Landsat thematic images bands 2, 3, 4 and 5 which were acquired from www.usgs.gov, for the year 1991 and 2014 respectively. With Erdas Imagine 9.2 software, the different bands of the various years (2, 3 and 4) were stacked to form single multiband images for the respective years.

The use of this source of data, key informant interview was an important technique to gain access to available data. A merit for using this data source is that it made the

collection inexpensive, however, it is sometimes difficult to gain access to reports required thereby making the data incomplete which will end up retarding the progress of the work.

3.3.2.2 Sampling Techniques

Sampling is a major concern for all researchers. It is impossible to study a whole population because time and finance will be a hindrance to the work. Every scientific enterprise tries to find out something that will be applicable within the study area or generalized (Becker as cited in Neuman, 2003 and Tanko, 2006)

Peil *et al*, (1982) explains sampling as selecting part to represent a whole. For the purpose of this study sampling refers to the process of selecting samples (units) from sample population. There are two main types of sampling. Probability and non-probability sampling techniques and this was used for this study because probability goes with quantitative while non-probability goes with qualitative data.

Both Probability and non-probability sampling techniques were employed. Probability sampling is the procedure in which the choice of respondents is guided by the probability principle, which says that every unit of the target population has an equal calculated and nonzero probability of being included in the sample (Sarantakos, 2005).

Probability sampling is the equal chances each member of the target population has of being selected. This type of sampling is used for a population which is heterogeneous in nature and the study population is not an exception. Due to the time, financial, logistics and among others, a population is sampled out (sample unit) from the sample frame to study and results obtained are being generalized. Examples of probability sampling that will be used for this include simple random sampling, stratified and systematic sampling.Simple Random Sampling was done by taking to account the fact that all the elements or individual in the population get equal chances of being

selected. Numbers were assigned to all the elements in the selected area. The assumption underlying simple random sampling is that the elements or the individual in the population are judged to be homogeneous (Twumasi, 2001)

This technique was used to randomly select three (3) GERMP communities and non GERMP using the lottery method, where the names of the communities were written on separate papers and folded into a basket, mixed together and the researcher picks one at a time for three times.

Systematic sampling was used to select houses in each community. Here the number of houses in each community divides the sample size already determined to give the interval. From each interval using simple random sampling (SRS) technique one house was selected (nth order house). Due to the random build of houses in the communities, a house was purposively selected a starting house and through an anti-clockwise movement every nth house was selected until the total sample size for that particular community was okay. The systematic sampling procedure for the selected houses is summarised in the Table 3.1.

Table 3.1: Selection of Housing Structure by Systematic Sampling

Community name	Number of household's sample f	Sample size	**Nth Order**
Kalsagri	152	66	Every 2nd
Kanpuoh	12	5	Every 3rd
Zakpeh	73	32	Every 1st
Paavuu	118	51	Every 2nd
Furo	47	20	Every 3rd
Gbier	126	54	Every 1st ho
Total	528	228	

On the other hand, non- probability sampling does not employ and any systematic technique in the choice of respondents meaning it does not ensure representativeness examples of non-probability sample includes snowball, purposive and quota sampling

3.3.2.3 Accidental / Convenience sampling

It is simple approach where a sample is selected according to the convenience of the researcher. This convenience may be in respect availability of data, accessibility of the subjects (Agyedu *et al.*, 2010). Accidental sampling was used to select one household respondent in every selected house because you can get more than one households in a particular house in the study communities. Any adult, either male or female who are 20 years and above available at time of visit to the house was interviewed on the subject area. This sampling procedure helped because it made access to sampled population convenient.

3.3.2.4 Purposive sampling

This type of sampling is chosen arbitrary on the basis of some characteristics possessed by the subject and deemed important for the research thus who can provide the best information with the aim of achieving the objectives of the study. The GERMP Communities and institutions like FAO, EPA who have the required information on the problem under study were chosen purposively.

Owning to the haphazard built houses in rural communities, the researcher purposively selected a starting house and through a circle movement every nth order house was selected until the sample size for that particular community is reached.

Furthermore, 30% of household respondents were randomly selected for each community base on the total number of household in the community which facilitated the collection of data.

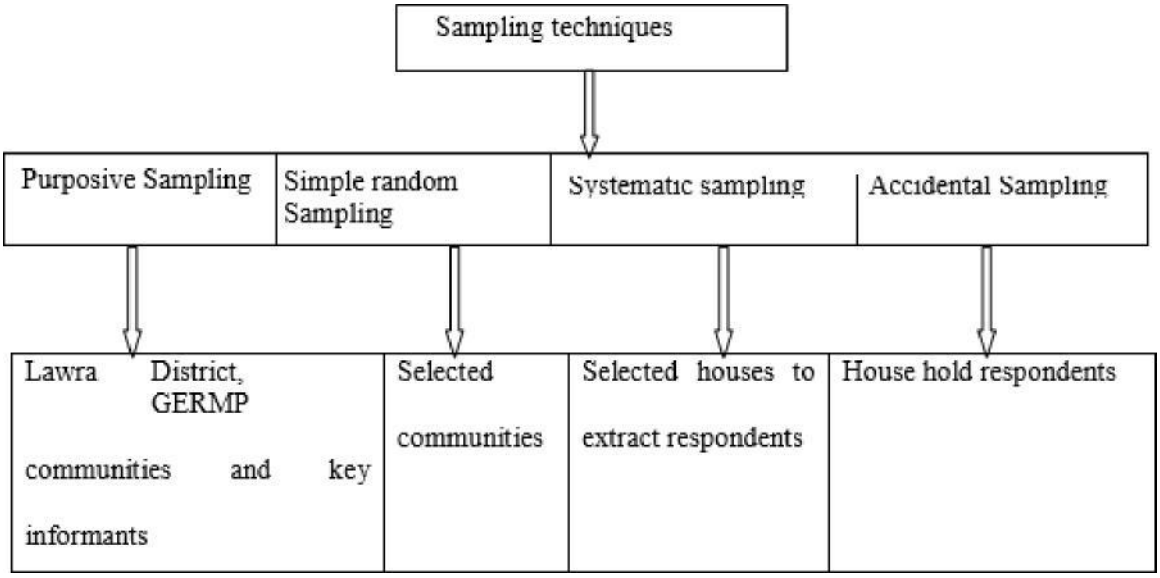

Figure 3.2: Sampling Techniques used in this study

3.3.2.5 Sample Frame and Sample Size Determination

The sample frame is made up of the total number of households identified in the six communities that are selected. To determine the sample size, a statistical formula by Yamane (1967: 886 as cited in Israel 1992) was used. The formula is stated as:

$= / [1 + ()^2]$

Where;

n = is the sample size, N = is number of households (sample frame) = 528, e = the level of precision, at confidence level of 95%, the value of e is 0.05 and 1 = is a constant.

Substituting 528 and 0.05 into the formula: n = 227.58 ≈ 228. Hence, the sample size for the households is 228 which show 95% confidence interval or 5% margin of error was chosen because the sample value obtained was close to the true population value or mean since it was practically difficult to study the entire population for reasons of insufficient resources and time stipulated for the study.

The number of household respondents from each community was proportionately distributed taken into account the sample size and the total number of households in each community.

Cp = $\frac{\textit{Number of households in a community } xn}{\textit{total number of households}}$, where Cp refers to community proportion and refers to sample size. For example, Kalsegre a community with a total household size of 152 substituted into the formula: cp = 152×228, cp = 66. In this case the number of households that 528 were interviewed in that community 66. The same formula was used for the other communities.

3.4 Units of Enquiry

The units of enquiry for this study were household farmers under the GERMP and those who are not under the GERMP project who tried to manage the degraded land for food security within the district and institutions concerned such as FAO, and EPA were also contacted for information. The households were selected from communities in the study area. Respondent were either male or female household head or any able adult household member.

3.5 Methods of data collection

In order to achieve the objectives of this study qualitative method was used to collect data. Information relevant to the study was collected using the following: interviews, observation and focus group discussions held in each of the GERMP and Non-GERMP communities.

The questionnaire for this study touched on issues such as: personal particulars of respondent; agricultural land use; perception on land degradation; land preparation; yield and effect of degradation; land tenure system and measures to combat land degradation in order to increase food security.

The total population of the communities was used as the sample frame. The respondents of the study were heads of families who are farmers. The proportion formula was employed to obtain the exact sample size distribution for each community to get the number of questionnaires administered in each community.

Research assistants from the study area were recruited during the study. This was to assist where there was a language barrier between the researcher and the respondents. The research assistants were first trained on questionnaire administration. Pre-testing of the questionnaire was also done on selected inhabitants of the study area in order to identify possible mistakes and difficulties that were to be encountered during the study.

I. Informal Interviews

Under this, open-ended questions were used on the stakeholders (Government and Non-Governmental Organizations) whose activities in one way or the other are related to environmental issues specifically land degradation and food security. Some of the organizations were the: Environmental Protection Agency (EPA), (District Officer); Food and Agriculture Organization (extension officer, district boss) GERMP officer in charge. Questions covered issues such as the extent of the degradation of arable lands, causes of land degradation, causes of food insecurity in the study area, and how they are managing the degraded land to improve food security.

II. Focus Group Discussions

Under this, group discussions involving a maximum of ten (10) people from each community were used. During the discussions everyone was given the chance to contribute to the issue raised. The target group here was the farmers from the respondents of the formal interviews who were selected (Subsistence farmers). The respondents were grouped in terms of males and females and favourable environment was created which made them express their views freely. During the discussions, two

groups were formed in each community except Konpuoh due to the small sample size in this community. Guided checklist was used in facilitating the discussions and equipment such as camera recorders, books and pens were used in recording the information which was later translated.

III. Field Visits and Field Observations

Field observations were used to throw more light on the causes and nature of the degraded land and the mechanisms used in managing the land through physical observation. During field visitations for the purposes of setting up appointments for interviews, observations of general environments were also noted.

These observations helped the researcher to understand the answers obtained from the respondents.

3.6 Data Analysis and Presentation

Information collected from respondents was edited, coded and in some cases tabulated for analysis. Editing was done to detect and eliminate errors commented during data collection. Conducted interviews were recorded and also translated. The analysis of data took into consideration qualitative and quantitative techniques. Qualitative data is normally analyzed by a procedure called content analysis in which data are grouped into mutually exclusive and comprehensive themes and sub-themes (Bell, 2004).

According to Wilson and Hutchinson (1986), content analysis is defined as method of analyzing qualitative data by counting the occurrence of specified units of analysis in the data. Also, data obtained from key informants and observations made were analyzed descriptively. On the part of quantitative data collected, statistical application techniques were used to analyze and compare data collected.

Data collected was analyzed with the use of the Statistical Package for Social Scientist (SPSS) and presented using tables, graphs, charts, pictures and diagrams.

CHAPTER FOUR

ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the research findings with detailed analysis and discussions supported by scholar's opinions on land degradation, its causes and effects on food security as well as the various land management practices in the Lawra District. The chapter is divided into three parts. The first part assesses the socio-economic characteristics of households and how they influence land degradation. The second part provides an assessment of the nature and causes of land degradation and food security. Lastly, the third section examines how land degradation is being managed for food security in the Lawra District.

4.2 Demographic Characteristics of Respondents

The following demographic characteristics of households 'presented here are sex, age, and educational background and occupation. The aim is to determine how these characteristics influence practices that affect land degradation and food security in the Lawra District.

It is evident from Table 4.1 that, 68% of the respondents were males with females constituting 32% as household heads. The results indicate that majority of the households are headed by males. However, a substantial number of the households are also headed by females. Hunt (1997:26 and 71) reveals that women who provide for basic needs such as food, shelter and clothing have the idea and knowledge of the state of the environment and sustainable land management strategies.

The results may therefore suggest that women should be recognized in that area and should be given the chance to take part in decisions regarding the sustainable use of land for food production.

From Table 4.1, the age group 40-49 recorded the highest respondents of both males and females but the age group 20-29 had the lowest respondents for males while the age group 30-39 recorded the lowest for the female's respondents. The low number of respondents among the age groups 20-29 and 30-39 was attributed to rural urban migration where members of these age groups migrate to the southern parts of Ghana to engage in various economic activities during the dry season. In general, 31% of the total respondents interviewed were in the age group 40-49 with the age group 20-29 being 11%.

Communities	Gender of Respondent	Age of Respondent					Total
		20-29	30-39	40-49	50-59	60+	
GERMP	Male (%)	2.63	7.5	8.77	5.26	8.77	**32.89**
	Female (%)	0.88	0.44	5.7	3.95	1.32	**12.28**
Non-GERMP	Male (%)	3.95	6.58	10.96	8.33	4.82	**34.65**
	Female (%)	3.07	3.07	5.7	4.82	3.51	**20.18**
Total (%)		**10.53**	**17.54**	**31.14**	**22.37**	**18.42**	**100**

Table 4.1: Gender and Age Distribution of Respondents

Source: Field Survey, May 2015.

From the study, 81% of the respondents were within the productive age group of 20-59 years whereas the remaining 19% were either below 20 years or above 59 years; hence majority of the respondents are capable of undertaking economic activities that enables them to make ends meet thereby impacting negatively or positively on the environment.

It also suggests that there is labour available for the implementation of appropriate land conservation technologies in the two groups of communities which will not be a challenge. The correlation between productivity and age has been posited by the life

cycle hypothesis of human capital theory (Johnson *et al.*, 1997). This predicts that in the early life cycle, productivity increases with age and then decreases with age late in the life cycle as human capital depreciation surpasses investment. Generally, the productive age is normally considered to be between age 18 and 49 (Johnson & Neumark, 1997).

4.3 Level of Education and Knowledge of Land Degradation

The educational background of respondents is significant to this study because it largely determines human capital which enhances their livelihood strategies in order to achieve desired livelihood outcomes. Investments in formal education and skill acquisition increase livelihood alternatives as Caldwell (1974) asserts that formal education offers individuals with great prospects and contributes to participation in formal employment. Thus educational level has an important influence on the level of inhabitants' knowledge of land degradation in the Lawra District. Figure 4.1 shows the level of formal education of respondents with respect to their perceptions of land degradation.

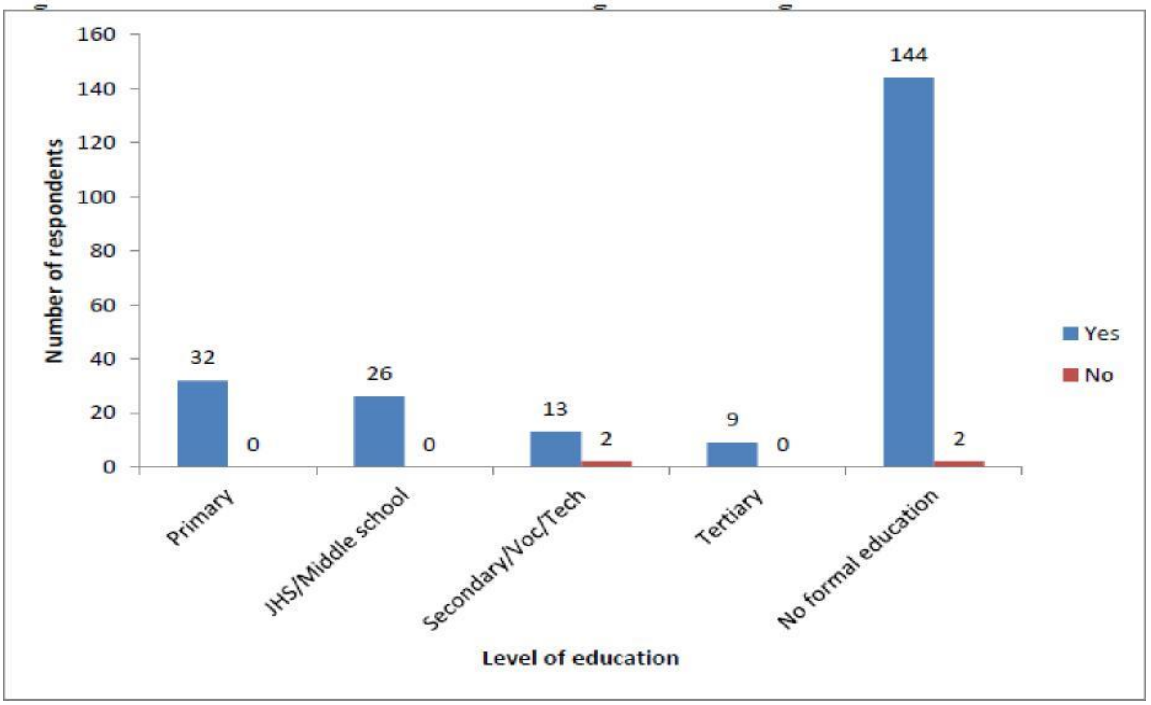

Figure 4.1: Level of Education and Knowledge of Land Degradation

Source: Author (2015)

From Figure 4.1, the knowledge of respondents about land degradation in the Lawra district was as high as 98.2%. However, it is realized that some respondents (1.8%) with secondary/vocational/technical and no formal education perceived that land degradation is not occurring in the district and hence may engage in activities that cause land degradation. This could be an indication that majority of the respondents may adopt land management practices to protect the land from degradation. This assertion contradicts Adugna (2005) findings that increase in the educational status of a households tend to increase the transfer of relevant information and as a result increase farmers' knowledge about the cause, severity and consequence of land degradation and how to tackle it to bring about food security. This was revealed from the focus group discussion held in Pavuu as a woman claimed:

"... I have not been to school, not even primary one but I have knowledge of land degradation because I have seen some changes in the land we farm on. The soil colour used to be dark but now it is brown"

4.4 Nature and Causes of Land Degradation

Growing demands of human society for economic development and expansion of settlements as a result of increasing population is driving unprecedented land use changes that have resulted in land degradation. For instance, soil erosion, nutrient depletion, extinction of wild life species which are attributed to human activities has rendered most of the respondents' food insecure. The farmers may be aware that degradation exists, but the process of land degradation cannot be admitted by mere observation until there are clear signs of the effects. This was based on their perceptions and interpretation of indicators that reveal certain conditions regarding crop cultivation and pastureland. In other words, to the local farmer, degradation is tantamount to its effects and this confirms the FAO (2008) finding that most

people perceive land degradation as a threat only when it affects their livelihoods. The results also agree with Dejene *et al* (1997) that farmers are aware that soil degradation is taking place on their farms at various levels as well as in the surrounding areas.

4.4.1 Nature of Land Degradation in the Lawra District

Land degradation usually occurs through natural processes (Johnson *et al.*, 1997) or by human induced processes (Arthur and Jeanette, 1995). Table 4.2 indicates the evidence of land degradation in the Lawra District as the study results reveals that, 36.9% of the respondents affirm that the most evidenced effect of land degradation in their communities is low crop yields which is largely attributed to low soil fertility rates as compared to 5.8% of the respondents who hold the opinion that the extinction of wild fruits shows the presence of land degradation. These 36.9% of the respondents harvested between 3-5 bags from an acre of land before the incidence of land degradation as compared to the 1 or less bags of cereals they harvest per acre after the incidence of land degradation.

Table 4.2: Evidence of Land Degradation in the Lawra District

Evidence of Land	**Communities**		**Total**
	GERMP	**Non-GERMP**	
	%	**%**	
Bare Lands	13.6	14.4	28
Erosion	13.6	11.2	24.8
Low Crop Yield	36.9	38.4	40.3
Extinction of Wild fruits	5.8	2.4	8.2
Deforestation	6.8	6.4	13.2
Nutrient Loss	3.9	4.8	8.7
Drought	19.4	22.4	41.8
Frus T**otal**	**100.0**	**100.0**	

Source: Field survey, May, 2015

According to the GERMP consultant in the district at the time of the research land degradation has been severe for the past 10 years and worsens annually through inappropriate human activities which have led to development of sheet erosion on sloppy areas and gullies in the valleys.

In addition, about 11.2% of the respondents from the non-GERMP communities were of the view that erosion is the evidence of land degradation in the Lawra District whereas 14. 4% see bare lands as the evidence of land degradation. These respondents expressed these views because bare lands are more exposed to various causes of land degradation. As evidence, most of these bare lands begin to develop gullies as result of erosion as noted by these respondents. About Twenty-two percent (22.4%) argue that drought is the major evidence of land degradation whilst the remaining 6.4% and 4.8 attribute land degradation to deforestation and nutrient loss respectively (Table 4.2). Respondents are of the view that drought, nutrient loss and deforestation often deny the land of vegetation cover or protection and as such expose it to degradation.

It is also realized that the destruction of land cover increased from 259.02ha to 999.36ha from 1991 to 2014 implying a percentage change of 5.66% (Figure 4.2). The increase in land cover destruction is due to the construction of dams totalling seventeen (17) to help reduce water shortages in the district. It has been observed that the construction of these dams led to clearing of trees and grasses which protected the land from eroding. The land cover for the closed savannah from 1991 decreased from 19035.99ha to 12496.32ha in 2014, implying a 50.0% increase in land cover destruction which was also attributed to the human population growth within the study area (Figure 4.2). This is because, in 1984, the population of the district was about 63,717 which increased to about 87,525 in 2000 and further increase to about 100, 929 in 2010. The continual increase in population has increased the number of settlement and farm lands around the district. The increase in the population has also made

people to engage in sand winning which also cause destruction to the land. This destruction was as a result of over cultivating on a piece of farm due to limited land available for farming. In Zakpeh community, a participant of the focus group discussion claimed that:

"... what I see to be an evidence of land degradation is the roots of giant trees in the community are exposed which shouldn't have been the case. The soil in my farm used to be black but now it is reddish in colour which i believe is the cause of low crop yields from my farm every year.

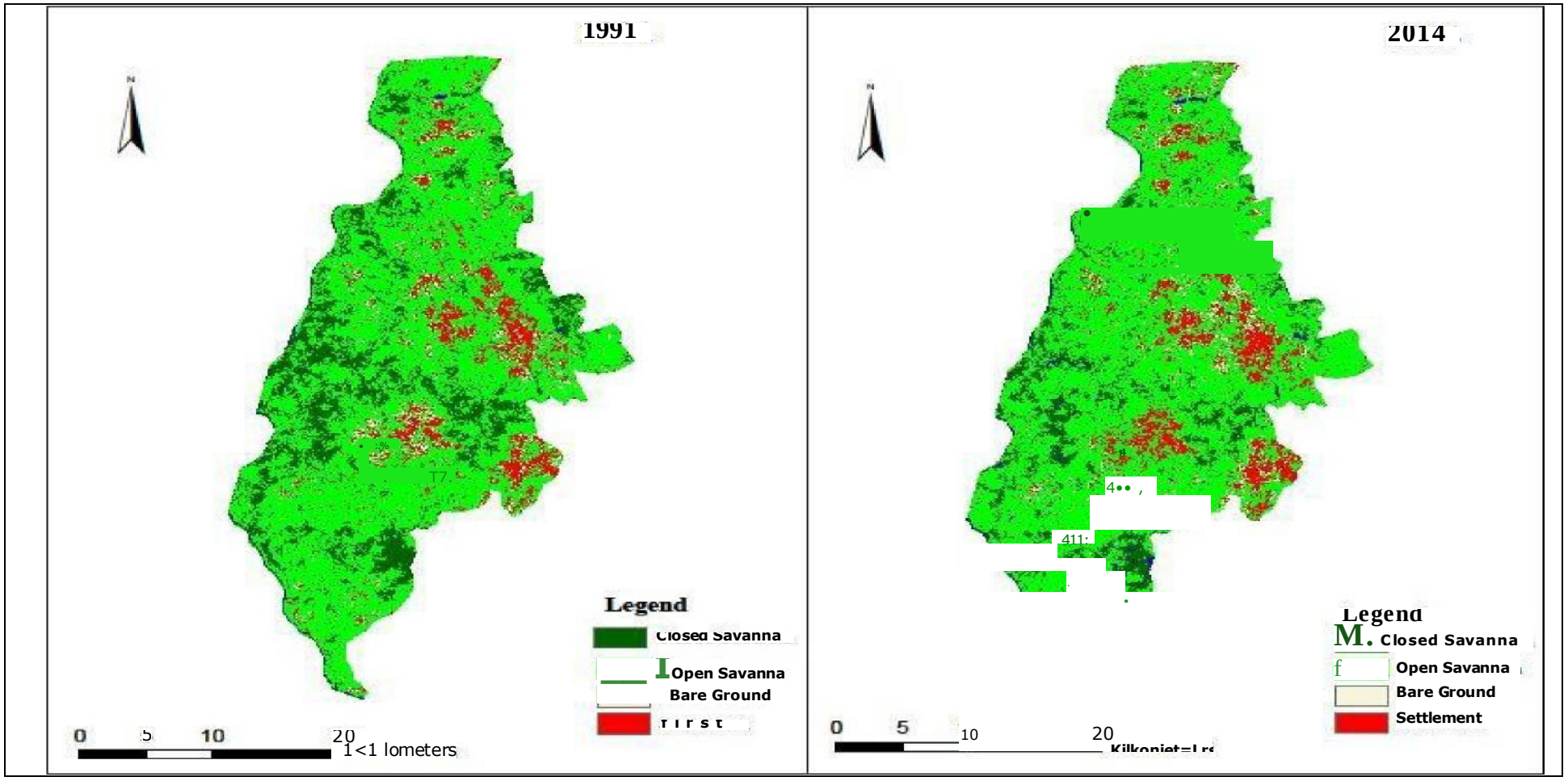

Figure 4.2: Land Use/ Cover Map for Lawra District (1991and 2014) Source: Authors construct with data from USGS.gov (2015)

Boserup (1996) and Turner *et al.* (1993) identified population increase as a push factor which compels farmers to intensify the cultivation of crops to increase food production. Figure 4.2 shows an increase in settlements, bare lands, open savannah and a decrease in closed savannah which is as a result of increase in the population of the study area. Based on the 2010 Population and Housing Census, the population of Lawra increased from about 87,000 in 2000 to 100,000 in the year 2010 (GSS, 2010) as against the fixed nature of land. To enable heads of household, meet the basic needs of the family especially in terms of food and shelter, the household head who is the farmer tries to clear more virgin lands for crop cultivation and construction of houses for the increasing population. Observations made at the study communities at the time of t h e visit show that most of the farms of the respondents are situated far away from where they stay and the reason given by an elderly woman of Kalsegra is that:

"..... some years back we used to farm around our houses and we get enough food to feed our family members, but now we have to move far away from our homes to look for fertile lands to farm".

Others also said that they did that to protect their share of land from being encroached and in trying to do all this few trees and grasses around are cleared making the savannah opened. Again the Open Savannah land cover destruction increased from 60927.66ha in 1991 to 64,991.43ha in 2014, implying a 31.07% increase in land cover destruction in the Lawra District (Table 4.3).

This destruction is attributed to the cutting of trees and clearing of virgin lands for farming purposes. Table 4.3 also reveal that there has been an increase of land cover destruction of 2,621.25ha in 1991 to 3,074.76ha in 2014, indicating a 3.47% increase in bare lands whereas an increase of 9.8% (7668.18ha in 1991 to 8,950.23ha) was realized in settlement as far as

land cover destruction is concerned. These bare lands results from bad farming practices of inhabitants of the district.

Table 4.3: Land Use/ Cover Change

Class Name	1991 (ha)	2014 (ha)	Change (ha)	Percentage of change (%)	Type of Change
Water	259.02	999.36	740.34	5.66	Increase
Closed	19035.99	12496.32	-6539.67	50.00	Decrease
Open	60927.66	64991.43	4063.77	31.07	Increase
Bare	2621.25	3074.76	453.51	3.47	Increase
Settlement	7668.18	8950.23	1282.05	9.80	Increase
Total	**90512.1**	**90512.1**		**100.00**	

Source: USGS.gov (2015)

From the discussion, the land use or land cover map indicates a vivid evidence of land cover destruction and degradation in the Lawra District. This evidence is partly due to the clearance of trees and other plant species in order to construct dams to supplement water shortages in the district.

4.4.2 Causes of Land Degradation

The causes of land degradation, as revealed by the study confirms Nachtergael *et al* (2011) claim that the slope of land, soil vulnerability to water as well as wind erosion influences the degradation processes of land and that factors, such as bush invasion, forest fires, floods, landslides and droughts, could be human involvement, while deforestation, over cutting of vegetation, shifting cultivation without adequate fallow period, overgrazing are classified as direct human induced factors. Figure 4.3, depicts the causes of land degradation in the Lawra District.

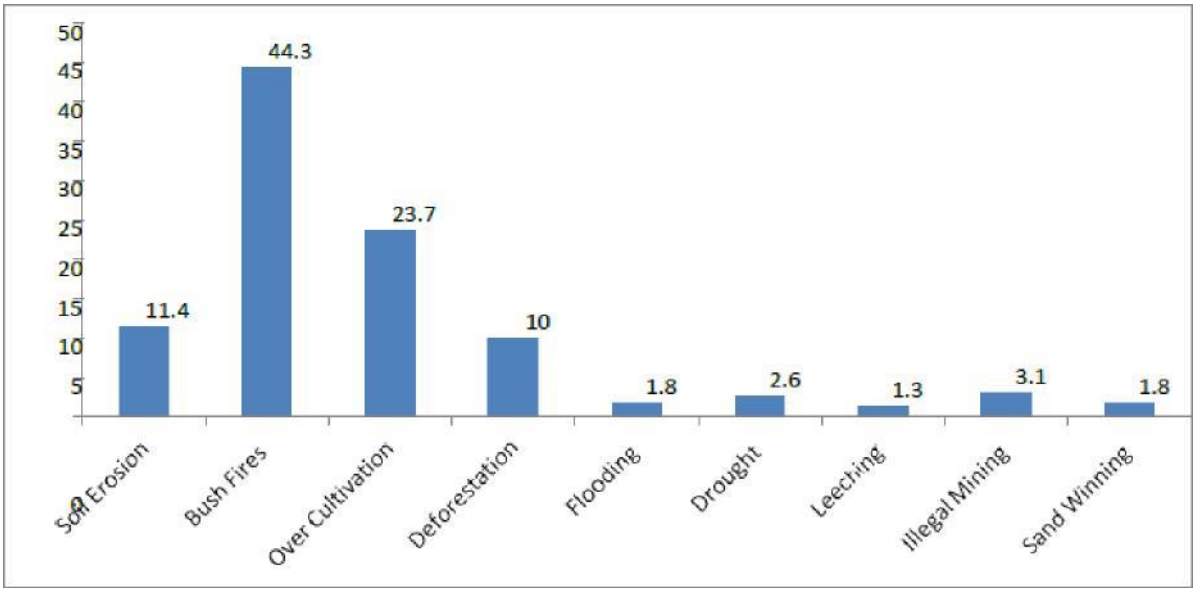

Figure 4.3: Causes of Land Degradation Source: Author (2015)

From the study, most of the respondents (44%) were of the view that bush fires are the leading cause of land degradation. They argue that fire is widely used in land preparation and indiscriminate burning in hunting game such as rats and rabbits while 2.6% of the respondents indicated that drought are the cause of land degradation since the vegetative cover often dries up and left bare for longer periods of time.

Bush fires impacts negatively on farm lands in the Lawra district. The annual burning of the bush has both socio-economic and environmental effects. In both GERMP and Non-GERMP communities, indiscriminate bush burning has been one of the major factors causing a change of forest into savannah and shrub lands. Fire produces immediate effects on aerial vegetation, which becomes evident by the total plant destruction and death. High canopy trees in the Lawra District usually escape ground fires because the vertical discontinuity of fuel prevents fire from reaching the canopies. Plant composition and soil fertility is also affected by fire in an indirect manner.

These findings support Nsiah-Gyabaah's (1996) finding that there is high incidence of bush fires in the Upper East and West Regions with 125 and 112 annual cases recorded respectively. The respondents attributed the causes of these bush fires to either natural or anthropogenic factors or both. Specific climatic factors, especially nature of the vegetation, and wind speed also play a role in land degradation. The study also confirms Millar *et al.*'s (2004), view that associates severe land degradation to high human population density and also high animal population density as causes of land degradation in Northern Ghana.

From the focus group discussions held with the GERMP coordinator and some beneficiaries of the project, it was revealed that over cultivation, deforestation excessive sand wining, population pressure, poor environmental governance in relation to law enforcement, immigration which increase demand for land, poverty among others also causes land degradation in the Lawra District. It was also revealed during the focus group discussion that overgrazing and cultivation equally cause land degradation since the inhabitants are predominantly farmers and animal keepers.

The study therefore acknowledges and upholds Lambin *et al.*'s (2003) and Van der Geest's (2011) postulation that apart from these causes of land degradation, there are some that are classified as deeply rooted drivers and they include population pressure, poverty, migration, lack of markets and infrastructure, poor environmental governance and weak institutional frameworks as well as inadequate education. The response of subsistence farmers in tackling declining land productivity in the Lawra District is always by abandoning degraded lands and clearing new land for cultivation.

Barbier's (2000) findings has been confirmed by this study in the sense that the process of land degradation will continue to repeat itself in a vicious circle with overgrazing and cultivation

causing land degradation, and then the search for new pasture and cropland, and since the human and animal population of the Lawra District increases geometrically, there will always be a search for crop lands and new pasture. Instances where population growth outweighs availability of land, people are forced to reduce the period for fallowing thereby making farmers to put more pressure on the available land causing depletion of soil nutrients. In simple terms, over cultivation leads to diminishing returns, where the yield decreases season by season, requiring an expansion of the areas to be cultivated simply to maintain the same return on the agricultural investment.

The removal of vegetation cover exacerbates and accelerates soil erosion which causes reduced soil fertility and eventually renders the land on productive; a situation that has often lead to the assumption that it is a human induced process which leads to the depletion of soil nutrients and a reduction of biological productivity.

Sand winning has also been identified as a cause of land degradation in the study area which could be attributed to rapid urbanization. Vast lands that were hitherto agricultural producing areas are rapidly being used for residential purposes. The direct effects of a fast expanding urban area in most African countries is the issue of sand winning activities, most of them illegal either within the city or close to it. This is in direct response to the many construction works that are taking place in these areas. Most of the illegal sand winning activities lead to land degradation, soil erosion, drainage obstruction and a general destabilisation of the ecosystem (Lambin, *et al.*, 2003).

Mining is a major economic activity in all parts of Ghana. Ghana mines Gold diamond and bauxite. The recent discovery of gold deposits around the Lawra District has resulted in increased activities of small scale miners which has the tendency to cause substantial environmental degradation due to the removal of forest covers and the discharge of byproducts of mining into water bodies. A number of respondents (3.1%)

have therefore identified illegal mining as one one the causes of land degradation in the study area (Figure 4.3).

According to Baartman *et al.* (2007), overgrazing is an excessive grazing by animals that leads to exposure of soil to erosion. Thus it involves the grazing of rangelands by animals at stocking densities above the carrying capacity. This mismatch leads to direct decline in the quantity and quality of the rangeland vegetation cover (Ahmad *et al.*, 2012). Reduction in rangeland vegetation cover eventually leads to wildlife habitat destruction and soil erosion.

4.5 Effects of Land Degradation

The physical environment of the Lawra District is affected by land degradation which often leads to excessive soil erosion usually accelerate by wind and rain water, loss of soil fertility through the destruction of soil structure, loss of wild edible fruits and low crop yields.

From Table 4.4, the study reveals that 45% of the respondents observed “very severe” degradation of the land which is evident in excessive erosion, extinction of plant and animal species, loss of land cover and nutrients whilst 42% of the interviewees claimed that land degradation is medium which is attributable to the fact that wild fruits are scarce but not extinct and accessing them is difficult.

The remaining 13% of the respondents asserted that there is minimal land degradation in the Lawra District which they attributed to drought and deforestation.

From Table 4.4, 44.7% of the respondents argued that erosion is the leading effect of land degradation in GERMP communities of the Lawra District whereas 48.8% of the

respondents are of the view that erosion is the major effect of land de gradation in t h e Non- GERMP communities.

Table 4.4: Effects of Land Degradation in the Lawra District

Effects of Land Degradation	GERMP %	Non-GERMP %	Total Respondents
Erosion	44.7	48.8	107
Loss of Soil Fertility	27.2	28.8	64
Loss of wild Edible Fruits	19.4	14.4	38
Low Crop Yields	8.7	8	19
Total	**100.0**	**100.0**	**228**

Source: Author (2015)

The respondents were of the view that the top soil is continuously being washed away creating several gullies located on their farms and homes. Also, 8.7% of the respondents were of the view that low crop yields are the effects of land degradation on GERMP Communities while 8% express the view the low crop yields are the effects of land degradation on Non-GERMP Communities in the Lawra District since their crops perform poorly or even die off. About 19.4 reveal that a reduction of wild edible fruits is as a result of excessive land degradation in the District. The causes of the reduction of wild edible fruits often limit alternate food sources are attributed to deforestation and indiscriminate bush fires.

The GERMP coordinator and some beneficiaries of the project in a focus group discussion revealed that low crop yields cause poverty, increases migration which corroborates the findings of Gyasi *et al* (2009), that low crop yields result in low incomes, increases poverty, which, in turn, promotes migration from rural to urban centers. Participants from Non-GERMP communities also express similar views as low crop yields affect their incomes.

4.6 Nature and Causes of Food Insecurity in the Lawra District

Food security for a household means access by all members at all times to enough food for an active, healthy life. The study revealed that because of nutrient loss, loss of land cover and erosion, there is inadequate food in the Lawra District and that any effort to access or acquire food usually leads to land degradation in the Lawra District.

4.6.1 Food Production/Shortages

In the Lawra District, food shortage has always been an issue of concern. This situation usually worsens some few months after the harvest of crops. Table 4.5 depicts respondents view on the months that the district experiences food shortages in the year.

Table 4.5: Periods of Food Insecurity the in Lawra District

Monthly food Insecurity	Communities		Total (n)
	GERMP %	NON-GERMP %	
Jan-April	16.5	18.4	40
May-August	66	60	143
Sept- Dec	12.6	15.2	32
All year round	4.9	6.4	13
Total	**100.0**	**100.0**	**228**

Source: Author (2015)

The study reveals that majority of the respondents constituting 66% and 60% of both the GERMP and non- GERMP communities were of the view that severe food shortages is experienced in the District from May to August because much of the seeds are re-sown on their farms whereas 16.5% and 18.4% of the respondents from the GERMP and non-GERMP communities claimed that severe food crises is experienced between January and April.

About 12.6% and 15.2% of both GERMP and non-GERMP respondents claimed that the District experiences severe food crises from September to December since they harvest less from their farms and inadequate storage facilities leads to post harvest loses. Low yield is one of the effects of land degradation as the lands lose fertility and not suitable for cultivation of food crops.

The size of land owned and used for cultivation by respondents influences the level of productivity. In the Lawra District, respondents used parcels of land ranging from one acre to about 14 or more acres in cultivation. Table 4.6 summarizes the number of acres of land used by respondents in cultivation and the corresponding levels of productivity.

Table 4.6: Acres of land and Productivity

Communities	Respondents	No of Acres	Productivity		
			Legumes	Cereals	Tubers
GERMP	63	1-4	3 Bags	4 Bags	30 or Less
	31	5-9	5 Bags	7 Bags	31- 100
	9	10-14	6 Bags	6 bags	100+
Non-GERMP	77	1-4	2 Bags	2 Bags	22 or Less
	41	5-9	3Bags	4 Bags	23- 80
	7	10-14	5 Bags	3 Bags	81+

Source: Author (2015)

As shown in Table 4.6, about 63 respondents of the GERMP communities cultivate between 1-4 acres and harvest about 3 bags legumes, 4 bags of cereals and about 30 tubers whereas 31 respondents indicate that they cultivate between 5-9 acres of land and harvest 5 bags of legumes, 7 bags of cereals and between 31 to 100 tubers per farming season.

The remaining 9 respondents cultivate between 10-14 acres of land and harvest about 6 bags of legumes, 6 bags of cereal and over 100 tubers for a single cultivation season. About 77 respondents in the non-GERMP communities reveal that they harvest about 2 bags of legumes, 2 bags cereals and 22 or less tuber per every 1-4 acres of land cultivated. 41 respondents however indicated that per every 5-9 acres of land cultivated, they harvest about 3 bags of legumes, 4 bags of cereals and between 23-80 tubers of yam whilst the remaining 7 respondents of the GERMP communities mentioned that they obtain about 5 bags of legumes, 3 bags of cereals and a little over 81 tubers of yam per every 10-14 acres of land cultivated.

The low levels of harvest recorded in the Non-GERMP communities are attributed to non-adoption of proper land management practices since there is now institution or project in place to guide their daily activities and land management practices.

4.6.2 Labour and Productivity

The amount or volume of output that is obtained from each employee on a farm is a key measure of business efficiency. In the Lawra District respondents employ both family and communal labour. Table 4.7 summarizes the labour type, the number of people employed and the level of production.

From the Table 4.7, about 40% of respondents from both the GERMP and non-GERMP communities employ only family labour whereas about 60% employs both family and communal labour types to have works on the farms completed in time.

The study reveals that about 1-4 family labour employed at the respondents farms of the GERMP communities yields about 2 bags of legumes, 3-4 bags of cereals and about 10-20 tubers whereas the Non-GERMP communities yield 1 bags of legumes, 2 bags of cereals and 10 tubers per a farming season whereas 5-9 family labour employed by the GERMP

respondents on their various farms yields between 3-4 bags of legumes, 3-4 bags cereals and between 40-50 tubers whereas the Non-GERMP respondents harvest 2 bags of legumes, 3 bags of cereals and between 21-30 tubers of yam (Figure 4.7).

Table 4.7: Labour and Productivity

Labour	Productivity					
	Legumes		Cereals		Tubers	
	GERMP	non-GERMP	GERMP	Non-GERMP	GERMP	Non-GERMP
Family Labour						
1-4	2 bags	1 bag	3-4 bags	2 bags	10-20	10
5-9	3-4 bags	2 bags	3-4 bags	3 bags	40-50	21-30
10+	4+	3+	8 bags	5 bags	60 +	31-40
Communal Labour						
5-10	7 bags	5 bags	12 bags	8 bags	100-120	30-40
11+	10 bags	6 bags	15 bags	10 bags	121+	41-60

Source: Field Survey, May 2015

For 5-10 communal labour employed in the GERMP communities yielded about 7 bags of legumes, 12 bags of cereals and 100-120 tubers of yam whereas respondents of the non-GERMP communities harvest 5 bags of legumes, 8 bags of cereals and 30-40 tubers of yam whilst with 11 or more communal labour engaged on the GERMP respondents farms yielded about 10 bags of legumes, 15 bags of cereals and over 121 tubers of yam whereas the non-GERMP respondents harvest 6 bags of legumes, 10 bags of cereals and about 41-60 tubers of yam per a farming season (Figure 4.7).

4.6.3 Causes of Food in Insecurity

Land degradation has become an issue worldwide as it threatens global food security and environmental quality. Research conducted by GLASOD (1988-91) indicates that South America's croplands have declined at a rate that is slower than the global average, while African per capita croplands have declined at a rate greater than the average rate. Table 4.8 shows the various causes of food insecurity in the Lawra District.

Table 4.8: Causes of Food Insecurity in the Lawra District

Causes of food Insecurity	Communities		Total respondents
	GERMP %	NON-GERMP %	(n)
post-harvest losses	38.8	16	60
low yield	24.3	56	95
foodstuff sold for basic needs	36.9	28	73
Total	**100.0**	**100.0**	**228**

Source: Field Survey, May, 2015

From Table 4.8, 38.8% from the GERMP communities contended that post-harvest losses are attributable to inadequate storage facilities and bush fires as the dominant causes of food insecurity in the Lawra District whereas 36.9% of the respondents attributed food insecurity to selling foodstuffs at lower prices solely to meet basic needs such as health care and education. Selling of food stuffs reduce food stock at their houses resulting in food insecurity. The remaining 24.3% of the respondents asserted that low crop yield due to the loss of soil nutrients, small farm size, the use of uncertified seeds (local seeds) coupled with the erratic rainfall patterns is the dominant cause of food insecurity in the Lawra District. Low crop yields cause

food insecurity since the crops on farm are usually consumed by buy bush fires resulting in inadequate amount of food harvested from the farm.

Also, 16% of the respondents from the non-GERMP communities argued that post-harvest losses attributable to destruction of farm produce by animals, market accessibility, inadequate storage facilities and bush fires are the dominant causes of food insecurity in the Lawra District since much of the food harvested go waste because of poor transport systems and storage facilities. whereas 56% of the respondents assert that low crop yield due to the loss of soil nutrients, small farm size, the use of uncertified seeds (local seeds) coupled with the erratic rainfall patterns is the dominant cause of food insecurity in the Lawra District since uncertified seeds and erratic rainfall patterns results in poor quality yields. The remaining 28% of the respondents attributed food insecurity to selling foodstuffs at lower prices solely to meet basic needs such as health care and education.

The study reveals that transitory food insecurity is an acute problem in the Lawra District where bush burning, deforestation, overgrazing and mismanagement of land resources have rendered several hectares of land unsuitable for any meaningful agriculture. These findings uphold Sant 'Anna's (1993 and 2001); Sherr and Yadav's (1996) view that food insecurity is generally caused by overgrazing and mismanagement of land resources, deforestation, bush burning among others. In the Lawra District, the most common form of degradation is soil erosion by water and wind, which results from vegetation removal with negative consequences for soil productivity hence confirming Oldman's (1994) findings on the forms of land degradation.

4.7 Land Management Practices for Food Security in the Lawra District

The Lawra District has a relatively large amount of cultivated land. However, most lands are characterized by poor fertility and are subjected to degradation.

To sustain crop production increases and ensure food security, soil, nutrients and water resources needs to be properly managed and conserved as hypothesized by Quansah (1996). Soil management is therefore crucial to the Lawra District and Ghana's economic development at large.

Table 4.9: Forms of Land Management Practices

Land Management Practices	Communities		Total Respondents
	GERMP %	Non-GERMP %	
Non- Bush Burning	19.4	15.2	39
Mulching	11.4	11.4	2
Cover Crops (Mocuna plant)	7.1	7.1	1
Contour Vegetative Barriers	4.8	-	5
Composting	32	-	33
Zai and Half Moon	14.6	-	15
Stone Bunds	4.9		5
Application of Manure	-	44.7	56
Application of Chemical Fertilizer	5.8	4.8	12
Zero Tillage	-	16.8	21
Total	**100.0**	**100.0**	**128**

Source: Field Survey, May 2015

Table 4.9 shows the various forms of land management practices used in the Lawra District. From Table 4.9, the respondents of the GERMP communities of the Lawra District adopted and practiced numerous land management practices to safeguard their lands so as to improve its fertility in order to get higher yields. Of the 103 respondents, 19.4% adopted and practiced non- bush burning claiming it is the most adopted land management practice among the people of the District which is enforced in some of the communities such as Kanpuoh and Kalsagre, while 11.4% adopted and practiced mulching, 7.1% plant cover crops, 4.8% use contour vegetative barriers, 32% practice composting, 14.6% and 4.9% practice Zai and Half

Moon and stone bunds respectively as the major forms of land management that were provided by the project but are not used by majority because of the labour involved.

The respondents of the non-GERMP communities of the Lawra District embraced and practiced numerous land management practices to safeguard their lands so as to improve its fertility in order to get higher yields. Of the 125 respondents 15.2% adopted and practiced non-bush burning while 11.4% adopted and practiced mulching, 7.1% plant cover crops such as beans, 44.7% apply manure thus using droppings from livestock such as sheep, goats and cattle. About 16.9% employ zero tillage and the remaining 4.8% apply chemical fertilizer as forms of land management in the Lawra District. Composting was not practiced by the respondents because much of the crop residue was used as fuel at home and also used to feed livestock during dry season.

Table 4.10: Productivity in GERMP and non-GERMP communities

Type of Community		Productivity			
		Livestock	Cereals	Legumes	Tubers
GERMP Communities	Kanpuoh	50	3-4 bags	5-10 bags	100
	Kalsagra	100	3-4 bags	5-10 bags	100
	Zakpeng	40	1-2 bags	3 bags	80
	Pavuu	30	2 bags	1 bag	100
Non GERMP Communities	Gbier	40	1-2 bags	1/2 bags	70
	Furo	20	1-2 bags	1/2 bags	70

Source: Author (2015)

Table 4.10 shows the levels of production of the GERMP and non-GERMP communities. The GERMP communities (Kanpuoh, Kalsagra and Zakpeng) cultivate predominantly cereals,

legumes and tubers with animal keeping. On the average each respondent of Kanpuoh had about 50 livestock and harvest about 3-4 bags of cereals, 5-10 bags of legumes and about a hundred tubers whilst a respondent of Kalsagra averagely had about 100 livestock and harvest 3-4 bags of cereals, 5-10 bags of legumes and about 80 tubers. Respondents of Zakpeng had an average of 40 livestock each constituting the lowest for the GERMP communities, they also harvest about 1-2 bags of cereals, 3 bags of legumes and 80 tubers per a farming season. On the other hand, Pavuu, Gbier and Furo are the three communities of the non-GERMP category. Gbier had more livestock constituting about 40 per respondent whereas Pavuu and Furo had 30 and 20 livestock per respondent respectively. Again, 2 bags of cereals, 1 bag of legumes and about 100 tubers were recorded by respondents at Pavuu whereas 1-2 bags of cereals, 1/2 bag of legumes and about 70 tubers were recorded at Gbier. Also, 20 livestock were recorded at Furo for each respondent whilst 1-2 bags of cereals, 1/2 bag of legumes and 70 tubers were the harvest respondents revealed they obtained per farming season.

From Table 4.10, the respondents of the Lawra District adopt and practice numerous land management practices to safeguard their lands so as to improve soil fertility in order to get higher yields. Of the 228 respondents 102 (45%) adopts and practice non-bush burning claiming it is the most adopted land management practice among the people of the district while others adopted and practiced mulching, planting of cover crops and contour vegetative barriers respectively.

4.7.1 Level of Education and Land Management Practices.

Education influences farmers' level of adoption and practice of land management measures. Table 4.11 show the level of education and the respective land management practices adopted and used by inhabitants of the Lawra District.

Majority of the respondents (64%) have undergone no formal form of education but adopted and practiced some forms of land management practices. About 9% of those with no formal education adopted and practiced non- bush burning, 6.6% practiced mulching whereas 17.5% practiced afforestation and cover cropping. The remaining 13.2%, 7.5% and 10.5% practiced Zai and half-moon, contour and vegetative barriers and composting. About 2.2% of those with tertiary educational level practiced non- bush burning whilst 1.8% practiced afforestation and cover cropping whereas none of the respondents in this group practice mulching, Zai and half-moon, contour and vegetative barriers, and composting.

Table 4.11: Level of Education and Land Management Practices

Level of Education	**Land Management Practices**					
	Non Bush Burning	Mulching	Cover cropping	zai and Half	Contour and Vegetative	Composting
Primary	6	10	5	4	6	1
JHS/Middle School	4	6	-	4	6	6
Secondary/ Voc/Tech	9	-	4	2	-	-
Tertiary	5	-	4	-	-	-
Non formal education	20	15	40	30	17	24
Total	**44**	**31**	**53**	**40**	**29**	**31**

Source: Author (2015)

The reason being that some of the respondents who find themselves in communities like Kalsagre and Kanpouh have bye-laws against bush burning, those respondents who practiced afforestation may do so in order to provide shade and also to serve as wind breaks to their houses, and that farming may not be their main occupation and they see no reason why they should practice Zai and half-moon, contour and vegetative barriers, and composting which they may see as waste of time. The respondents that practice cover cropping do it in their backyard gardens. Also, 3.9% of respondents with secondary/vocational/technical status practiced non-bush burning whereas 1.8% practiced afforestation and cover cropping, less than 1% practiced Zai and half-moon methods of land management. Furthermore, 1.8% of those in the JHS/middle educational level practiced non bush burning, 2.6% practiced mulching whereas 1.8% practiced the Zai and half-moon method and the remaining 2.6% and 2.6% practice contour and vegetative barriers and composting respectively. The trend of results shows that majority of them practiced more than one method indicating that they are subsistence farmers who cannot afford chemical fertilizers and other farm implements which they have attributed it to low income.

Finally, out of the 14% of respondents who had education up to the primary level, 2.6% of them practiced non-bush burning, 4.5% practiced mulching, and 2.2% practiced cover cropping. The remaining 1.8%, 2.6% and less than 1% practiced zia and half- moon, contour and vegetative barriers and composting respectively.

4.8 Occupation and Land Management Practices

From the results, the principal work, livelihood or means of earning a living of respondents influence the land management practices they adopt and use. Table 4.12 indicates the

occupation of respondents and their respective land management practices adopted and utilized.

From Table 4.12, 39.8% of farmers who responded to the study from the GERMP communities practice non - bush burning, 12.6% practice mulching, 19.4% practice, cover cropping 12.6% practice contour farming whereas 15.5% practice composting so as to maintain the fertility of the lands they cultivate on.

Also, about 11.2% of responded from the non-GERMP communities to the study practice non- bush burning, 21.6% practice mulching, 13.6% practice cover cropping whereas 12% practice contour farming, 0.8% practice composting, 20% practice zero tillage and the remaining 22.4% practice fertilizer application. The study reveals that majority (31.1%) of farmers in the GERMP communities practice non-bush burning with very few traders and salaried or wages workers constituting 2.9% and 5.8% respectively. None of the respondents recruited for this study in the GERMP communities practiced zero tillage and chemical fertilizer application but rather 16% of farmers in the non-GERMP communities practice zero tillage, 13.6% practice mulching whilst 12% practice chemical fertilizer application. Salaried or wages workers (public servants) constituted about 12.3% of the respondents to the study, of which 6.4% and 4% practice fertilizer application and non-bush burning respectively. Only few (5.6%) salaried or wage workers practice mulching, contour/vegetative barriers and composting which was attributed to the fact that these land management practices are time wasting.

Table 4.12: Occupation and Land Management Practices of Respondents

Communities	Occupation	Land Management practices						
		Non-Bush Burning	Mulching	Cover Cropping	Contour Farming	Composting	Zero Tillage	Fertilizer
GERMP	Farming	32	13	5	8	16	-	-
	Traders	3	-	5	5	-	-	-
	Salary/Wages	6	-	10	-	-	-	-
Non-GERMP	Farming	5	17	6	9	-	20	15
	Traders	4	5	8	5	-	3	5
	Salary/wages workers	5	5	3	1	1	2	8

Source: Author (2015)

4.9 State of Farms before and after GERMP Project

The introduction of the Ghana Environmental Resource Management Project started five years ago by the EPA. The aim of the GERMP is to guide smallholder farmers on sustainable land management practices such as the use of legumes as cover crops to retain soil moisture and prevent soil erosion, rearing of drought resistant animals such as goats, poultry, drought resistant or early maturing crops and the siting of developmental projects in communities as incentives. The implementation of the project brought about significant changes in the growing of crops for the past two years. Table 4.13 shows the state of the lands before the GERMP.

Table 4.13: State of the Lands before GERMP

State of Farms	Frequency	Percent
Infertility	31	29.8
Loose soils	26	25
Frequent occurrence of erosion	27	26.3
Reduction in number of trees	19	18.9
Total	**103**	**100.0**

Source: Author (2015)

From Table 4.13, of the 103 respondents interviewed in the GERMP communities, 30% indicated that their farm lands were infertile before the institution of the GERMP, whereas 19% were of the view that loose soils and reduction in the number of trees were rampant before the GERMP. The study therefore reiterates Mando's (2000) assertion that after the GERMP was instituted, stone bonding was adopted and properly installed, resulting in a tremendous positive impact on soil properties and on crop production. Table 4.14 indicates the state of lands after the introduction of the GERMP program in the Lawra District.

Table 4.14: State of the Lands after GERMP

State of Farms	Frequency	Percent
Fertile lands	38	36.9
Compaction of soil	14	13.6
Reduced Erosion	29	28.2
Increased number of trees	19	18
Total	**103**	**100.0**

Source: Author (2015)

From table 4.14, respondents revealed the state of lands in the Lawra District after the institution of the GERMP program. Out of the 103 respondents, 36.9% argue that their lands are now more fertile after the introduction of the GERMP program whereas 28.2% claim they have noticed a reduction in erosion cases in the District, about 18% revealed that many tree species that were lost some years before the introduction of the GERMP program have re-germinated because of favourable conditions hence increased the number of trees whiles the remaining 13.6 of the respondents asserted that the loose nature of soils that existed before

the introduction of the GERMP program have become compacted after the introduction of the program hence prevents easy washing of the top soils and the destruction of crops by wind or rain water.

A comparative analysis of the state of lands in the Lawra District before and after the introduction of the GERMP program show that lands are better off since the introduction of the GERMP program than before. There were cases of infertility of lands, loss of cultivable lands caused by soil erosion, and the extinction of numerous tree species because of unfavourable conditions. Tree species with the aid of favourable conditions however, got replenished to restore the population of trees in the Lawra. Soil fertility increased and with the compaction of soil, erosion has been reduced drastically.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter is the final section of the study. It presents a summary of the key findings of the study as well as the conclusions drawn and recommendations made to enhance the adoption and practice of proper land management methods aimed at improving soil fertility through reducing land degradation in the Lawra District.

5.2 Summary of Major Findings

The findings of the study are based on the objectives of the study. As a result, this section summarizes the key issues of the socio-economic characteristics of respondents, the nature and causes of land degradation, the nature and causes of food insecurity and finally managing land degradation for food security.

5.2.1 Socio-Demographic Characteristics of Respondents

Productivity increases with age in the early life cycle and then decreases later in life as human capital depreciation surpasses investment. From the study, majority of the respondents fall within the productive age group of 18-60 years; hence they are capable of undertaking economic activities that enables them to make ends meet thus impacting negatively or positively on the environment. Majority of the respondents with low levels of education are employed largely by the agricultural sector in the selected communities.

5.2.2 The Nature and Causes of Land Degradation

The study revealed that the most evidenced effect of land degradation is low yield obtained from their farmlands, which is largely attributed to low soil fertility. The extinction of wild fruits shows the presence of land degradation. The study a l s o found that population

pressure, poor environmental governance, migration and poverty also causes land degradation in the Lawra District.

It is revealed that "very severe" degradation of the land in the Lawra District is caused by soil erosion. Low crop yields which are caused by poverty, increase migration are the effects of land degradation in the District. Majority of the respondents claimed that there has been an extinction of wild fruits (Shea, Dawadawa, Baobab and Berries), caused by excessive deforestation and indiscriminate bush burning in the Lawra Districts.

5.2.3 Nature and Causes of Food Production/Insecurity

Majority of the respondents are of the view that severe food shortage is experienced by the district from May to August. Low food production is one of the effects of land degradation as the lands loose fertility and not suitable for cultivation of food crops. Majority of the respondents asserted that low crop yields, selling food stuffs at relatively lower prices solely to meet basic needs are the dominant causes of food insecurity in the Lawra District. Also the number of acres of land cultivated by the respondents influences the levels of productivity.

There is a direct relationship between labour used in farming and the levels of productivity. Majority of the respondents employ both family and communal labour types to work on their farms so as to meet the time constrained farming season.

Transitory food insecurity is an acute problem in the Lawra District, where bush burning, deforestation, overgrazing and mismanagement of land resources have rendered several hectares of land unsuitable for any meaningful agriculture. In the Lawra District, the most common form of degradation is soil erosion by water and wind, which results from vegetation removal through indiscriminate bush burning with negative consequences for soil productivity.

5.2.4 Managing Land Degradation for Food Security

The study found out that majority of the respondents (60%) are aware of land management practices in the Lawra District, the few who are not aware do nothing to protect the land from degrading and maintaining its fertility. The most commonly cited factors considered to endanger the protection of land include failure to consider indigenous land management practices, high initial costs of farm inputs which are not affordable to poor farmers and also applying uniform techniques in different agro- ecological regions. Insecure land tenure systems, difficulties in accessing credit and poorly functioning output and input markets significantly lowers the incentive for farmers to adopt land management practices in the district.

Respondents adopted and uses control measures (moisture and fertility management measures that consist of afforestation/agro-forestry, mulching, cover cropping and contour vegetative barriers, and relatively inexpensive physical structures such as ridge- furrow systems, stone lines, tied-ridging and contour bonds) towards maintaining or improving the fertility of their farmlands.

The GERMP communities (Kanpuoh, Kalsagra and Zakpeng) cultivate predominantly cereals, legumes and tubers with animal keeping.

5.3 Conclusion

It is imperative to note that land degradation is and will continue to be a global issue if not properly addressed and solutions found to its inherent problems.

5.3.1 Food production: Secured and Insecured

The study concludes that bush fires and excessive deforestation in the Lawra District exposes the land for degradation. There was transitory food insecurity in the months of May to

August. Post- harvest losses, low crop yields and selling out farm produce resulting in inadequacy of food are as a result land degradation and poor storage facilities.

5.3.2 Land Degradation: Management and Food Security

The study on land management practices and land degradation of the three selected GERMP and three non- GERMP communities of the Lawra District has provided a bearing for additional research because it has highlighted a topic of emerging concern among local governments and civil society organizations. Future research could identify and focus more on the relationship between inhabitants' livelihoods, poor land management practices, food insecurity, poverty and malnutrition. Although demographic trends will increasingly shift the locus of poverty related problems into urban areas over the next two decades, policy makers and civil society organizations could launch capacity-building programs to potentially alleviate the menace of poor land management practices to ensure the adoption of proper land management practices to help curb the menace of land degradation in the Lawra District.

5.4 Recommendations

Experiences gained from the field survey and review of literature makes it possible for the following recommendations to be made on the nature and causes of land degradation, the nature and causes of food insecurity and how land degradation can be managed for food security in the Lawra District.

- Actors engaged in agriculture and farmland development should focus more attention on the phenomenon of improper cultivation methods, and over grazing that often lead to land degradation. It is therefore important to draw policies on a more effective approach to agriculture and farmland management practices.

- The Ministry of Food and Agriculture should institute soil fertility improvement programmes and advocacy on land degradation. Also drought resistant and early maturing seeds should be provided to them at reduced prices.

- There should be an institutional support from the District Agriculture Office. This type of support should come in a package where inhabitants can get skills training on proper land management practices and credit services to enable farmers farm effectively.

- Also Agriculture extension officers should be resourced with the needed logistics to help them intensify their visits to farms during the land preparation stage through the cultivation stages to the stage of harvesting.

- Community leaders should be supported by the District Assembly to form strong neighbourhood volunteer groups to undertake sensitization on the causes and effects of land degradation and how to manage it to increase food production, educate the inhabitants towards proper land management practices. It is believed that constant education and reminder of the people on the issue is very necessary in solving problems of land degradation. Also, anti-bush burning clubs/committee should be formed in the other four communities to help solve the problem just as what has been done in the Kalsagre and the Kanpuoh by equipping farmers with necessary items and also motivate them for the work done.

- Government in collaboration with the traditional leaders should institute an award scheme for the best conserved community to encourage farmers and other land users to work at conserving their environment and also, watch dog committees should be formed at various communities to monitor the activities of various land users so as to reduce in proper land uses.

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APPENDIX

Key Informant Questionnaire (MOFA EPA And GEMP Consultant) at the District Level

UNIVERSITY FOR DEVELOPMENT STUDIES

FACULTY OF INTEGRATED DEVELOPMENT STUDIES

DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES

Research Topic: Managing land degradation for food security in Lawra District Please indicate your institution by ticking [√]

EPA ( ) FAO ( ) GEMP CONSULTANT ( )

Questionnaire on managing land degradation for food security.

PREAMBLE: This questionnaire is to collect data for a research on the above topic. The data collected is for academic purpose only and all information provided will be treated with confidentiality. Please provide the appropriate response by ticking [ ] or filling in the space provided.

(Give explanations to all your answers.)

Objective one; what are the nature and causes of land degradation?

1. What is the rate of land degradation in the district for the past 10 years?

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2. Which category of land degradation occurs in your area?

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3. In your opinion, what are the main causes of land degradation?

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4. Which of the cause/s is or are more prominent in the locality?

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5. Is land degradation on the increase in the district? a)Yes ( ), b) No ( ) explain your

answer .....

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6. Do you observe changes in your environment? a)Yes ( ), b) No ( ) .Explain your answer.

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7. What impact/s has land degradation got on the lives of the people (Effects of it on the people? Give little explanation to your answer.

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8. Do you observe social instability as a result of these problems? a). Yes( ) b). No( ) Back your answer with some examples or explanation

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Objective two; nature and causes of food

insecurity

10. What has been the impact of it on food security for the past 2yrs? (Has food production increased/decreased?

11. For the past two years what has been the level of food production from an arc of land on the part of cereals and grains? a) Less than one bag b) One-two bags c) More than two

12. Do you experience food insecurity every year? a) Yes b) No

.....

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.....

13. Which period of the year do you experience food insecurity? a) First quarter of the year b) second quarter c) third quarter

14. What causes food insecurity in the Lawra district?

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15. What is being done to reduce or prevent the occurrence of food insecurity in the

district?

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16. Has there been an increase on the quantity of food stuff from an arc of land after adopting mechanisms to reduce land degradation? Yes/No please your answer.

.....

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.....

Objective three; sustainable land management practices.

17. In your own little way as an agriculturalist/environmentalist, what are you doing to help solve this problem?

i. Training programs on good farming practices such as contour farming, stone bonding.

ii. Visit to farm lands

iii. Introduction of new crops

iv. Others(specify)

18. Is it visiting farmers and teaching them new mechanism to adopt in order to improve food security? Yes/No

19. If yes, what are some of the mechanisms you have introduced to farmers?

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20. What is GERMP about?

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21. What activities are carried out by the project?

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22. Which communities are being introduced to this project?

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23. What benefits does the communities derived from the project?

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24. After the implementation of the project, what has been the nature of the communities' lands and their surroundings?

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UNIVERSITY FOR DEVELOPMENT STUDIES

FACULTY OF INTEGRATED DEVELOPMENT STUDIES DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES

Questionnaire on managing land degradation for food security.

PREAMBLE: This questionnaire is to collect data for a research on the above topic. The data collected is for academic purpose only and all information provided will be treated with confidentiality. Please provide the appropriate response by ticking [ ] or filling in the space provided.

Researcher Information

Research Name: ..... Time of interview: .....

Questionnaire No.: ..... Community: .....

SECTION A: Background of Respondent

i. Sex :(a) Male [ ] (b) Female [ ]

ii. Age: a) 20 – 29 ( ) b) 30 – 39 ( ) c) 40 – 49 ( ) d) 50 – 59 ( ) e) 60+ ( )

iii. Level of education: a) primary b) secondary c) tertiary d) non formal education.

iv. Occupation: a) government workers b) traders c)

farmers Section B: the nature and causes of land degradation

1. Do you perceive the problem of land degradation in your community? Yes/No explain

your answer

2. If yes, what features lead you to believe that such problem exists?

I. II.
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I I I .
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3. How severe is land degradation in your community?

I. Very severe

II. Medium

III.
minimal

4. Which of the following are the factors/main causes of land degradation?

I. Natural factors

II. Human induced factors.

5. Have you observed reduction of edible wild fruits and in your community?

I . Y E S / N O

. 6. If yes, mention of the fruits and?

.....

8. What caused the reduction of those wild fruits and the?

.....

.....

9. Have you observed erosion on your cultivated land for the past 2 to 5 years?

(i) Yes/No

10. If yes, has it been increasing or remained the same?

(i) Increased

(ii) Remained the same

11. Do you observe changes in farm lands that indicates decline in soil fertility?

Yes/No. briefly explain your answer

.....

12. If yes mention some of the changes.

.....

.....

Section C: The Nature and Causes of Food Insecurity

13. Do you owe land? Yes/No

14. How was the land acquired? i. inherited ii. Borrowed, iii. Bought

15. How many hectares of the land do you have?

.....

16. What quantity of land is used for farming purposes?

.....

17. What is your household strength? i).1-5, ii). 5 and above

18. What type of labour do you used at your farms?

i) Family labour, ii)communal labour.

19 If family labour is the answer, how many people are used?

20. What quantity of food stuffs do you get from an arc of farm? Legumes

Cereals .....Tubers.....

21. Is the food always enough to cater for the family throughout the whole year? YES/No 22 If no how do you get other food stuff to supplement i). buy food stuff, ii).depend on wild fruits, iii) aid from the government, iv. Support from family members v).Others

(specify).....

23. Do you experience food shortage during the year? YES / NO.

If yes to question 23 State the month(s) of the year.....

24. What accounts for shortage of food? I). post-harvest losses ii) low yield iii). Food stuffs sold to acquire other basic need iv). Others (specify). Back your answer with reasons

.....

25. What measures have you kept in place to mitigate the food insecurity problem based on your chosen answer to question (24)?

26. Do you undertake any land management practices to increase crop yield? YES / NO

If yes to the above question mention some of the land management practices .....

.....

Section D: Land Management Practices for Food Security

This part of the questionnaires will be answered by GERMP communities.

27. Do you have any idea about GERMP? YES/NO

28. What is it about?

29. Before the implementation of the GERMP in your community, what has been the state of your farms?

30. Before the planting of the project what was the situation in-terms of availability of food stuff? Was it encouraging /not encouraging

If not encouraging what were you doing to solve the problem?

31. What quantity of food stuff do you get from your farms in-terms of cereals, legumes, tubers and others?

32. After the implementation of the project have you realize any changes in your food production for the past 2years? YES / NO.

33. If yes, what are the changes and give explanations

34. If no advance reasons for that.

35. Did you benefit from the project? YES/NO

36. If yes mention some of the benefits

CHECKLIST/GUIDE FOR GROUP DISCUSSION ON GENDER BASIS (Groups:

25 years and above)

- Place & date of discussion...
- Number of people participating...

1. General view of land degradation trend over the past 2 – 5 years.

2. The causes of land degradation and its effects on arable lands.

3. General view of the state of the land in terms of vegetative cover, plant and wildlife composition (natural biodiversity) and soil fertility/productivity over the past 2 - 5 years.

4. What do you think are the causes of food insecurity?

5. What are the impacts of the degraded land in terms of food security?

6. What measures have you kept in place to make degradable lands fertile for growing of crops?

7 In your own opinion, what is the way forward to either reduce land degradation or reclaim degraded land for agricultural purpose in order to improve food security?