

**Deforestation and its effect on livelihood patterns of forest fringe communities in
the Asunafo North Municipality**

BY
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DECLARATION

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

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DEDICATION

I dedicate this work to my father Alhaji Mohammed Halidu and my mother Hajia Rahinatu Zakari, my dear lovely wife Mrs Hickmatu Abdulai Sadik Timtoni and my lovely children Samira A. Sadik Timtoni, Abdul Hafiz Sadik Timtoni, Rahina Nasara Sadik Timtoni, Mohammed Fauzan - Saha Sadik Timtoni, Zulfawu A. Sadik Timtoni, Abdul Wadud Mohammed and to my siblings, all family members and friends.



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ABSTRACT

In spite of their immeasurable benefits to life sustenance, the sustainable management of forest and forest resources in Ghana is fraught with innumerable challenges such as the conflicting roles of the various stakeholders involved in forest management. Forests have since ancient times played an important role in the lives of people and the environment in general. That is, forests provided and continue to provide numerous benefits to humanity. This has repercussions for the environmental and livelihood patterns on the people especially the poor and the people who depend on the forest. It is in this vein that this study was undertaken to assess the effects of deforestation on the livelihood patterns of the forest fringe communities (farmers) in the Asunafo North District. The study adopted the case study research design in undertaking this systematic enquiry. This was adopted to help acquire knowledge on the current situation with regards to the phenomenon under consideration. Both primary and secondary data were collected and used for the study. The study employed both qualitative and quantitative data gathering techniques to collect the necessary data and was analyzed in great depth to determine their implications for changing forest cover and livelihood patterns in the study area. The respondents for the study comprised Farmers, Municipal Meteorological Department, Forestry Commission and Municipal Agricultural Development Units. The study showed that, the farmers in the study area are largely engaged in the cultivation of food crops which are mainly subsistence in nature. It was realized that the farmers practice mixed cropping with slash and burn as the predominant land preparation method. The study showed that deforestation has affected crop production in the areas of delayed commencement of planting seasons, pest and diseases infestation, level and quality of crop yields and reduction in the income levels of farmers. The study recommended among other things, the continuous education and sensitization of farmers, strengthening of the public institution stakeholders and promotion of active research that will ensure a decline in deforestation.

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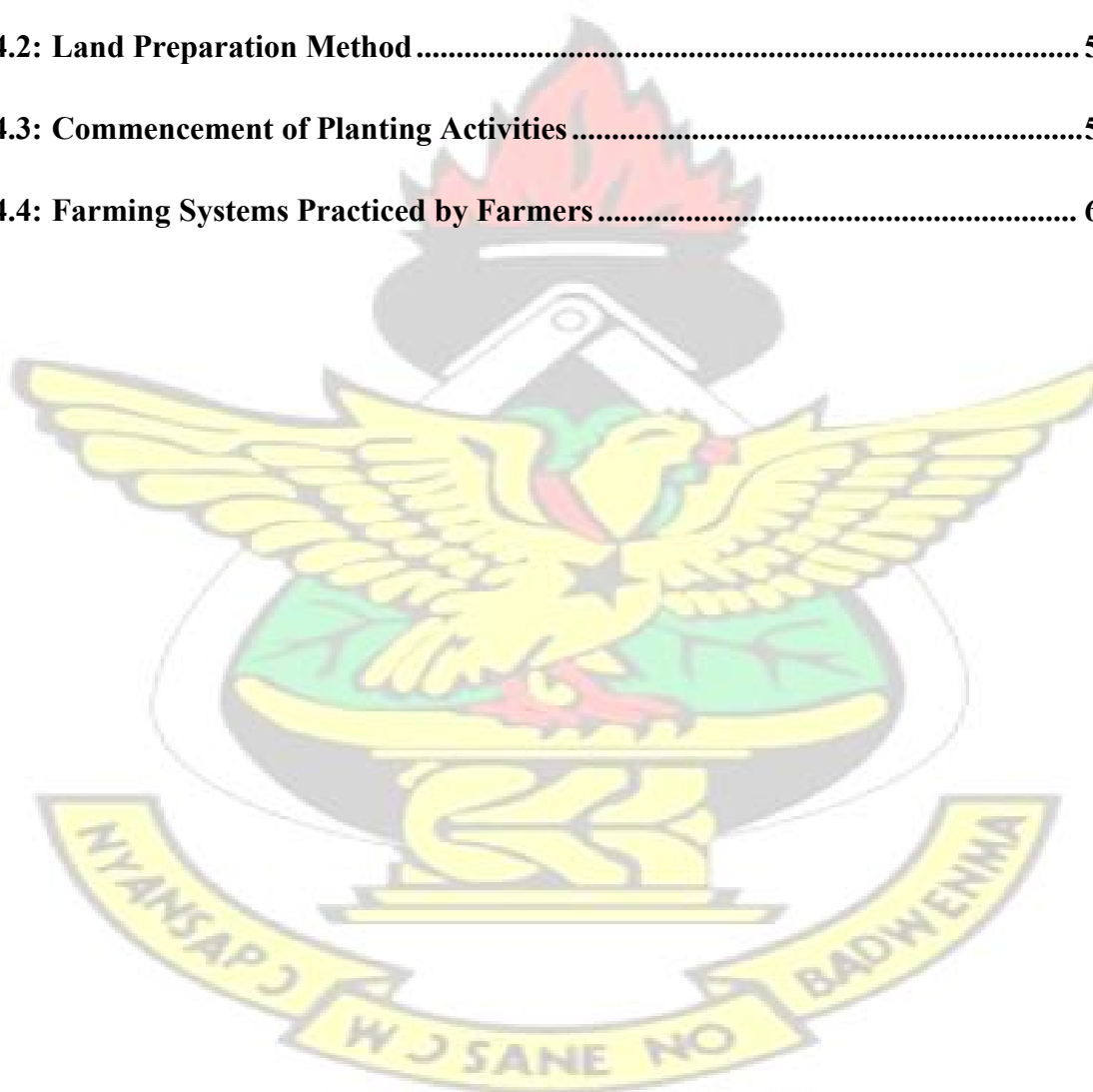


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LIST OF ACRONYMS



AD	Anno Domino
MADU	Municipal Agriculture Development Unit
DFID	Department for International Development
EPA	Environmental Protection Agency
FAO	Food and Agricultural Organization
FC	Forestry Commission
GHG	Greenhouse Gases
ITTO	International Tropical Timber Organization
MLNR	Ministry of Lands and Natural Resources
NTFPs	Non Timber Forest Products
SPSS	Statistical Package for Social Sciences
TUC	Timber Utilization Contract
UNDP	United Nations Development Programmes
UNECA	United Nations Economic Commission for Africa

CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 Introduction

Tropical rainforests are the world's most important repository of biological diversity, and they are regarded as "the lungs of the planet" (Philip Stott, 1999). Tropical rainforest are a natural reservoir of genetic diversity which offers a rich source of medicinal plants, high-yield foods and a myriad of other useful products (Panayotou and Ashton, 1992). They are an important habitat for migratory animals and sustain as much as 50 percent of the species on earth, as well as a number of diverse and unique indigenous cultures. They also play an elemental role in regulating global weather in addition to maintaining regular rainfall, while buffering against floods, droughts, and erosion (Taylor, 2005). They store vast quantities of carbon while producing a significant amount of the world's oxygen. The important ecological functions of tropical rainforest provide numerous goods and services that contribute significantly to human well-being at local, national, and global levels (Amisah et al., 2009).

Undoubtedly, forests play critical roles in the social and economic development of humankind. In Ghana, forests provide goods such as timber and other non-timber products (e.g. bamboo, chew stick, game) which help most communities to meet the requirements for rural economy (Amisah et al., 2009). Blay et al. (2008), indicated that the forest supports the livelihood of about 20 million inhabitants particularly in rural communities. Though, the forests are essential due to the wide variety of goods and services they provide, they are under threat from especially human-induced disturbances (Appiah et al., 2009; Gupta et al., 2005; Kozlowski, 2000).

The 2010 Global Forests Resources Assessment showed that there was a 2 percent (135,000 ha) loss of forest annually from 1990-2000 in Ghana (FAO, 2010). Moreover, most of the country's forest resources are considered to be degraded (Marfo, 2010). The causes of the continuous forest loss are multi-dimensional and they include both internal and external factors. The internal factors include: unsustainable agriculture, conversion to agriculture, wanton logging, wildfires, firewood collection and charcoal production, mining, population pressure, poorly defined land and resource tenure. On the other hand, the external factors include: market failures, international trade, and the

imposition of economic programs such as the Structural Adjustment Program (Appiah et al., 2009; Benhin and Barbier, 2004).

The concerns about deforestation have mainly focused on the effects on atmospheric gases, climate change and particularly biological diversity (Amisah et al., 2009; Gupta et al., 2005; Benhin and Barbier, 2004). As a result of the high spate of deforestation, a lot of indigenous tree species like, *Milicia excelsa* and *Milicia regia*, the mahoganies (*Khaya* and *Entandrophragma* species), *Pericopsis elata*, *Nauclea diderrichii*, and *Triplochitonscleroxylon* which generate substantial revenues for Ghana's economy have drastically reduced over the past decades (Wong, 1989 in Benhin and Barbier, 2004).

1.2 Problem Statement

Forest fragmentation and deforestation remain as central problems in Ghana, especially the high forest zone of Ghana due, primarily, to both legal and illegal timber exploitation and arable crop farming (Amisah et al., 2009). The consequence has been a dramatic change in climate and evolution of strategies to sustain rural livelihoods. In most African countries the spate of deforestation has increased over the past four decades, with significant effects on rainfall, temperature, water resources, wildfire frequency, agriculture and livelihoods (Amisah et al., 2009).

In less developed countries, particularly those in Africa, livelihood insecurity remains a major problem (Shepherd *et al.*, 1999 in Tropenbos International, 2005). Forest dependent communities in these countries, rely heavily on their farmlands. Many forest dependent people employ a diversity of means to help meet basic needs: food and cash crop production, forest and tree product gathering and income-earning enterprises both on and off the farm. Often, the poorer the household, the more diverse the sources of their livelihood, as the needs for the year must be made up from various off-farm as well as on-farm natural resources, and often from migrant labouring as well (Shepherd *et al.*, 1999 in Tropenbos International, 2005).

At the beginning of the 21st Century, a third of Ghana's land area of 238,533 km² was covered by high forest whilst the remaining was savannah woodland. Currently, only about 10 percent of this area remains as forested land. Logging, bush fires, agricultural practices, excessive exploitation of Non Timber Forest Products (NTFPs) have been implicated (Amisah et al., 2009). Deforestation rates remain high and will probably

increase in the coming years as the population grows and demand for new settlements, wood for construction, fuelwood, charcoal and food increases as a consequence (Amisah et al., 2009).

This frightening spate of forest degradation potentially poses enormous adverse effects on forest reserves. These forest communities exert excessive pressure on forest reserves as many of those living in such communities have their livelihoods predicated on the availability, access and utilization of forest products (Appiah, 2009). The concomitant repercussions associated with this forest degradation include exposing such degraded forest communities as well as their farmlands to high risk of erosions and floods. Additionally, forest degradation risks the quality of life in forest communities and beyond, militates against the stability of climate and local weather, threaten the existence of other species and undermine the valuable services provided by biological diversity. Ultimately, these effects affect the livelihoods in such forest fringe communities.

An important location in Ghana where forest communities have suffered considerable setbacks in their livelihoods due to changing forest cover (deforestation) is the Goaso forest catchment area. The forest loss has occurred as a result of excessive timber exploitation, bad farming practices and other land use activities. Forest communities in the area are characterized by high poverty levels and rely on rain-fed agriculture with little or no access to modern agricultural technology (Blay et al., 2008).

The Brong Ahafo Region is one of the important agricultural regions of Ghana, especially the Goaso area, and is often regarded as the breadbasket of the country (www.ourghana.com; accessed 2007). With about six forest districts, the region has a lot of fertile lands and actually serves as the production site for most of the food crops and cash crops in Ghana. As forest reserves make significant contributions to the development of Ghana, there is the need to strongly create awareness and understanding of the extent and nature of the endowed forest resource as well as the method of exploitation. The implication of this is the importance and necessity for adequate care of the forest through appropriate planning and management as to the utilization of the forest resources. The reasons being that, these forest resources are in a web within a system and any disturbance of one element will dislodge the equilibrium. Besides the imbalances created in the forests' ecosystem, the depletion of the forest

cover poses significant repercussions on the livelihood of people, particularly those in such forest fringe communities who depend heavily on the forest and its resources. It is in this vein that this study is being conducted to assess the effect of deforestation on livelihood patterns on forest communities in the Brong Ahafo Region.

1.3 Research Questions

Based on the afore-stated problem, the study provided answers to the following questions:

1. What is the extent of deforestation in the Asunafo North Municipality over the last ten years?
2. What are the causes of deforestation in the Asunafo North Municipality?
3. What are the sources of livelihood for forest communities in the Asunafo North Municipality?
4. How has the deforestation in the area affected the livelihood patterns in the study area?
5. How is the people in the study area adapting to the deforestation in the study area?

1.4 Research Objectives

The overarching purpose of this research is to assess the effects of deforestation on the livelihood patterns on the forest fringe communities in the Brong Ahafo Region. In line with that, specific objectives have been set to help realize this ultimate purpose. The specific objectives of the study are to:

1. Assess the extent of deforestation in the Asunafo North Municipality.
2. Identify the causes of deforestation in the Asunafo North Municipality.
3. Identify the sources of livelihood for forest communities in the Asunafo North Municipality
4. Examine how deforestation has affected the livelihood patterns in the study area.
5. Assess how the people have been adapting to the effects of deforestation in the study area.

1.5 Scope of the Research

The scope of the research shows the coverage of study in terms of the context which also defines or influence the theoretical framework of the study and the second aspect is the geographic scope.

1.5.1 Contextual Scope

The contextual scope revolved around the effects of deforestation on the livelihood patterns of forest fringe communities, the extent to which deforestation has affected livelihood patterns and the means of adaptation in forest fringe communities.

1.5.2 Geographical Scope

Geographically, the study looks at the Asunafo North Municipality. The Asunafo North Municipality lies between latitudes 6°27'N and 7°00'N and longitudes 2°52'W. It shares common boundaries with Asutifi District in the North East, Dormaa Municipality on the North West and Juaboso Bia and Sefwi-Wiaso Districts in Western Region on the West-South borders, and Asunafo South Municipality in the Brong Ahafo Region on the South-Eastern borders. The total land size of the District is 1093.7km² with 389.7 km² proportion covered by several forest reserves including: Aboniyere, Esukese, Subim, Bonkoni and Ayum Forest Reserves.

Some of the towns in the district are Bediako, Pomaakrom, Dominase, Asummura, Asanteman Council, Mim, Abuom, Asuadai, Ampenkro, Gyasikroan Kojo Addai. The study area was chosen due to the vast amount of forest reserve in the municipality and the alarming rate at which the forest is being depleted.

1.6 Justification

Research is advanced in trying to understand the alternative livelihoods of forest communities. This work will go a long way to add to knowledge about the social and economic impacts of forest on the surrounding communities in Ghana. The study will not only achieve its purpose but will also open up other avenues for further research to be done to add to the body of literature that exist on forestry and livelihoods as well as the impacts of forests have on communities that surrounds these areas in question.

The research is worth undertaking considering the frightening spate at which the country is losing its forest cover. It is obvious that the wave of deforestation is now knocking at the doors of existing forest and exerting maximum pressure on the

regulatory processes of forest. The study will provide some useful reasons why we should preserve our forests beside sustainability reasons.

The study relied on empirical data that was gathered from the field in the study region. This data will add to existing data base by way of updating what already exist. This will also present a fresh picture about the level of economic and social development in some communities in Brong Ahafo region. The data base can serve another good purpose for investors to direct some investments into the region to ensure the development of the study region.

The research brought to fore the challenges and prospects that forestry in Brong Ahafo Region face and this would inform policy decisions to get the best out of the forests we have in Ghana. These findings from the study may possibly assist policy makers in developing pertinent policies to protect the forests in Ghana and also, provide better alternatives for the people to take advantage of the forest for their own development.

1.7 Organization of Chapters

The report was organized into five chapters. The first chapter which is the background of the study comprises of the general introduction, the problem statement, the research questions, research objectives and purpose, scope of the research, justification and organization of the research report.

Chapter two is basically a literature review on key terminologies and concepts related to deforestation on the livelihood patterns of forest communities in the study area. Findings from the various chapters informed the data needs and requirements for empirical data collection from the field.

The third chapter looks at the methodology and profile of the study region. The methodology considered the data needs, sources of data, types of data, data analysis, sampling technique and sample size among others. The profile of the case region on the other hand showed the physical, social and economic characteristics of the study region which influence or explained some of the findings that were obtained from the analysis.

The fourth chapter dealt with the analysis of primary data collected from the field. Tools such as matrices and charts were used to analyze the data and also, provided quick visual impressions of the findings. The key findings, conclusion and recommendations from the analysis were covered in the fifth chapter of the report.

CHAPTER TWO

REVIEW OF CONCEPTS ON DEFORESTATION AND LIVELIHOOD PATTERNS OF FOREST FRINGE COMMUNITIES

2.1 Introduction

The previous chapter set the tone for the study by giving an overview of the background of study, problem statement, research questions, objectives and significance of the study. This chapter is dedicated to the review of literature on changing forest cover and its effects on livelihood patterns on people living in forest areas. It looks at the definition of basic concepts such as forest degradation, livelihood and forest. Again the causes of deforestation, effects on livelihood patterns are also discussed under the chapter.

2.2 Definition of Forest

Defining what constitutes a forest is not easy as forest types differ widely. It should also be kept in mind that, different definitions are required for different purposes and at different scales. A basic definition of a forest is that, it's an ecosystem or assemblage of ecosystems dominated by trees and other woody vegetation. The Food and Agriculture Organization (FAO) however, provides a more comprehensive definition of the term. According to FAO (2010), a forest is a land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds situated naturally and uninterrupted.

The FAO provided some criteria as to what a forest is and these include:

1. It does not include land that is predominantly under agricultural or urban land use. Forest is determined both by the presence of trees and the absence of other pre dominant land uses. The trees should be able to reach a minimum height of 5 meters in situ.
2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and tree height of 5 meters. It also includes areas that are temporarily not stocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.

3. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.

4. Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.

5. Includes abandoned shifting cultivation land with a regeneration of trees that have, or is expected to reach, a canopy cover of 10 percent and tree height of 5 meters.

6. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.

7. Includes rubber-wood, cork oak and Christmas tree plantations.

8. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.

9. Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the “Taungya” system where crops are grown only during the first years of the forest rotation should be classified as forest.

For the purpose of this study, the working definition of forest is defined as “a large stretch of land of about 0.5 hectares dominated by trees, plants and other organisms in their natural environment, being intact and without external or human intrusions. This definition encompasses all organisms- both flora and fauna, and their interaction in a particular natural environment without human interventions.

The plate 2.1 provides a pictorial illustration of a typical forest in Ghana.

Plate 2.1: Picture of a forest in Ghana



Source: Forestry Commission, 2010.

2.3 Livelihood

Carney (1998: 4) defines a livelihood as “the capabilities, assets (including both material and social resources) and activities required for a means of living”. The assets are defined as capitals (natural, human, financial, physical and social) and more than just being simply the means to make a living with, they also give value to people’s life. This definition incorporates attributes such as: getting the basic requirement of living (food, shelter, clothing, money); capabilities or capacities, which are based on equity of resources and participatory decision making (Hiremath and Raju, 2004).

One of the widely accepted definitions of a livelihood system is from the work of Chambers and Conway (1992) which defined the concept to comprise people, their capabilities and their means of living, including food, income and assets. The authors indicate that livelihood has a tripartite relationship where people survive by using their capabilities to make productive uses of their assets, which are both tangible (resources and stores) and intangible (claims and access). Ellis (2000) also defines livelihood as the activities, the assets and the access that jointly determine the living gained by the

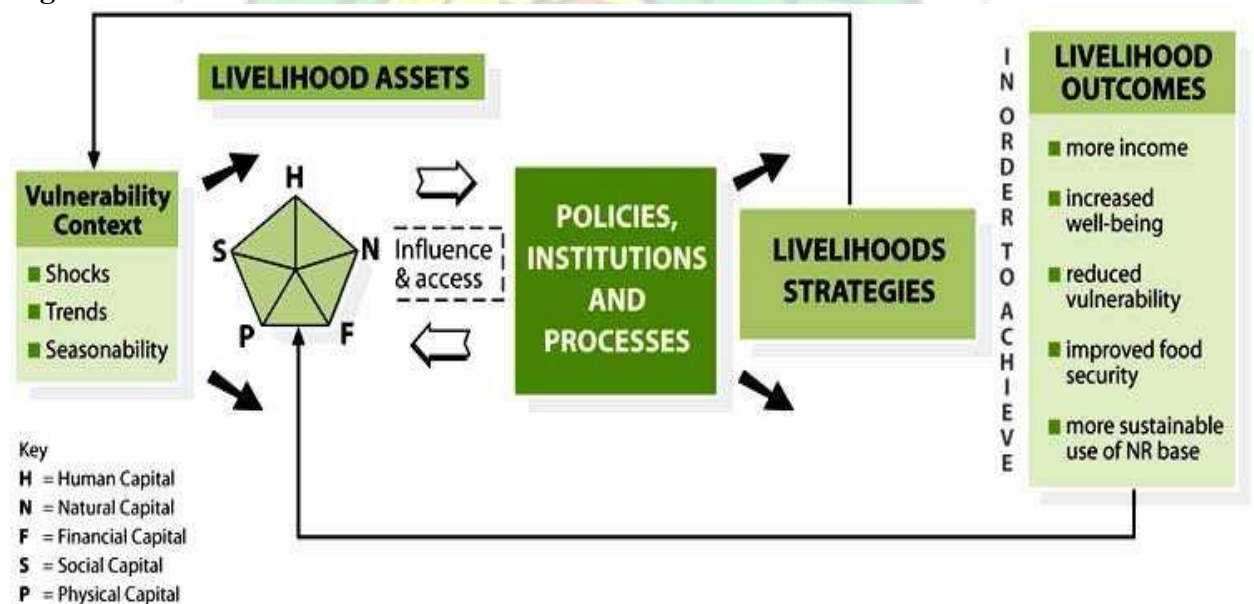
individual or household. What is common to the three views is the ability of people to undertake activities and own assets to guarantee them decent living conditions.

Aduse-Poku et al., (2003) posits that livelihood is much more than a job. It covers the wide and diverse range of things people do, comprising the capabilities, assets and activities required for a means of living. In most situations resources found within one's immediate vicinity will provide a livelihood or the means of making a living, which is true of most rural dwellers in Ghana. A livelihood framework is the tool used to analyze and improve understanding of livelihoods. Many livelihood frameworks have been used over the years to explain the concept of livelihood; however, in this research, the DFID livelihood framework and the rural sustainable concept have been used to explain some of the basic elements of livelihood. The framework presents the main factors that affect people's livelihoods and typical relationship between them. In particular, the framework:

- Provides a check on important issues and sketches out the way these link to each other;
- Draws attention to core influence and processes; and
- Emphasizes the multiple interactions between the various factors which affect livelihoods.

The figure 2.1 provides a sustainable livelihood framework developed by DFID:

Figure 2.1: The Sustainable Livelihood Framework.



Source: DFID (1999) Sustainable Livelihoods Guidance Sheets.

From the framework (fig 2.1), there are five basic capital assets upon which livelihoods are built; Financial, physical, human, social and natural. **Financial capital** denotes the financial resources that people use to achieve their livelihood objectives. There are two main sources of financial capital; available stocks and regular inflows of money. **Physical capital** comprises the basic infrastructure and producer goods needed to support livelihoods. Infrastructure includes affordable transport, adequate water supply and sanitation, affordable energy, and access to communication. The **human capital** represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives.

Social capital is taken to mean the social resources upon which people draw in pursuit of their livelihood objectives. It is developed through networks and connection, membership of more formalised groups and relationships of trust.

However, the most related capital asset to the study is natural assets since livelihoods in forest fringe communities are mostly predicated on natural resources. Thus, **Natural capital** is the term used for the natural resource stocks from which resource flows and services useful for livelihoods are derived. Clearly, natural capital is very important to those who derive all or part of their livelihoods from resource based activities such as farming, fishing, gathering and mineral extraction (DFID, 1999).

Moreover, shocks, trends and seasonality are factors that people are vulnerable to in their choice of livelihood options. As a result, various strategies are adopted by people in response to threats and opportunities they face in society. Linking it to the study, as natural resources that constitute natural capital on which forest communities' livelihoods depend are being threatened by shocks including deforestation, it affects the other four livelihood assets since they are complementary.

Also, transforming structures and processes within the livelihoods framework are the institutions, organizations, policies and legislations that shape livelihoods. Thus, in order to salvage the livelihoods of forest communities, there's the need to employ the transforming structures and processes to protect the forest cover of the country.

2.3.1 The Concept of Sustainable Rural Livelihoods

The concept of 'Sustainable Rural Livelihoods' relates to a wide set of issues and is increasingly central to the debate about rural development, poverty reduction and

environmental management (Scoones, 1998). It was first put forward in the report of an Advisory Panel of the World Commission on Environment and Development (Chambers and Conway, 1992). In calling for a new analysis, the commission proposed sustainable livelihood security as an integrating concept, and made it central to its report. The definition was as follows:

"Livelihood is defined as adequate stocks and flows of food and cash to meet basic needs. Security refers to secure ownership of, or access to, resources and income-earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies. Sustainable refers to the maintenance or enhancement of resource productivity on a long-term basis. A household may be enabled to gain sustainable livelihood security in many ways - through ownership of land, livestock or trees; rights to grazing, fishing, hunting or gathering; through stable employment with adequate remuneration; or through varied repertoire of activities" (WCED, 1987, in Chambers and Conway, 1992: 7).

Thus, the idea of sustainable livelihoods emerged as an approach to maintaining or enhancing resource productivity, securing ownership of and access to assets, resources and income-earning activities, as well as ensuring adequate stocks and flows of food and cash to meet basic needs. Clearly, food security is an important component of this framework (Tropenbos International, 2005). The definition of sustainable livelihoods has undergone modifications since it was first introduced. For example, in modifying the WCED Panel definition, Chambers and Conway (1992) put forward the following working definition of sustainable livelihoods:

"A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term" (Chambers and Conway, 1992: 7).

Drawing on Chambers and Conway (1992), Scoones (1998) also defines sustainable livelihoods as follows: "A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or

enhance its capabilities and assets, while not undermining the natural resource base" (Scoones, 1998: 5; see also Carney, 1998).

Comparing the sustainable rural livelihood concept with that of the DFID's sustainable livelihood framework, both are comprehensive in approach. However, it appears the DFID's framework is universal in its application regardless of the setting- whether rural or urban whereas this concept is more specific to rural settings where livelihoods are agricultural based. Thus, from the above concept, three fundamental attributes of a sustainable livelihood can be identified, namely: the possession of human capabilities (such as education, skills, health, psychological orientation, etc.); access to tangible and intangible assets (such as land, forests, etc.); and the existence of economic activities. In particular, the asset dimension is critical to an appreciation of the concept. Assets, in this context, are resources and stores (tangible assets), and claims and access (intangible assets), which a person or household commands and can use towards a livelihood (Chambers and Conway, 1992). Out of these tangible and intangible assets people construct and contrive a living, using physical labour, skills, knowledge, and creativity. In a rural context, households may construct four main categories of livelihood strategies: agricultural intensification; agricultural extensification; livelihood diversification, e.g. forest product gathering, processing, consumption and sale, petty trading, formal employment, etc; and migration (Carney, 1998; Scoones, 1998; Mearns and Dulamday, 2000). Broadly, these are seen to cover the range of options open to rural people. More commonly, rural people pursue multiple strategies, together or in sequence. They may, for instance, depend on their own farming, on selling their labour locally, on gathering and processing forest products, on hunting, or on migration, all within the same year. Outcomes will not be simply monetary, or even tangible in all cases. They may include, for instance, a sense of being empowered to make wider, or clearer, choices (Farrington *et al.*, 1999). Sustainability is a key quality of successful livelihoods. Sustainability means both the ability of the livelihood system to deal with and recover from shocks and stresses, and also the ability of the livelihood system and the natural resources on which it depends to maintain or enhance productivity over time (Tropenbos International, 2005).

2.3.2 Determinants of Livelihoods

Many livelihoods are predetermined by where one is born, gender or through socialization. It could also be improvised or acquired by choice. An example of

livelihood determined by the social status derived from the circumstances into which somebody is born is the caste system. For instance, being born into a caste or a particular ethnic group where specific roles are assigned. A person may also be born, socialised and apprenticed into an inherited livelihood for example as a carpenter, farmer or cooked food vendor. Some people also improvise livelihood with degrees of desperation with what they do being largely determined by the social, economic and ecological environment in which they find themselves. Through education and or migration, an individual or a household may choose a livelihood.

Those who are better off in society usually have a wider choice than those who are worse off, and a wider choice is usually generated by economic growth (Chambers and Conway, 1992). A livelihood is considered environmentally and socially sustainable if it maintains or improves the local and global assets and is able to recover from stress and shocks and the assets are able to provide for future generations. In the mining industry the term sustainable livelihoods is often associated with interventions that mitigate the impact of mining activities on communities (DeJong, 2012).

Conceptually, 'livelihoods' denote the means, activities, entitlements, and assets by which people make a living. Assets are defined as: natural/biological (land, water, common-property resources, flora, fauna), social (community, family, social networks), political (participation, empowerment – sometimes included in the 'social' category); human (education, labour, health, nutrition); physical (roads, clinics, markets, schools, bridges); and economic (jobs, savings, credit) (Krantz, 2001).

2.4 Livelihoods in Forest Fringe Communities in Ghana

Most forest fringe communities are rural in nature and that, the rural economy is primarily agricultural although some trading, small-scale production and food processing, collection and processing of non-timber forest products (NTFPs) and services take place in the community (Abane, 2009). Some of the dominant livelihood activities include farming (crop production and animal rearing.), gathering, hunting, trading and craft making. Among these livelihood activities, crop production and animal rearing are the most common source of livelihoods for most rural dwellers.

Gathering is a seasonal livelihood activity since most of the items collected do not appear throughout the year. These products are usually gathered in the forest and are called Non Timber Forest Products (NTFPs). Examples include snails, mushrooms,

canes, raffia and leafy vegetables. They are particularly important among the rural poor who have access to few resources beyond the forest. Hunting is another form of livelihood, mainly practiced by males. Small rodents are hunted during the day and bigger animals hunted during the night. Women are normally not involved Aduse-Poku et al (2003). This livelihood depends on the continued existence of suitable wildlife habitats. With the introduction of commercialisation, trading has become very popular in most rural economies. Items traded include food, crops, local and imported products. Women and the youth used to do most of the selling; however the trend is now changing since more men are getting involved. In some villages and towns cottage industries such as pottery, woodcarving, soap making, basket weaving, cloth making, wood industry, palm oil extraction and food processing e.g. corn or rice mill are found. Some rural dwellers that have some form of formal training are employed in the public services such as teaching, nursing, or in providing services to the public. These people may be few due to lower levels of education in the rural areas (Aduse-Poku et al., 2003).

2.5 Deforestation

Deforestation is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing or urban development (van Kooten and Bulte, 2000). Deforestation is primarily a concern for the developing countries of the tropics (Myers, 1994). Roseann (1990), also defined deforestation as the process by which land is cleared of forests or trees. Deforestation, which is sometimes euphemistically called “timber extraction”, occurs throughout the developed and developing world and can be seen as a by-product of industrialization and development process.

Forests cover almost a third of the earth’s land surface providing many environmental benefits including a major role in the hydrologic cycle, soil conservation and prevention of climate change and preservation of biodiversity (Sheram, 1993).

Forest resources can provide long-term national economic benefits. For example, at least 145 countries of the world are currently involved in wood production. Sufficient evidence is available that the whole world is facing an environmental crisis on account of heavy deforestation. For years remorseless destruction of forests has been going on and we have not been able to comprehend the dimension until recently. Nobody knows exactly how much of the world’s rainforests have already been destroyed and continue to be razed each year. Data is often imprecise and subject to differing interpretations.

However, it is obvious that the area of tropical rainforest is diminishing and the rate of tropical rain forest destruction is escalating worldwide, despite increased environmental activism and awareness (Anon, 1994a).

The plate 2.2 provides a pictorial evidence of a forest reserve in Ghana experiencing deforestation.

Plate 2.2: A Forest Reserve in Ghana undergoing deforestation



Source: Forestry Commission, 2010.

The state of deforestation at the global, continent (i.e. Africa) and national levels (i.e. Ghana) are discussed under sub-sections 2.5.1, 2.5.2 and 2.5.3 respectively

2.5.1 Deforestation at the Global Level

Annually, the rate of global deforestation is around 13 million hectares, most of which occurs in the developing world (FAO, 2010; CIFOR, 2005). According to Myers, “the annual destruction rates seems set to accelerate further and could well double in another decade” (Myers, 1992). Mostly deforestation has occurred in the temperate and sub-tropical areas. However, deforestation is no longer significant in the developed temperate countries now and in fact many temperate countries now are recording increases in forest area (Anon, 1990a). In most instances developed nations are located

in temperate domains and developing nations in tropical domains. However deforestation was significantly less in tropical moist deciduous forest in 1990-2000 than 1980-1990 (Anon, 2001a).

However extensive tropical deforestation is a relatively modern event that gained momentum in the 20th Century and particularly in the last half of the 20th Century. The Food and Agriculture Organization (2010 report indicated considerable deforestation in the world during 1990-2010 but this was almost entirely confined to tropical regions (Anon, 2001a). A summary of deforestation during the decades 1990-2010 is given in Table 2.1 and Table 2.2. These tables show that, there was considerable deforestation in the world during 1990-2010 but this was almost entirely confined to tropical regions (Anon., 2001a: Sumit et al., 2012).

Rowe *et al.* (1992) estimated that 15 per cent of the world's forest was converted to other land uses between 1850 and 1980. Deforestation occurred at the rate of 9.2 million hectares per annum from 1980-1990, 16 million hectares per annum from 1990-2000 and decreased to 13 million hectares per annum from 2000-2010. The net change in forest area during the last decade was estimated at 5.2 million hectares per year, the loss area equivalent to the size of Costa Rica or 140 km² of forest per day, was however lesser than that reported during 1990-2000 which was 8.3 million hectares per year equivalent to a loss of 0.20 per cent of the remaining forest area each year. The current annual net loss is 37 per cent lower than that in the 1990s and equals a loss of 0.13 per cent of the remaining forest area each year during this period. By contrast some smaller countries have very high losses per year and they are in risk of virtually losing all their forests within the next decade if current rates of deforestation are maintained.

Table 2.1: Annual Change in Forest Area by Region and Sub-Region, 1990-2010

Region/sub-Region	1990-2000		2000-2010	
	1000ha/year	Percent	1 000 ha/year	Percent
Eastern and Southern Africa	-1841	-0.62	-1839	-0.66
Northern Africa	-590	-0.72	-41	-0.05
Western and Central Africa	-1637	-0.46	-1535	-0.46
Total Africa	-4067	-0.56	-3414	-0.49
East Asia	1762	0.81	2781	1.16
South and Southeast Asia	-2428	-0.77	-677	-0.23
Western and Central Asia	72	0.17	131	0.31
Total Asia	-595	-0.10	2235	0.39
Russian Federation (RF)	32	n.s.	-18	n.s.
Europe excluding RF	845	0.46	694	0.36
Total Europe	877	0.09	676	0.07
Caribbean	53	0.87	50	0.75
Central America	-374	1.56	-248	-1.19
North America	32	n.s.	188	0.03
Total North and Central America	-289	-0.04	-10	0.00
Total Oceania	41	-0.02	700	-0.36
Total South America	-4213	-0.45	-3997	-0.45
World	-8327	-0.20	-5211	-0.13

Source: Anon, 2010

South America with about four million hectares per year suffered the largest net loss of forests during the last decade followed by Africa with 3.4 million hectares annually and the least Oceania with seven lakh hectares annually. Oceania suffered mainly due to Australia where severe drought and forest fires from 2000 AD had exacerbated their loss. Both Brazil and Indonesia had the highest net loss of forest during the decade of 1990 but has significantly reduced their rate of loss after this decade. Brazil and

Indonesia dominate accounting for almost 40 per cent of net forest loss over the decade of 1990s. Even though Brazil was the top deforesting country by area, the forests in Brazil are so extensive that this represents a loss of 0.4 per cent per year. The forest area in North and Central America remained stable during the past decade. The forest area in Europe continued to expand although at a slower rate of seven lakh hectare per year during the last decade than in the 1990s with nine lakh hectares per year. Asia lost some six lakh hectares annually during 1990s but gained more than 2.2 million hectares per year during the last decade (Sumit et al., 2012).

The ten countries with the largest net loss per year in the period 1990-2000 AD had a combined net loss of forest area of 7.9 million hectares per year. In the period 2000-2010 AD this was reduced to six million hectares per year as a result of the decline in deforestation in Indonesia, Sudan, Brazil and Australia (Table 2.1). There were 28 countries and areas which have an estimated net loss of one per cent or more of their forest area per year. The five countries with the largest annual net loss for 2000-2010 AD were Comoros (-9.3 per cent), Togo (-5.1 per cent), Nigeria (-3.7 per cent), Mauritania (-2.7 per cent) and Uganda (-2.6 per cent). The area of other wooded land globally decreased by about 3.1 million hectares per year during 1990-2000 AD and by about 1.9 million hectares per year during the last decade. The area of other wooded land also decreased during the past two decades in Africa, Asia and South America (Sumit et al., 2012).

Table 2.2: Countries with Largest Annual Net Loss of Forest Area, 1990-2010

Country	Annual change 1990-2000		Country	Annual change 1990-2000	
	1000 ha/year	Percent		1000 ha/year	Percent
Brazil	-2890	-0.51	Brazil	-2642	0.49
Indonesia	-1914	1.75	Australia	-562	-0.37
Sudan	589	-0.80	Indonesia	-498	0.51
Myanmar	435	-1.17	Nigeria	-410	-3.67
Nigeria	-410	-2.68	Tanzania	-403	-1.13
Tanzania	-403	-1.02	Zimbabwe	-327	-1.88
Mexico	354	-0.52	the Congo	-311	-0.20
Zimbabwe	327	1.58	Myanmar	310	0.93
Congo	-311	-0.20	Bolivia	290	-0.49
Argentina	-293	-0.88	Venezuela	-288	-0.60
Total	-7926	-0.71	Total	-6040	-0.53

Source: Anon., 2010

2.5.2 Deforestation in Africa

Forest loss in Africa is particularly troubling, and this is due to the fact that; two-thirds of the continent's population depends on forest resources for income and food supplementation and 90 percent of Africans use fuel wood and charcoal as sources of energy (FAO, 2010). Hence, the over-reliance on forest resources and non-timber forest products (NTFPs) has accounted for the huge change in forest cover and that; deforestation in Africa is estimated at around 3.4 million hectares per year (FAO, 2010; CIFOR, 2005).

According to Naoto (2006), between 1990 and 2000 Africa had the highest rate of deforestation of about 0.8 percent, followed by Latin America with 0.4 percent, and 0.1 percent in Asia. Some scholars associated the deforestation rate in Africa to their sluggish economic growth. However, the significance of deforestation to Africa has led to a number of recommendations on how to reduce the rate of deforestation on the continent. Poverty on the African Continent has led to continued loss of tree cover. According to the United Nations Economic Commission for Africa (Henceforth referred to as UNECA), the proportion of land covered by forests in Sub-Saharan

Africa is estimated to have decreased by 2.2 percent between 1990 and 2000. Due to over reliance on forests to meet the energy needs, with little access to alternative and affordable energy sources, the rate of loss of forests is increasing at an alarming rate. Sixty percent of Africa's energy demand is met by forests (UNECA, 2005).

2.5.3 Deforestation in Ghana

Disappearing forest cover is a particular problem in Ghana, where NTFPs provide sustenance and income for 2.5 million people living in or near forest communities (Acheampong and Marfo, 2011; Domson, 2007). According to the International Tropical Timber Organization (ITTO, 2005), the annual rate of deforestation in Ghana is around 65,000 hectares and the country's substantial forest cover could completely disappear in 25 years. This stark prediction underlies the fact that deforestation is not only a serious national policy challenge at present, but has been a chronic problem facing a number of past governments that have failed to implement a viable national mitigation plan. Between 1990 and 2005, for example, Ghana lost about 1,931,000 hectares of forest, equivalent to 26 percent of total tree cover (Amisah et al, 2009).

Forests and lands outside of designated Forest Reserves (FRs) (including protected areas) are commonly referred to as off reserve areas. In the High Forest Zones (HFZs), there is about 1.6 million hectares in 216 forest reserves (FR). About 0.35 million ha in 24 reserves, including 7 national parks, are protected areas for biodiversity and other protective functions, while the rest are assigned productive functions. The Savannah Zone covers 14.7 million ha of woodlands and includes some 0.88 million ha of reserves, of which Mole NP alone is about 0.5 million ha Ministry of Lands And Natural Resources (MLNR, 2012).

The official reported deforestation-rate has been around 2 – 2.1 percent per year since 1990 up to 2010 (FAO 2010). Ghana is losing annually approximately 135,000 ha, of which 65,000 ha per year is thought to relate to intact closed forest. A more recent assessment of land use and land use change across a landscape encompassing forest reserves and cocoa farms in five districts spanning the southern Brong Ahafo Region and northern portion of the Western Region found that deforestation rates may have been accelerating. Within this area, both primary and secondary forest was lost at a combined annual rate of 1.9 percent over 25 years (1986 – 2011), whereas forests were lost at a rate of 2.3 percent over the last 11 years (MLNR, 2012).

The degree of forest degradation is more difficult to assess. There are different estimates on the status of the forest reserves generally pointing to various degrees of degradation and an overall decline of their integrity. Some estimates on the status of forest reserves in the high forest zones note that 14percent have no forest, 15percent are classified as in very bad status, 20percent as mostly and 35percent as partly degraded, while only 14percent are in good and 2percent in excellent state (FORIG, *in prep.*). While recent unpublished analysis of basal area indicates a continuing decline in stocking of forest reserves over the period 1955 – 1995. The overall average basal area has declined by 25percent but with significant differences between reserves and regions. The status of forests in the off-reserve areas is even more problematic to assess. Estimates for closed canopy forest vary from 374,000 ha (1992) to as low as 20,000 ha (World Bank, 2005). A UNDP report estimates that the country has lost about 79percent of forests at the beginning of the 20th Century; the report further states that between 1990 and 2000 Ghana lost an average of 135,400 hectares of its forests cover annually. There has been an increase between 2000 and 2005 of 115 400 hectares more annually. In summary the country lost about 1,931,000 hectares of forests between 1990 and 2005 (GoG/ UNDP, 2006).

2.6 Causes of Deforestation

In Ghana, the major causes of deforestation are the result of a number of economic activities: legal and illicit logging, clearing trees to increase arable land, fuel wood extraction and mining. These causes are differentiated across the various forest zones in the country, however in the south, timber exploitation, mining and agriculture expansion have been identified as predominant causes (Boafo, 2012), while in the north, unsustainable charcoal and firewood production, forest fires and agriculture expansion (again) are the major causes (Agyeman et al, 2012). Without realistic mitigation policies and coordination on a national level, these activities and their deforestation consequences are likely to continue and even increase as Ghana's growing population demands more forest products and land area for settlements, construction, energy and food (Amisah et al, 2009).

In fact, the causes of deforestation are many and some of them are summarized under the following subsections below:

2.6.1 Expansion of farming lands

About 60 per cent of the clearing of tropical moist forests is for agricultural settlement (Myers, 1994; Anon., 1991) with logging and other reasons like roads, urbanization and Fuelwood accounting for the rest (Anon., 1994b). Tropical forests are one of the last frontiers in the search for subsistence land for the most vulnerable people worldwide (Myers, 1992). Millions of people live on the tropical forest with less than a dollar a day where a third of a billion are estimated to be foreign settlers. However, as the land degrades people are forced to migrate, exploring new forest frontiers increasing deforestation (Wilkie *et al.*, 2000; Amor, 2008; Amor and Pfaff, 2008).

One major cause of deforestation is the expansion of agricultural land. This is because agricultural land expansion is generally viewed as the main source of deforestation contributing around 60 per cent of total tropical deforestation. Shifting agriculture also called slash and burn agriculture is the clearing of forested land for raising or growing the crops until the soil is exhausted of nutrients and or the site is overtaken by weeds and then moving on to clear more forest. It is been often reported as the main agent of deforestation. Smallholdings in agricultural production and the growing number of such producers, notably shifting cultivators were the main cause of deforestation (Anon., 1990b; c; Dick, 1991; Anon., 1992a; b; Barbier *et al.*, 1993; Ascher, 1993; Dove, 1993; 1996; Dauvergne, 1994; Porter, 1994; Thiele, 1994; Anon., 1994c; Angelsen, 1995; Ross, 1996).

Mostly all reports indicate shifting agriculture as responsible for about one half of tropical deforestation and some put it up to two-thirds. Shifting agriculture was greatest in Asia (about 30 per cent) but only about 15 per cent over the whole tropical world. It appears that the proportion of direct conversion of forest to agriculture is increasing and the proportion of shifting agriculture is decreasing with time (Sumit, 2012).

2.6.2 Logging and fuel wood

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

forest areas (Repetto, 1988; 1990; Rowe *et al.*, 1992; Anon., 1994a). Fuelwood is not usually the major cause of deforestation in the humid tropics although it can be in some populated regions whereas in the drier areas of the tropics, fuelwood gathering constitutes a major cause of deforestation and forest degradation. For instance, fuelwood gathering was considered to be the main cause of deforestation and forest degradation in El Salvador (Repetto, 1990).

2.6.3 Mining

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

Massive and unchecked mining of coal, iron ore and bauxite in Jharkhand, India has caused large scale deforestation and created a huge water scarcity (Anon., 2011b). In return for US\$3.8 billion of investment, the agreements between the State government of Jharkhand, India and mining companies, there will be a massive land acquisition which will deforest no less than 57,000 hectares of forest and displace 9,615 families, many of them located in legally protected Scheduled Areas set aside for indigenous peoples in the State (Mullick and Griffiths. 2007). Moreover, Roads constructed to support the mining operations will open up the area to shifting agriculturists, permanent farmers, ranchers, land speculators and infrastructure developers. For instance the core of Brazil's Amazon development strategy were infra-structure development projects such as roads providing access to frontier regions, mining area and large hydroelectric reservoirs (Mahar, 1988; Fearnside and Barbosa, 1996; Carvalho *et al.*, 2002, 2004).

The construction of roads, railways, bridges, and airports opens up the land to development and brings increasing numbers of peoples to the forest frontier. If wood is used as fuel in mining operations and it is sources from plantations established for the purpose, it can cause serious deforestation in the region. On the other hand, mining can be labour intensive and take labour away from clearing forest (Sumit 2012).

2.6.4 Urbanization/Industrialization and Infra-structure

Expanding cities and towns require land to establish the infrastructures necessary to support growing population which is done by clearing the forests (Mather, 1991; Sands, 2005). Tropical forests are a major target of infra-structure developments for oil exploitation, logging concessions or hydropower dam construction which inevitably conveys the expansion of the road network and the construction of roads in pristine areas (Kaimowitz and Angelsen, 1998). The construction of roads, railways, bridges, and airports opens up the land to development and brings increasing numbers of people to the forest frontier. Whether supported or not by the governmental programmes, these settlers have usually colonized the forest by using logging trails or new roads to access the forest for subsistence land (Wilkie *et al.*, 2000; Amor, 2008; Amor and Pfaff, 2008). (Wilkie *et al.*, 2000; Amor, 2008; Amor and Pfaff, 2008). The development of these infrastructure projects are of worldwide concern, since tropical forest clearing accounts for roughly 20 per cent of anthropogenic carbon emissions destroying globally significant carbon sinks (Anon., 2001c) and around 21 per cent of tropical forests have been lost worldwide since 1980 (Bawa *et al.*, 2004).

2.6.5 Corruption and political cause

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

2.7 Effects of Deforestation

The implications of deforestation are far-reaching as they transcend national boundaries. This underscores the need for a global approach to combating the problem.

Some of the effects of deforestation are discussed under subsections 2.7.1 to 2.7.3.

2.7.1 Climate change

It is essential to distinguish between microclimates, regional climate and global climate while assessing the effects of forest on climate (Gupta *et al.*, 2005) especially the effect of tropical deforestation on climate. Deforestation can change the global change of energy not only through the micrometeorological processes but also by increasing the concentration of carbon dioxide in the atmosphere (Pinker, 1980).

Deforestation affects wind flows, water vapour flows and absorption of solar energy thus clearly influencing local and global climate (Chomitz *et al.*, 2007). Deforestation on lowland plains moves cloud formation and rainfall to higher elevations (Lawton *et al.*, 2001). Deforestation disrupts normal weather patterns creating hotter and drier weather thus increasing drought and desertification, *crop failures*, melting of the polar ice caps, coastal flooding and displacement of major vegetation regimes (Dregne, 1983).

2.7.2 Economic Losses

The tropical forests destroyed each year amounts to a loss in forest capital valued at US \$ 45 billion (Hansen, 1997). By destroying the forests, all potential future revenues and future employment that could be derived from their sustainable management for timber and non-timber products disappear.

2.7.3 Social Consequences

Deforestation, in other words, is an expression of social injustice (Colchester and Lohmann, 1993). The social consequences of deforestation are many, often with devastating long-term impacts. The most immediate social impact of deforestation occurs at the local level with the loss of ecological services provided by the forests. Forests afford humans valuable services such as erosion prevention, flood control, water treatment, fisheries protection and pollination functions that are particularly important to the world's poorest people who rely on natural resources for their everyday survival. By destroying the forests we risk our own quality of life, gamble with the stability of climate and local weather, threaten the existence of other species

and undermine the valuable services provided by biological diversity (Schmink and Wood, 1992).

2.8 Effects of deforestation on livelihoods in forest fringe communities

Deforestation destroys the forests that buffer the water resources which form essential livelihood assets in forest communities (Agyemang, 1996; Brown, 1999). This exposes the water resources to the elements of the weather, leading to the drying up of vital water bodies. Deforestation also makes forest communities susceptible to erosions and floods.

Another major environmental threat of deforestation to the livelihood of forest fringe communities in Ghana is soil degradation. That is, deforestation exposes the surface of fertile lands to the harsh conditions of the atmosphere such as the ultra violet radiation of the sun and the blowing away of the top soils by heavy winds, thereby leaving surfaces of lands hard and bereft of plant nutrients. Many forest communities' farmlands are fragile and can be easily made non-viable by small changes in their ecology (Amisah et al., 2009). It is a known fact that deforestation disrupts normal weather patterns creating hotter and drier weather thus increasing drought and desertification that lead crop failures. Thus, in the long term deforestation could create adverse ramifications on plant growth that could potentially grind farming livelihoods to a halt in such forest fringe communities.

In addition, forest fringe communities are deprived of forest resources such as wood products, food, medicinal plants through deforestation. Thus, the impacts of deforestation in exacerbating rural poverty are complex and widespread. Not only does forest loss reduce forest communities' contributions to national economic growth, but more critically, it threatens the livelihoods and traditions of rural and forest dwelling people across the country (Acheampong and Marfo, 2011). With NTFPs reducing alongside the trees that support them, forest communities often have to travel further distances into the forest to access products that sustain their food security and socioeconomic well-being (Bosu et al, 2010).

Across Ghana, logging operations have also had negative impacts on the collection of NTFPs at the local community level. Forest dwelling or depending communities rarely benefit from timber harvesting as concessions are reserved exclusively for corporate use (despite pervasive illegal tree cutting), while social responsibility agreements do

not make adequate compensation provisions when forest dwellers' farming activities are destroyed in the process of timber harvesting (International Tropical Timber Organization (ITTO), 2005).

2.9 The effects of regulation enforcement on forest based livelihoods

Most often than not, various bodies such as governments, public agencies and suchlike, in their efforts to prevent or check deforestation introduce new laws/regulations to debar people from intruding the forest reserves. These laws sometimes deny forest fringe communities the right of accessing NTFPs which form important part of their livelihood.

Sunderlin et al. (2005) make an elaborate analysis of forest-based livelihoods activities that capture relevant human-forest interactions. Three types of forest based livelihood activities are classified. The first activity encompasses hunting and gathering of food and other non-timber forest products. The second is "swidden cultivation", which defines forest resources of agricultural land. The last forest-based livelihood activity is sedentary agriculture at forest frontier that is defined by agricultural land and marketing of forest products (Sunderlin et al., 2005).

The first forest-based activity of hunting and gathering has been identified as a major livelihood activity for those who live near the forest. This type of forest-dependency includes the gathering of a wide variety of non-timber and forest products, such as fuel wood, bush meat, fruit, herbal medicines, weaving materials and wood for construction. These products are harvested for both subsistence and commercial use on regular basis or for seasonal dependence (Shackleton & Shackleton, 2004).

Many of the above mentioned forest-based livelihoods are greatly affected by policy and regulations in relation to the forest (Sunderlin et al., 2005). Kaimowitz (2003) presents several scenarios under which the livelihoods of poor rural households and communities will be affected due to the strict enforcements of forest management laws. Depending on the character of the forest laws, rural households can be negatively affected or can be strengthened. Some existing legislations have severe negative implications for rural livelihoods.

Major negative effects include government interference with traditional and indigenous forest regulations concerning the use of the forest, loss of social capital, threat to

physical security, loss of job opportunities and loss of access to forest resources such as fuel wood and food. Ultimately, enforcements of these laws can result in further degradation of the forest. Other legislations however can contribute to the livelihoods of local communities near the forest areas. this can be done by assuring access for poor rural households to various non-timber forest products, decreasing the level of physical violence by stricter control and punishment of illegal activities, helping to maintain the long-term supply of forest products and serves poor households, promoting poor people's participation in decision-making and respecting poor household's rights, cultures and traditions.

2.10 Livelihood consideration in the Ghana forest policy

The Forest and Wildlife Policy (1994) of Ghana explicitly recognizes the rights of local communities to benefit from the forest resources in their daily livelihoods. The policy explicitly states that:

- The Government of Ghana recognizes and confirms the right of people to have access to natural resources for maintaining a basic standard of living and their concomitant responsibility to ensure the sustainable use of such resources.
- A share of financial benefits from resource utilization should be retained to fund the maintenance of resource production capacity and for the benefit of local communities.

These stipulations are reflected in a complex legal structure regarding the rights to forest lands and products in Ghana. This legal structure combines elements from statutory and customary legal systems and includes a distinction between land tenure and tree tenure rights (Amanor, 1999; Owuba et al., 2001; Otsuka et al., 2003; Akyeampong Boakye and Affum Baffoe, 2008; Dabrowska, 2009; Marfo, 2009a).

Access and ownership rights to forest lands and products

With regard to access and ownership rights to forest lands and products in Ghana, there exists a distinction between the tenure arrangements for land and for trees (Amanor, 1999; Marfo, 2009a). The land tenure rights are governed by a combination of both statutory and customary laws. The formal ownership of lands in Ghana is based on a division between public lands and stool lands under allodial title by traditional chiefdoms and clans. The public lands concern either lands that were officially acquired

by the state from the allodial owners or vested lands for which the legal title is transferred to the State, whilst the beneficial interests rest with the community. The formal permanent forest estates established by the state concern such vested lands in which the land continues to be the property of the community, while the government manages it for the collective good of the public.

These rights do not only concern trees in the forest reserves, but also trees on farmer fields. Notably in the widespread cocoa plantations trees are commonly maintained for micro-climate regulation (Asare, 2005; Slesazack, 2008). Although farmers are allowed to select which trees should be removed or maintained on their farms during clearing for cultivation, they have formally no rights to fell commercial trees on their farms. However, in respect of planted trees on freehold lands, ownership rights of the planter are recognized.

Forest benefit-sharing mechanisms

The legal pluriformity regarding forest use with a differentiation in land and tree tenure conditions and a combination of both statutory and customary rights has resulted in a complex system of benefit-sharing from timber exploitation. Formally, the government has the sole right to decide over commercial exploitation of natural forests. For timber logging, they issue logging permits to timber companies holding a formal Timber Utilization Contract (TUC). The net benefits from the revenues received by the state from these timber sales are distributed to the traditional stool authority (45percent) and the District Assembly (55percent) responsible for the administrative region where the stool lands are situated (Marfo, 2009a).

Officially, the government, in consultation with the land owners, has the right to control timber exploitation on off reserve areas. In practice, however, on the off-reserve areas, Timber Utilization Contract (TUC), Timber Utilization Permit (TUP) as well as Salvaging Permit are often granted to prospective timber contractors. However, informal system of timber exploitation through chainsaw operators takes place. These small-scale operators do not hold an official timber permit from the forestry commission. They normally negotiate with the land owners or individual farmers to get their way through. These suggest that; timbers cutting without permission of the farmers are uncommon. Since the publication of the 1998 Timber Resources Management Regulations chainsaw logging is formally illegal, but it is still widespread

and supplies most of the domestic timber market (Hansen and Treue, 2008; Marfo 2009b). Thus, within the Ghanaian forestry policy system explicit attention is given towards the sharing of benefits of timber production. In practice, most attention is often given to the benefit-sharing mechanisms for the customary authorities formally holding land ownership rights. In the Ghanaian Constitution, it is stipulated that these customary authorities should act on the basis of being a trustee or custodian of the land with the obligation to discharge their functions for the benefit of the people and be accountable as fiduciaries in this regard (Marfo, 2009a). However, there is no explicit legal stipulation that (part of) the timber revenues received by the stool authorities should be invested in the local communities. Hence, when it comes to benefit-sharing of the royalty payments, there is an ongoing discussion in Ghana on whether the timber revenues should be partly (re)allotted by the traditional authorities and/or district authorities to local communities (Opoku, 2006; Marfo, 2009a).

In order to ensure further community benefits from timber production, on the basis of the 1994 Forest and Wildlife Policy, several initiatives have been undertaken to further stimulate community involvement in forest management and benefit-sharing. The two most important initiatives concern the introduction of the Social Responsibility Agreements and the introduction of collaborative forest management in the form of the Modified Taungya System. The first initiative concerns a new regulation that stipulates that before being granted a logging permit, timber contractors need to negotiate an agreement on the provision of specific social facilities and amenities to the local inhabitants of a proposed logging area (Ayine, 2008). The second initiative concerns new approaches towards benefit-sharing in tree plantation schemes on reserved forest lands (Blay et al., 2008).

The Taungya system involves a reforestation method in which farmers are temporarily given a plot of forest land to plant forest trees and to produce food crops. The farmers had the rights to the food crops, but the trees remain the property of the management organization. Originally, the revenues from the timber produced under this scheme was distributed between the Forestry Commission having the management responsibility over the forest reserves (60 percent), the District Assembly and Administrator of stool lands representing the land owners (24 percent), and local community groups and customary freehold landowners (16 percent). However, in order to allow more local livelihood benefits, the new Modified Taungya System officially allocates only 40

percent to the Forestry Commission, 20 percent to local communities groups, and 40 percent to the farmers participating in the scheme (Marfo, 2009a)

2.11 Key Findings from the Literature Review

From the literature, it's clear that deforestation has far-reaching implications in terms of environmental, social and economic dimensions of development. The literature reviewed has shown that, human activities such as cultivation of forest areas, logging and fuel wood use, mining and urbanization form some of the major drivers of the deforestation process. This destruction of the forest cover leads to climate change including changes in rainfall pattern. Since most of the farmers rely heavily on rain-fed agricultural production, the changes in the rainfall pattern affect the yields of farm produce. When this phenomenon of crops failure continues to occur unabatedly, some of the farmers get frustrated and quit farming and for that matter, lose their means of livelihood.

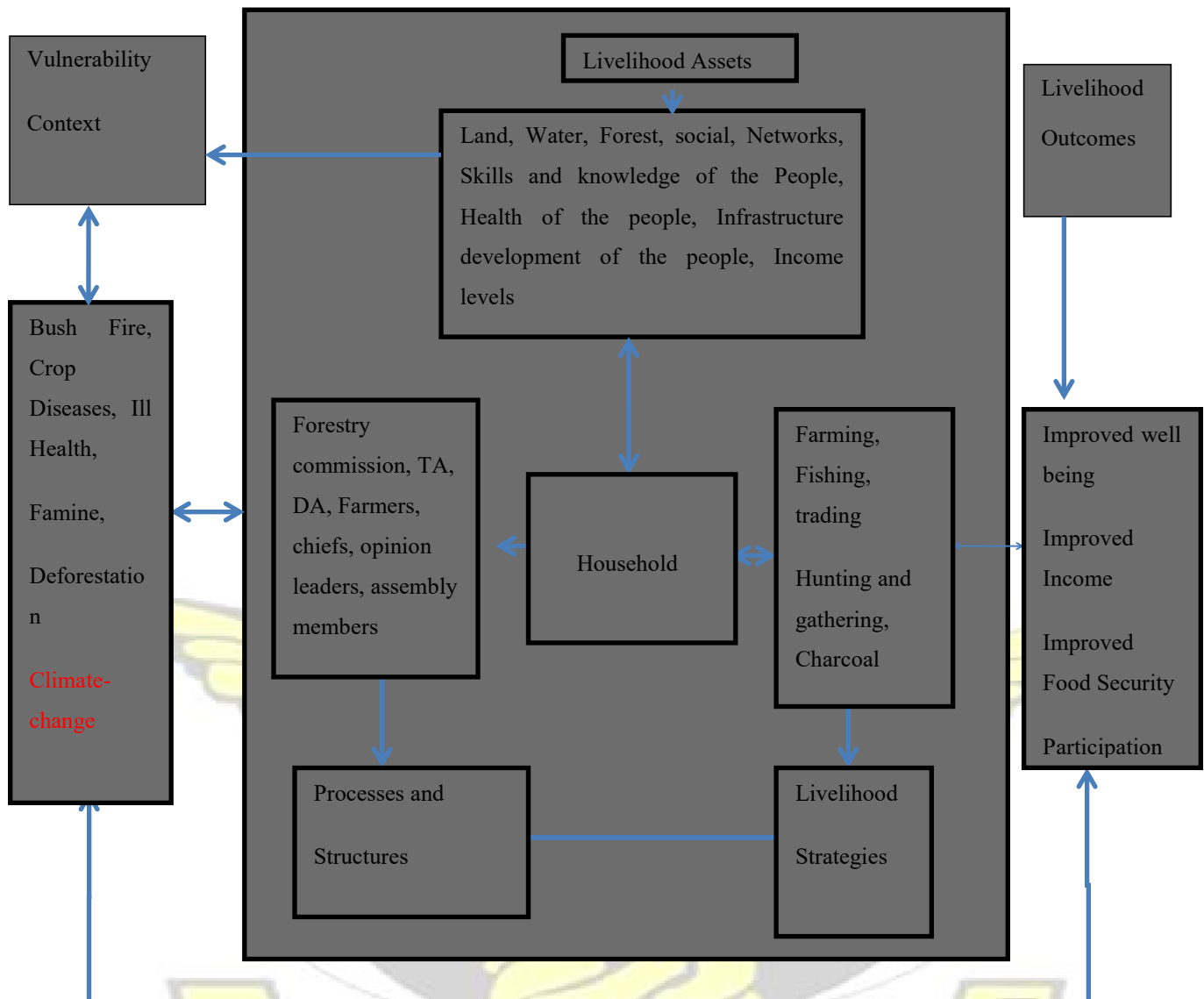
Another effect of deforestation on livelihoods of forest communities is that, without the forest, community dwellers that depend on hunting as their means of livelihoods would be hard hit by the loss of the forests where their hunting activities take place. Moreover, deforestation makes the sustenance of water resources such as streams, springs and rivers that serve as both drinking and domestic water sources become a problem.

Moreover, products usually gathered from the forest by such forest fringe communities mostly Non Timber Forest Products (NTFPs) including snails, mushrooms, canes, raffia and leafy vegetables. They are particularly important among the rural poor who have access to few resources beyond the forest. Women, children, youth, and men engage in gathering depending on the product being gathered. Most of these NTFPs are however becoming extinct or unavailable due to bushfires and its continuous exploitation without any attempt to regenerate them. Hunting which is another form of livelihood is mainly practiced by males. However, the continuing existence of this livelihood depends on the continued availability of suitable wildlife habitats.

The study therefore seeks to confirm or otherwise refute what the literature has revealed concerning deforestation and its effect on livelihood patterns of forest fringe communities. This was done by exploring empirically the problem of deforestation in the Asunafo North Municipality and how it is affecting livelihood patterns.

2.13 Conceptual Framework

Figure 2.2: Conceptual Framework for Effects of Deforestation on Livelihood Patterns



Source: Author's Construct

Figure 2.2 above discusses the livelihood strategies, structures, livelihood outcomes and livelihood assets of Asunafo North Municipality. The assets of the people are financial, human, physical, natural and social capital. The stakeholders managing the forest resources are the forestry commission, the traditional authorities, the opinion leaders, the Municipal authorities and the farmers. The livelihood assets of the people are basically land, forest reserve, income, skills and infrastructure in the area. The relationship between natural resources such as forest resources and the livelihoods

opportunities of the forest fringe communities, is heavily determined and dependent on the quality of the natural resource available to them.

The livelihood of the people in the forest fringe areas of Ghana including the Asunafo North Municipality are farming, fishing, hunting and gathering, trading, craft making and animal rearing. The products usually taking out of the forest are mostly Non Timber Forest Products (NTFPs). Such as snails, mushrooms, game, canes, raffia and leafy vegetables. They are particularly important among the rural poor who get access to few resources beyond the forest. Women, children, youth, and men who are engaged in gathering depend on the produce being gathered. Most of these NTFPs are however becoming extinct or unavailable due to human induce activities such as food and cash crop farming, construction, bushfires and its continuous exploitation without any attempt to regenerate them. Hunting which is another form of livelihood is mainly practiced by males. However, the continuing existence of this livelihood depends on the continued availability of suitable wildlife habitats.

The critical conjunction of these factors is that they determine the sources of livelihoods of people and how they manifest in their lives. Choices on how to improve their wellbeing are therefore determined by the livelihood environment where the nature of livelihoods in forest fringe communities becomes evident. Thus human, social, physical, natural and economic capital define the nature of livelihoods assets which determines the choices people make about how to cope, reduce, manage risks and shocks in forest fringe localities .

The arrows in figure 2.2 above show the direction of flow in terms of livelihood strategies and opportunities that are available to the people leaving in the forest fringe communities.

CHAPTER THREE

RESEARCH METHODOLOGY AND PROFILE OF STUDY AREA

3.1 Introduction

This chapter details the processes and methods used in conducting the study. It constitutes a research design type used for the study, sampling and sample size determination, type and sources of data, and the methods of data gathering, processing, and analysis and reporting. This chapter also contains the profile of the study area such as the demographic, physical, economic and social characteristics of the study area. Also the climatic conditions in the study area are duly covered under the profile.

3.2 Research Design

The study employed a case study research design to undertake this enquiry. Yin (2003) explains case study as an approach, which examines a contemporary phenomenon within its real-life context. According to Yin, the distinctive need for case studies emerges out of the yearning to comprehend complex social phenomena. This is because, “the case study method allows researchers to retain the holistic and meaningful aspects of real- life events” Yin (2003:2). Again the case study approach allows for establishment of relationships among the factors that have resulted in the phenomena under study.

The case study has been found to be suitable for investigating into issues that seek to establish relationships such as this research which aims at assessing the relationship between deforestation and livelihood patterns. To achieve the objectives of this study, data was collected on issues like the pattern deforestation, contribution of deforestation to changing livelihood patterns and effects of agricultural on livelihood patterns in the municipality.

In explaining the suitability of the adopted research design, it has been found out that case study is appropriate for investigating how and why things happen, allowing the investigation of contextual realities Again, the case study aptly allows for empirical enquiry that helps to investigate the dynamics of a particular system (Haggett and Frey, 1997).

Case study is not intended as a study of the entire organization; rather it is intended to focus on a particular issue, feature or unit of analysis. This method enables the researcher to understand the complex real-life activities in which multiple sources of evidence are used. The use of case study to probe an area of interest in depth is particularly appropriate as case studies are useful where one needs to understand some particular problem or situation in great-depth, and where one can identify cases rich in information. In order to gain the deeper understanding of the phenomenon under study, the case study approach has been adopted for this study. This will help link the background issues on the subject matter which have been discussed in the chapter one.

3.3 Research Variables

According to Mugenda and Mugenda (1999), a variable is a measurable characteristic that assumes different values among subjects. They are therefore logical groupings or expression of attributes (Babbie, 2007). Miller and Brewer (2003) indicate that variables help in moving a research from a conceptual to an empirical level, employing the variables as key elements of the research problem.

With these understandings and in line with the focus of this study, the variables for the study comprised but not limited to: amount of trees cut down annually, methods of lumbering, farming practices and output levels of agriculture, livelihood patterns, livelihood sustainability, alternative livelihood approaches adopted and among others.

3.4 Data Sources and Collection Methods

Data for this study was obtained from both primary and secondary sources. Both the secondary and primary data comprised of quantitative and qualitative data. The primary data was gathered directly from the field and from stakeholders like farmers, Municipal Meteorological Department, Forestry Commission and Municipal Agricultural Development Units. The primary data was collected using a combination of interview guides and structured questionnaires. The structured questionnaires were used to collect data from the farmers while the interview guides were used for the Municipal Meteorological Department, Forestry Commission, Municipal Agricultural Development Units and Agricultural Extension Officers.

The secondary data also served as another important source of data for this study. The secondary data were sourced from books and publications of various scholars and authors which are related to deforestation and livelihood patterns. The information from

the secondary data sources gathered were reviewed and used to supplement the field data.

The data required, data sources and mode of collection are summarized in Table 3.1 below:

Table 3.1: Data Required, Sources and Collection Techniques

Study Objectives	Variables (Data Required)	Data Source	Mode of Collection
Assess the extent of deforestation in the Asunafo North Municipality.	Extent of forest loss, rise of temperatures,	Farmers, MADU, FC	Questionnaire and Interview
Identify the causes of deforestation in the Asunafo North Municipality.	Pattern of deforestation, good farming practices, measures put in place to stop illegal logging	Farmers, MADU, FC	Questionnaire and Interview
Identify the sources of livelihood on forest communities in the Asunafo North Municipality	Farming practices, fertiliser applications	Farmers, MADU, EPA	Questionnaire and Interview
Examine the extent to which deforestation has affected the livelihood patterns in the study area.	Pattern of deforestation, livelihood pattern,	MADU, FC,	Questionnaire and Interview

Source: Author's Construct, 2013.

3.5 Study Population

According to Frankel and Wallen (2000) a population is defined as the total number of all units of the issue or phenomenon to be investigated into which is “all possible observations of the same kind”. Population is understood as the group to which the results of the research are intended to apply (Frankel and Wallen, 2000). They further argued that population is usually the institutions or individuals who possess certain features or a set of features a study intends to examine and analyze.

The population for this study comprised of stakeholders concerned with the issues of forest utilization and deforestation. The accessible population comprised of farmers, government agencies and departments like the Municipal Meteorological Department,

Municipal Agricultural Development Unit and Forestry Commission. These formed the units of enquiry for the collection of all the requisite data for this study.

3.6 Sampling Technique and Sample Determination

The concept of sampling is most fundamental to the conduct of any research and the interpretation of research result.

In general terms sampling enables the researcher to study a relatively small number of units in place of the target population and to obtain data that are representative of the whole target population. In most cases, however, researchers opt for an incomplete coverage and study only a proportion of the population with homogenous properties, a sample.

The need to undertake sampling or sample survey is guided by a number of factors. In many cases a complete coverage of the population (universe) is not possible. In this case, sampling serves the practical purpose of making possible the study of problems otherwise could not be undertaking due to prohibition of cost, time, personnel or scope. A sample is thus, a representative selection of a population that is examined to gain statistical information of the whole. Samples are expected to be representative of the population. For that reason samples must be chosen by means of sound methodological principles. Sampling thus denotes the process of choosing the research unit of the target population which are to be include in the study.

Before any accurate sample can be obtained, it is required that the following are determined;

{a} identification of a sampling frame, {b} determination of the appropriate sampling technique that ensures a representation of the universe {c} spreading the sample to ensure equal representation. In this regard, the mathematical method was applied to determine the sample size as explained below.

$$n = \frac{N}{1 + N(\alpha)^2}$$

Where: N = Total Population (excluding institutions)

α = Confidence Level (The researcher took 95 percent confidence level).

n = Sample Size

The Table 3.2 provides some registered farmers population figures for the four major communities in the study district.

Table 3.2: Some registered farmers of the case study communities

Communities	Total Farmers (2013)
Fawohoyeden	2850
Akwasi Addai	1254
Gyasikrom	894
Apenkro	1105
Total	6103

Source: Dormaa Municipal Assembly, 2011

Using the mathematical determination with the total population of the four (4) selected communities = 6103

$$n = \frac{N}{1 + N(\alpha)^2} = \frac{6103}{1 + 6103(0.05)^2} = 375$$

n = 375. Therefore, the total sample size for the study is 375

Table 3.3 shows the computation of some registered farming populations that were selected from each of the settlements under review

Table 3.3: Sample size for case study communities

Community	Calculation	Percentage samples	Absolute samples
Fawohoyeden	$\frac{2850}{6103} * 100\%$	46.7	175
Akwasi Addai	$\frac{1254}{6103} * 100\%$	20.5	77
Gyasikrom	$\frac{894}{6103} * 100\%$	14.6	55
Apenkro	$\frac{1105}{6103} * 100\%$	18.2	68
Total		100	375

Source: Author's construct, 2012

The table 3.3 above represents the various communities and their register obtained from Asunafo North Municipal Assembly. A simple random sampling was applied to choose the sample size. The total number of the entire population was 6103. Thus to get the sample size from the unit of analysis. The respective community population were divided by the entire Gross-total population of 6103 and then multiply by 100%.

Adding up the corresponding values together gives a total of 375 respondents. Spread through a proportionate random sampling procedure. (SEE Table 3.2 and 3.3).

3.7 Data Collection Procedure

Reconnaissance surveys, desk studies, interviews and on-field observations were undertaken in the study area to obtain first-hand information on the prevailing situation, climatic conditions and adaptation strategies and mechanism that are in place with the forest fringe communities. Extensive literature review was undertaken to gather information on the extent of deforestation over the years, changes in forest cover, forest types and forest designations.

A pilot test was conducted with a small group representative of the population to assess the face validity of the questionnaires. The questionnaire was pretested with ten farmers. Respondents were asked to fill out the questionnaire accompanied by interviews in order to refine the meaning, understanding, wording and formatting of the questions. During the individual pretest, the researcher sought to seek respondents' understanding in respect of the structured questionnaire and the interview guide bearing in mind the various principles underpinning social research and the ethical practices. Revisions were made based on the feedback, comments and recommendations from the respondents.

3.8 Data Analysis

The understanding and insight gained from the literature reviewed formed a formidable foundation for the analysis of the field data gathered. The processing of the data collected involved data editing to overcome errors. Then, the data was coded and then entered into Statistical Package for Social Sciences (SPSS) to allow for the analysis. The analysis of the data was carried out using qualitative and quantitative techniques. Tables and charts were used for the quantitative analysis. The Statistical Package for Social Sciences (SPSS) and Excel were employed to process and analyze the data. The

SPSS allowed for the identification of causal relationship between variables and cross tabulation for useful analysis.

3.9 Profile of the Study Area

This section discusses issues such as the location and size of the study area, climatic conditions, demographic and the various economic activities in the study area.

3.9.1 Location and Size

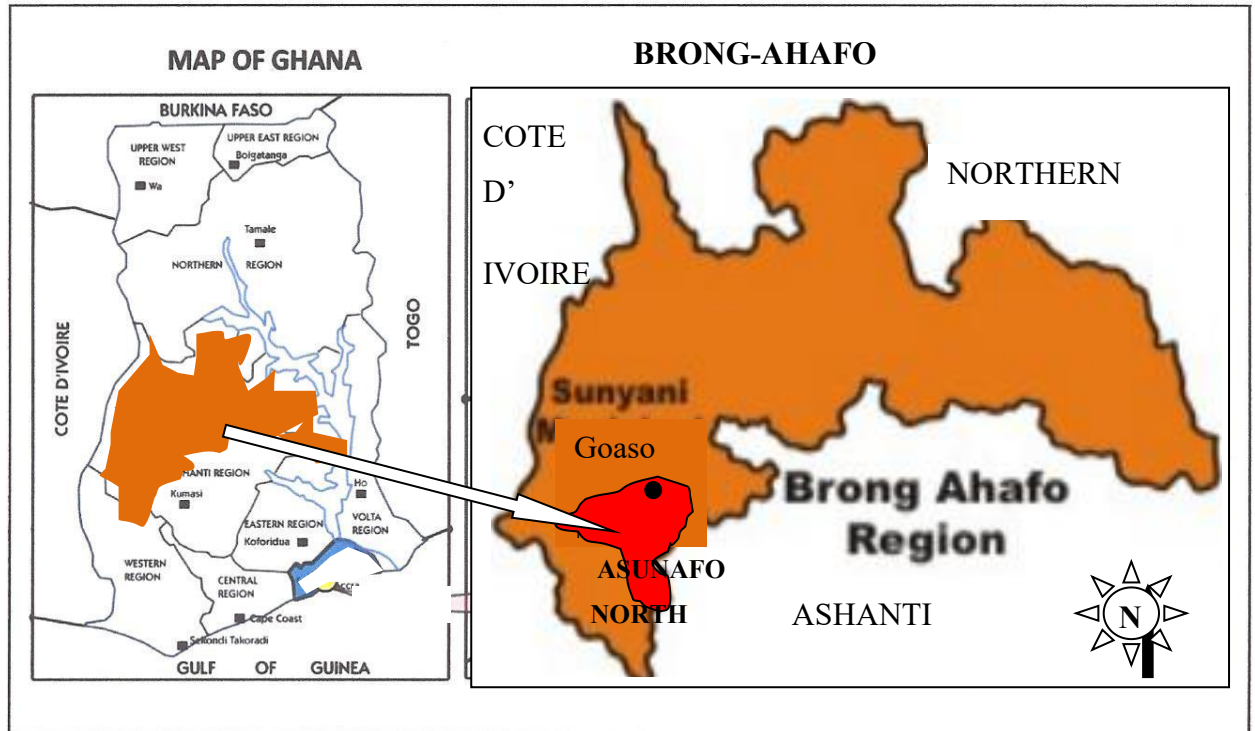
The Asunafo North Municipality is one of the Municipalities in the Brong Ahafo Region. The Asunafo North Municipality lies between Latitudes 6°27'N and 7°00'N and Longitudes 2°52'W and shares common boundaries with Asutifi in the North East, Dormaa Municipality on the North West and Juaboso Bia and Sefwi-Wiaso Districts in Western Region on the West-South borders, and Asunafo South Municipality in the Brong Ahafo Region on the South-Eastern borders. The total land size of the District is 1093.7km² with 389.7 km² covered by several forest reserves (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009).

For purposes of decentralization and ensuring the participation of the local people in the decision making process and efficient administration of the Municipality, the area is further divided into six sub-structures through a Legislative Instrument 1589. These structures are made up of One Urban Council at Mim, One Town Council at Goaso and four Area Councils, namely Ayomso, Asumura, Akrodie and Dominase.

Figure 3.1 below has been incorporated by the researcher to provide easy location and visual appreciation of the study area.

The figure 3.1 shows the location of the study Municipality in National and Regional Context.

Figure 3.1: Asunafo North Municipality in the National and Regional Context



Source: Ghanadistricts.com, 2014.

3.9.2 Geology Relief and Drainage

Asunafo North Municipality lies within the central part of the forest-dissected plateau of the physiographic Region of Ghana. There are different types of rocks in the district; these include the pre-cambrian Birrimian and Taruwaian Formations. The Municipality has a gently rolling landscape ranging between 500 feet and a little over 1000 feet (above sea level). The topography is more rugged towards the North-Eastern (Mim Area) and south-Western (Abuom). There are two main rivers among several other smaller streams in the district. The major Rivers in the District are Rivers Goa and Ayum (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009).

Geology, relief and the drainage has been provided to show the relative importance of the study area in terms of deforestation and the concomitant effects it has on the nature, and the justification for the investigation in the study area.

3.9.3 Climate and Temperature

Asunafo North Municipality experiences the Wet-Semi-equatorial type of climate; the principal characteristics are discussed under Temperature, Rainfall and Relative

Humidity. The temperature of the Municipality is uniformly high all year round with the hottest month being March where about 30°C have ever been recorded. The mean monthly temperature for the Municipality is 25.5°C (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009).

The Municipality experiences a double Maxima rainfall pattern with the Mean annual rainfall roughly between 125cm and 175cm. The major rains occur between April and July with the minor falling between September and October. There is a short dry spell in mid-August before the prolonged dry season between November and March. The main planting season starts with the onset of the major rains. The relative humidity of the district is highest on the wet season ranging between 75-80 percent while the dry season gives the lowest range between 20-55 percent. The major soil groups which cover the surface of the district is forest Occhrosols. The soils are highly coloured and contain great quantities of nutrients. They are generally alkaline and support many crops such as plantain, cocoyam and cocoa (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009). This shows the relative importance of the study area in terms of its contribution to national rainfall figures, food production, stock of natural resources conservation and sustainability requirement in the area.

3.9.4 Vegetation

The district lies within the semi-deciduous forest belt of Ghana. The forest contains different species of timber some of which are Mahogany, Chenchen, Dahoma, Kusia, Sapale, Odum Aprozuma, Emirre and Onyina/Ceiba etc. These trees are highly valuable for the timber industry and provide sources of employment and foreign exchange earnings for the country Ghana. The main vegetation cover of the Asunafo North Municipality is the closed forest type. For many important reasons, parts of the forest in the district have been reserved. The main forest reserve in the district and their coverage in square kilometres are Abonyere Reserve 41.18km, Bonsambepo 135.90km, Ayum Reserve 112.85km and Bonkoni Reserve 108.564km (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009). PUT FOREST RESERVES MAP

The presence of the forest reserves and the livelihood opportunities it provide to forest fringe population and the nation at large underpin why researcher's should pay particular attention to the area for tentative findings for national development,

3.9.5 Demographic and Socio-economic Characteristics

This section of the profile deals with the population and some of the socioeconomic characteristics of the district. These include population size, growth rates, population density, rural urban split and age and sex ratios among others.

Population Size and Growth Rates

The district has a population of 124,685 people (Ghana Statistical Service, 2012). This is made up of about 50.4 percent males and 49.6 percent females with a population growth rate of 2.6 percent which compares favorably with the Regional and National growth rates of 2.5 and 2.6 percent respectively within the same period of 2000 and 2010.

Age-Sex Structure

The population of the district comprises of 62,854 and 61,831 males and females respectively (Ghana Statistical Service, 2012). This phenomenon of more males than females in the district is at variance with the national situation where females outnumber males. The district's population is heavily concentrated within the ages of 0-34 years and that; the economically active population constitutes 53.3 percent while the dependent population forms 46.7 percent (Asunafo North Municipal Assembly-Medium Term Development Plan, 2009).

Rural – Urban Split

Rural–Urban split indicates the proportion of population living in rural and urban areas. The Asunafo North District is predominantly rural with 71.6 percent of its population living in the rural areas (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009). Apparently, since most rural areas in Ghana are agrarian and largely depend on the forests and forest products for their livelihoods, the implication is that; the depletion of the forest resources will affect majority of the people (71.6%), especially the rural folks.

3.9.6 Socio-economic Characteristics

Farming Practices and Crop Production

The major farming practice in the municipality is mixed cropping which constitute about 81% of persons employed in the agricultural sector of the district. This is

followed by plantation farming which is 15 percent with only 4 percent mono-cropping (Asunafo North Municipal Assembly- Medium Term Development Plan, 2009).

Some of the major food crops grown in the Municipality are plantain, cocoyam, rice, maize and cassava whilst some of the main cash crops include oil palm, cocoa and coffee.

The Table 3.4 provides information on the major crops cultivated in the study area.



Table 3.4: Major crops cultivated in the Asunafo North Municipality

Comparative Production Figures (2009-2010)

Crop	Area Cropped (Ha)			Average Yield (Mt/ha)			Production (Mt)		
	2009	2010	% Change	2009	2010	% Change	2009	2010	% Change
Maize	5,710	5,710	0.04	1.79	1.80	0.74	10,202	10,278	0.74
Rice	110	130	18.18	1.27	1.30	2.63	139	169	21.29
Cassava	4,000	4,100	2.50	15.30	15.40	0.67	61,189	63,140	3.19
Yam	90	90.01	2.00	13.87	13.86	-0.01	1,248	1,247	-0.01
Cocoyam	3,480	3,680	5.83	7.61	7.70	1.24	26,467	28,336	7.06
Plantain	8,250	8,360	1.33	18.94	18.10	-4.44	156,266	151,316	-3.17

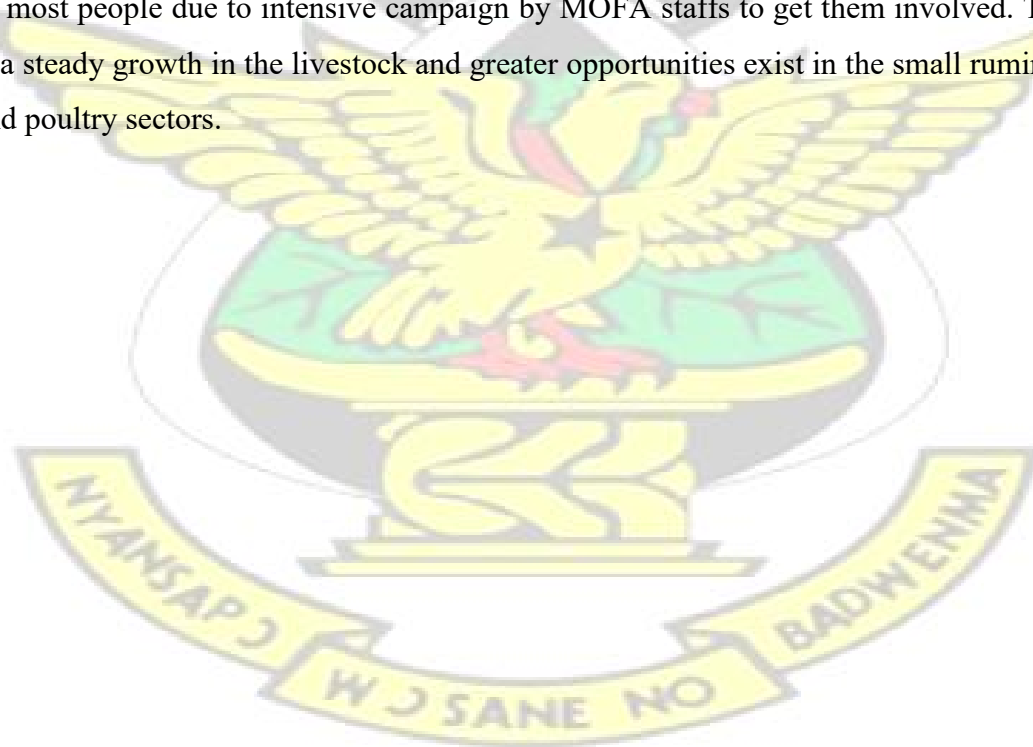
SOURCE: Municipal Agriculture Development Unit (MADU), 2010

Fisheries

The Municipality abounds in small scale fish pond farming which normally occurs in Swampy and low lying areas, due to the extensive drainage pattern of major rivers and streams. Fish ponds are stocked with low prolific species and productivity per pond per year is very low (1.7 tons). Activities under this sub-sector have been quite poor. Out of 140 fish ponds constructed in the 80's only 25 are functional. Wrong siting of ponds has also been one of the major setbacks.

Livestock

Cattle rearing are of late assuming significance. Cattle reared in the district are small herds of local breed such as the West African Short horn, Gudali and Sanga. Sheep and goats are reared almost in every village and usually under free range system. Commercial poultry rearing is ongoing and confined mainly to the big towns such as Mim and Goaso. Peasant farmers also keep some local fowls on free range system in almost every household. Pigs, rabbit and grass cutter rearing are fast receiving attention of most people due to intensive campaign by MOFA staffs to get them involved. There is a steady growth in the livestock and greater opportunities exist in the small ruminants and poultry sectors.



CHAPTER FOUR

DISCUSSION AND ANALYSIS OF DATA

4.1 Introduction

This chapter of the report focuses on the analysis of data gathered from the field. The analysis encompasses the data which was collected from the units of enquiry namely; some members of the study communities, Farmers, Municipal Assembly, Forestry Commission, Environmental Protection Agency, Metrological Service and the Municipal Agricultural Unit. The analysis covers the socio-economic background of the farmers, crop production characteristics, deforestation and its effects on livelihood patterns in the study area. Inferences are drawn from the analysis based on the literature review and the findings made from the field data.

4.2 Background of Respondents

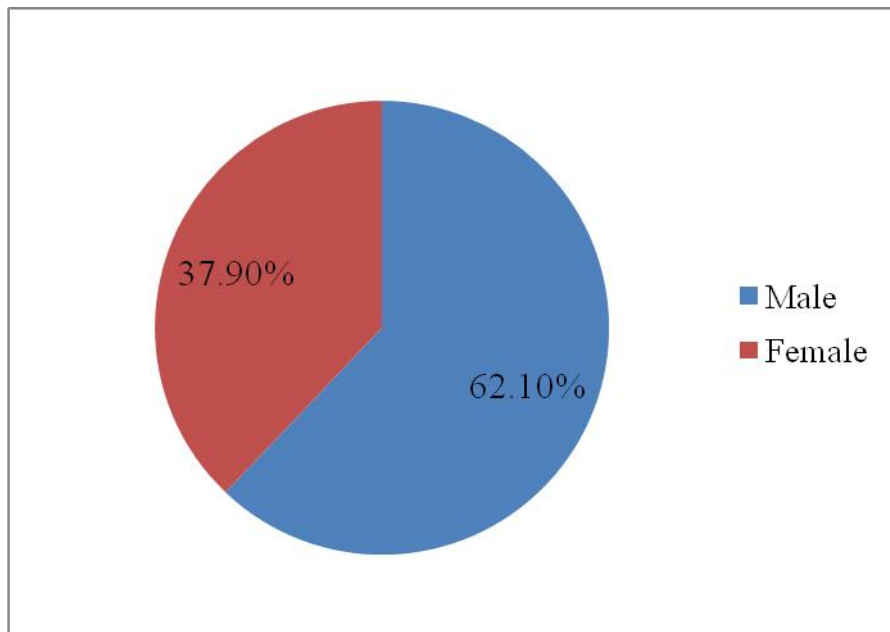
This section looks at the demographic characteristics of the respondents interviewed during the field survey for the study. Though this section does not necessarily address the core objectives of the study, however it provides useful information that complement the findings for policy decisions to be made on the affected population.

4.2.1 Sex of Respondents

The survey of the study revealed a male dominated agricultural sector with males constituting 62.1 percent of the population with females constituting 37.9 percent of the heads of household in the study area.

Figure 4.1 presents the sex distribution of the respondents.

Figure 4.1: Sex of Respondents



Source: Field Survey, 2013.

The findings above suggest that, the study area are male dominated (62.10 percent) as against the female counterparts (37.90 percent). This show that the male population are engage in activities that causes deforestation and deprived the people of their livelihood sources than the females. Though literature have identified many causes of deforestation which include mining, logging, and bushfires among other factors, this did not show much significance in the study communities in relation to Agricultural production (food and cash crop farming) as being the major undertaken by men with women and children playing supporting roles.

4.2.2 Educational Level and Occupation of Respondents

To an extent educational level of people determine the skills and knowledge they have, which also has a bearing on occupations. (See Table 4.1)

Table 4.1: A cross tabulation of educational levels and occupations of Respondents

Educational level	Occupation			
	Farming	Public Service	Civil Service	Total
No formal education	211	0	0	211
Junior High School	145	0	0	145
SHS/Tech	6	2	0	8
Tertiary	0	4	7	11
Total	362	6	7	375

Source: Field Survey, 2013.

From the survey, it was found out that, respondents without any form of formal education are approximately 56.3 percent and again, 38.6 percent who have completed school at either Junior High School level or primary level. Moreover, those who completed at the Senior High level are 2.1 whereas 2.9 percent completed their education at the tertiary level.

From Table 4.1, show that (2.9%) respondents who have completed tertiary level are either been engaged by public or civil service. Furthermore, a larger section of the respondents (56.3%) did not have any formal education. This clearly show that in terms of education, the municipality do not meet national literacy standards of 71.5 percent (Population and Housing Census, 2010). This hinders their ability to diversify their economy and again to acquire employable skills to be employed in other sectors of the economy other than depending on the forest and its resources for their livelihood. As a result farming becomes an option of last resort to most of the inhabitants in the study area. This puts pressure on the existing forest since the livelihoods of these ‘uneducated’ people are based on hunting and gathering, palm wine tapping snail picking, illegal sawing of lumber as their alternative livelihood sources to make ends meet. Often, those who are into farming use poor farming practices such as shifting cultivation, slash and burn, girdling and under burning of trees to pave way for sunlight penetration which are detrimental to the forest and its resources.(see section 4.3.4 on Land preparation methods).

4.2.3 Ages of Respondents

The study focused on respondents who were eighteen and above since this age cohort (18+) is to a larger extent, economically active and regarded as matured.

Thus, the ages of the respondents were categorized as: 18-25 years, 26-33 years, 34-41 years, 42-50 years, 51-57 years, 58+ years and was found to constitute 5.3 percent, 10.6 percent, 8.8 percent, 38.4 percent, 10.4 percent and 26.5 percent respectively. The ages of the respondents as noted depicts that rural urban migration of the youth population is eminent since the youth age cohort (18-33) constitute only 15.9% of the respondents.

The interview conducted with some of the youth during the survey also indicated that the youth in the communities do not find much prospects in the forest and its resources. Farming has also been left basically in the hands of the elderly and the aged who depend on hire labour with their little earnings instead of the youth being encouraged to take over farming activities that will increase productivity. The situation has led to subsistence and peasant farming which has exacerbated poverty in the area. (See Table 4.2). Table 4.2 provides the data on the ages of respondents.

Table 4.2: Ages of Respondents

Ages of Respondents	Frequency	Percentage
18-25	20	5.3
26-33	40	10.6
34-41	33	8.8
42-49	144	38.4
50-57	39	10.4
58+	99	26.5
Total	375	100

Source: Field Survey, 2013

4.2.3 Marital Status of Respondents

From the survey it was found out that a large majority that is about 70.3 percent of the respondents are married whiles, 23.4 percent are single. Only 4.7 percent and 1.6 percent of the respondents were found to be divorced and widowed respectively. Given the fact that majority of the respondents are married, it is appropriate to infer that, their stay in the communities and their livelihood sustainability depend largely on the forest

and its resources relative to those that are singles or divorce that are quite mobile and can therefore migrate to other parts of the country in search for greener pastures.

Conversely, the larger group who are married cannot easily migrate and will be the hardest hit when their livelihoods sources are adversely affected. This implies that, efforts should be made to sustain the livelihoods opportunities in these forest fringe communities to help arrest rural urban migration of the youth by way of encouraging them to stay in the rural areas to work on the farms and take advantage of the nature abound forest resources. (See Table 4.3)

Table 4.3: Marital Status of Respondents

Marital Status	Frequency	Percent
Married	261	70.3
Single	86	23.4
Divorced	18	4.7
Widowed	10	1.6
Total	375	100

Source: Field Survey, 2013.

4.2.4 Years of Farming

From the survey, 42.7 percent of the respondents who constitute the majority has been involved in agricultural activities for more than six years while 37.5 percent of the respondents have been farming for more than a decade. Accordingly, 86.7 percent of the respondents are well acquainted with issues of crop production and trends of productivity over the years. Undoubtedly, this knowledge/information puts the respondents in a better position to know the effects of deforestation on crop production and consequently evoke appropriate adaptation strategies that support their subsistence. (See Table 4.4)

Table 4.4: Years of Farming Experience of Respondents

Years	Frequency	Percent
1-5	67	17.9
6-10	160	42.7
More than 10	147	39.4
Total	375	100

Source: Field Survey, 2013.

4.3 Rate of Deforestation in the Asunafo North Municipality

4.3.1 Changes in Land under Cultivation (in hectares)

From the survey, it was revealed that; any increase in farm sizes implies additional clearing of forest areas to make extra land available for further cultivation.

To determine the extent of deforestation in the study area, the researcher conducted a trend analysis of the changes in farm sizes between 2006 and 2010 per the data from the Municipal Agriculture Development Unit (MADU) as shown in Table 4.5. This provided a clue of the extent of damage meted out to the forest cover.

The survey revealed that (as shown in table 4.5), land under cultivation for the various food crops, namely: maize, rice, plantain, cassava and yam increased substantially with the exception of cocoyam that remained unchanged. The combined effect of the changes in land under cultivation over the ten-year period (i.e. between 2006-2010) is 64.53 percent implying an annual forest loss of 6.453 percent. From the discussion, the most suitable way of expanding farm sizes is by clearing additional virgin lands, which are usually forest areas.

This rate of converting forestlands into agricultural land (forest loss) is quite alarming, as it exceeds that of the national forest loss rate of 2.3 percent over the last 11 years (MLNR, 2012). This implies that, if this trend is allowed to continue without proper mechanism in place to check the menace, the forest resources in these communities will be exhausted in not too distant future leading to loss of alternative livelihood opportunities. (See Table 4.5).

Table 4.5: Land under Cultivation (in hectares)

Crop	Area Cropped (Ha)			
	2006	2008	2010	% Change
Maize	4,820	5,710	5,710	18.46
Rice	110	130	145	31.82
Cassava	4,000	4,100	4,400	10.00
Yam	90.	90.5	93.5	3.89
Cocoyam	3,480	3,480	3,480	0
Plantain	8,350	8,360	8,380	0.36
Total				64.53

Source: MADU, 2010

4.3.2 Increase in Farm Sizes

The researcher investigated the changes that have taken place with regard to average farm sizes in the study area.

Considering data obtained from Municipal Agricultural Development Unit (MADU), it was clear that, from 2008 to 2011 as indicated in Table 4.6, the average farm sizes for both food and cash crops have increased over the period. These increases in the average farm size over the period means that, more forestlands have been cleared to make land available for farm expansion. From the statistics, the rate of change in farm sizes of food crops and cash crops over the four year period (2008-2011) are 37 percent and 50 percent respectively.

This implies that, more forestlands would be cleared to pave way for new farms and expansion of existing ones, should the current trend are allowed to continue.(See Table 4.6)

Table 4.6: Average Farm Sizes in Acres between 2008 and 2011

Year	Average farm sizes in the Municipality	
	Food Crops (ha)	Cash Crops (ha)
2008	3.0	4.0
2009	3.2	4.57
2010	3.8	5.36
2011	4.11	6.0
Rate of Change	37%	50%

Source: MADU, 2011

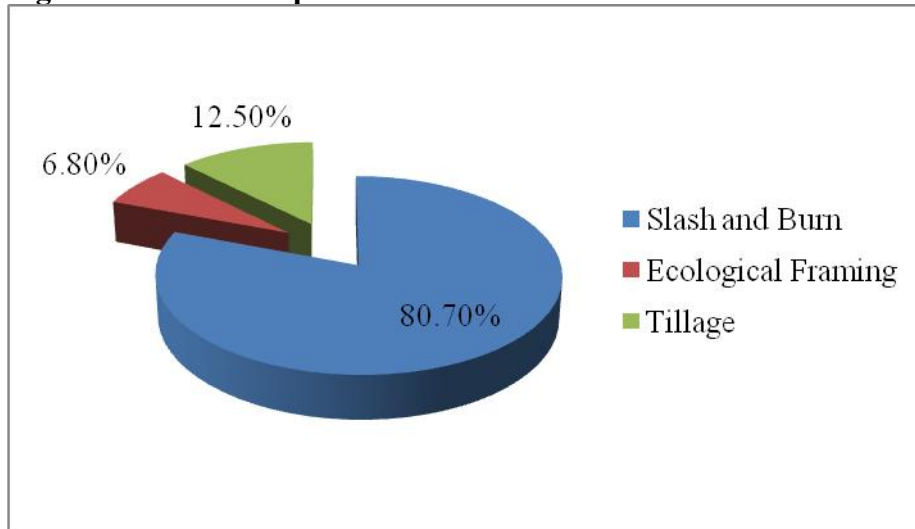
4.4 Causes of Deforestation in the Asunafo North Municipality

The study revealed that, farming is the major and significant cause of deforestation in the study area though others such as logging, bushfires, mining etc. do exist but on a limited scale.

4.4.1 Land Preparation Methods

From the survey, the system of farming and land preparation methods were identified as shifting cultivation, slash and burn, tillage and ecological farming. The slash and burn method was the predominant means practiced by 80.7 percent of the respondents (See figure 4.2). However, this method of farming has a lot of environmental repercussions and often accounts for bush fire occurrences and rapid deterioration of soil fertility. It also account for some of the factors that lead to deforestation and eventual loss of livelihood sources despite some awareness created about the effects of the method being used. Farmers are still engaged in this kind of poor farming practice as against the other methods that are environmentally friendly, due to reasons such as finances to purchase/ hire tractor for land preparation. (See Figure 4.2).

Figure 4.2: Land Preparation Method



Source: Field Survey, 2013.

4.4.2 Purpose of Farming and Farm Sizes

With regards to farm size, majority of the respondents (50.2 percent) were identified to be farming on land area of 1-2 acres with 6.7 percent of the respondents farming on less than an acre of land. Table 4.7 presents much information about the sizes of farm in the study area. In general, about 56.2 percent of the respondents' farm on 2 acres or less. Again the survey results show that 32.7 percent and 10.7 percent of the respondents respectively are engaged in crop production for subsistence and commercial purposes only while 57.3 percent undertake it for both purposes. The motive for farming usually influence the size of land on which one undertakes his or her activities. From the survey it was realized that 57.3 percent of the crop farmers undertake farming activities for both home consumption and sale. This clearly indicates that crop production is the main source of livelihood for the respondents.

From the discussions therefore, farmers should be supported in diverse means to expand food and cash crop production but must be encouraged to integrate tree crops in the early years of the farm to regain the loss vegetation that nourishes the land for increase productivity. (See Table 4.7).

Table 4.7: Farm Sizes in Acres

Farm Size	Frequency	Percent
Less than 1	25	6.7
1-2	188	50.2
3-5	100	26.4
6-10	62	16.7
Total	375	100

Source: Field Survey, 2013.

4.4.2 Modes of Production

The survey revealed that, 76.3 percent, 13.7 percent and 10 percent of the respondents use labour-intensive, capital-intensive and a combination of the two methods respectively. This means that, 76.3 percent of the respondents solely rely on simple farm implements such as hoe, cutlasses and axes for farming whereas 13.7 percent also rely on machinery for their cultivation. This puts those who employ modernized machinery in their farming at 23.7%. From the discussions, farmers who use machinery like tractors are able to clear and prepare vast lands to increase their farm size and productivity. Nonetheless, if adequate checks are not put in place, farmers who have access to these machines and implements will accelerate the spate of deforestation leading to loss of alternative livelihood opportunities in the study area.

4.5 Sources of Livelihood in the Asunafo North Municipality

Agricultural production specifically, food and cash crop production was found to be the main source of livelihood sustainability in the study area employing about 61.7 percent of the labour force (Asunafo North Municipality-MTDP, 2009). Although, the existence of other means of livelihood such as livestock rearing, fish farming, hunting and gathering of NTFPs, commerce/trading, banking and insurance as well as other formal institution players such as health workers, teachers, local government officials, the police etc were found, but are on a limited scale. Formal sector jobs accounted for less than 20 percent in the Municipality (Asunafo North Municipality-MTDP, 2009).

From the statistics, it is obvious that deforestation rate is likely to go up if efforts are not made to diversify the economy. This is because, farming has negative repercussion for forest conservation which employs about 61.7 percent of the population in study area.

4.6 Effects of Deforestation on Livelihoods in the Asunafo North Municipality

This section of the study looks at the effects of deforestation on livelihoods patterns in the study area. The section discusses rights of the forest fringe communities to Forest Reserves, commencement of farming activities, trend of output of farming products and income level of the respondents.

4.6.1 Right to Forest Reserves (Hunting and Gathering of NTFPs)

It was discovered that, the Municipality had imposed restriction on the entry of Forest Reserves as a way of protecting the forestlands in the study area. Table 4.8 shows that rights to forest reserves are greatly restricted as majority of the respondents (77.87%) indicated that communities are not allowed to enter the reserves to undertake farming or some other commercial activities. To them, the reserves are restricted areas and one needs a permission from the Forest Services Division to access the forest. It was observed that although entry is restricted, people enter the reserves illegally. For instance, hunters enter the forest under cover of darkness on hunting expeditions. There were also visible signs of collection of NTFPs such as palm-wine tapping, building materials, canes and raffia. With increasing population of fringe communities the possibility of unsustainable pressures on NTFPs becomes real. Undoubtedly, forests have traditionally been used as valuable resources for forest fringe communities particularly because of hunting and gathering of NTFPs. Nonetheless, it was revealed that, people living in fringe communities in the study area could harvest a variety of NTFPs so long as they respect the rules governing the forest reserves to the satisfaction of the District Forestry Unit. This therefore suggest that the forest resources provide useful products that support the socio-economic development of mankind and enhance their livelihood sources. Hence, the need for conservation and sustainable utilization of the forest resources for the benefit of current and future generation. (See Table 4.8).

Table 4.8: Right to Forest Reserves

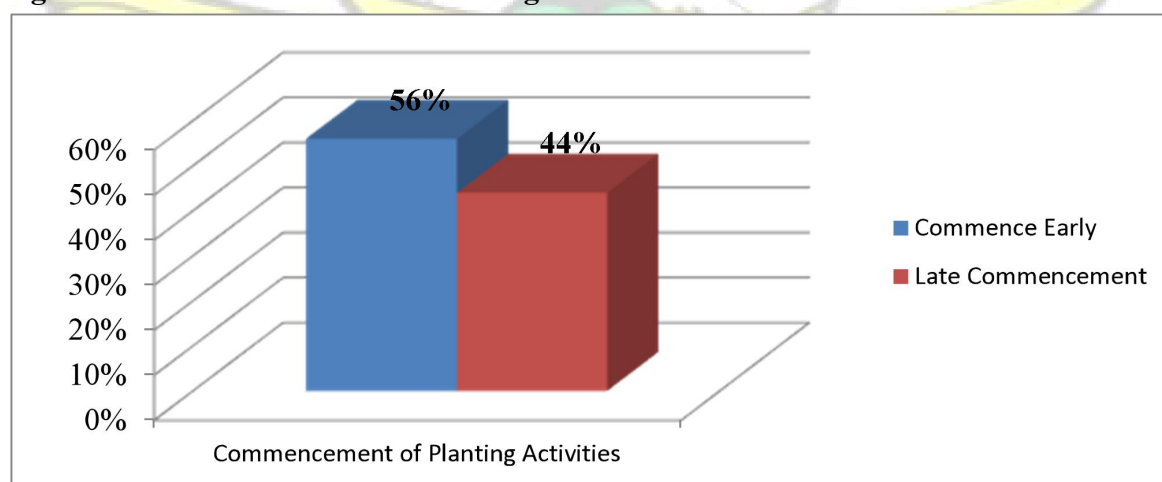
Status	Frequency	Percent (%)
Right to Forest Reserve	83	22.13
No Right to Forest Reserve	292	77.87
Total	375	100

Source: Field Survey, 2013.

4.6.2 Commencement of Farming Activities

The survey revealed that 56 percent of the respondents observed changing patterns in the date for commencement of farming activities. Figure 4.8 presents more information about the phenomenon. This assertion was corroborated by the Regional Meteorological Department that the study area has been characterized by erratic rainfall pattern in recent times. The two major rainy seasons in the area starts from April to July and August to November and the farming seasons coincides with the rainy seasons due to the reliance on rainfall for cultivation. Due to the erratic nature of the rainfall, periods for planting have been affected dramatically. This is because it has become increasingly difficult to accurately predict the weather and the climate. Day-to-day and medium-term planning of farm operations have become more difficult. As a result, many farming activities and operations are either commenced rather too early or too late leading to poor yields. The implication are that poverty are excerebated by the poor yield syndrome leading to much more pressure on the forest and the livelihood opportunities it provide.(See Figure 4.3)

Figure 4.3: Commencement of Planting Activities



Source: Field Survey, 2013

4.6.3 Crop Output Levels

The yield obtained from crop production is one of the major consideration in measuring output levels. Data gathered and analyzed from the MADU revealed that the yield of some crops have been decreasing over the years while the one which experienced increasing increase at a decreasing rate. For example, the yield of maize which is one of the major crops cultivated in the study area experience a marginal drop of 0.74 percent from 2009 to 2010. (Refer to table 4.10 for details). This trend have been consistent

with all the other crops that are cultivated in the Municipality. The statement is corroborated as 84.2 percent of the respondents described the yield or output levels as decreasing when the question about the output levels were posed to them. Though literature identified land fragmentation, decline in soil fertility, limited extension services, poor access of transport and marketing of agricultural produce, lack of support for farmers and the use of poor agricultural technology as other factors and possible cause for low output levels. In this regard, only poor agricultural technology were implicated. The low output level was mainly due to the erratic rainfall and difficulty in weather and climate prediction. (See Table 4.9)

Table 4.9: Crops Yield (in tonnes)

Crop	Average Yield (Mt/ha)			Production (Mt)		
	2009	2010	% Change	2009	2010	% Change
Maize	1.80	1.79	-0.74	10,278	10,202	-0.74
Rice	1.30	1.27	-2.63	169	139	-21.29
Cassava	15.40	15.30	-0.67	63,140	61,189	-3.19
Yam	13.86	13.87	0.01	1,247	1,248	0.01
Cocoyam	7.70	7.61	-1.24	28,336	26,467	-7.06
Plantain	18.94	18.10	-4.44	151,316	156,266	-3.17

Source: MADU, 2010

4.6.4 Income Level of Farmers

Income levels vary from one community to the other in the study communities. Average monthly incomes for the four study communities- Fawohoyeden, Akwasi-Addai, Apenkro and Gyasikrom are GHC 120, GHC 100, GHC 100 and GHC 90 respectively. The survey revealed that the average monthly income of the farmers in the Municipality is GH¢100.00. This is relatively low compared to the National Minimum Wage of GH¢150.00 by Ghana Labour Commission.

The low income are attributed to low output levels and poor pricing of agricultural produce that are traded in the Municipality. The survey showed that 43.9 percent save at the end of the month although the amount is less than 5.0 percent of their monthly income. The money saved are re-invested in the farms and payment of children school fees. Due to the erratic rainfall patterns coupled with low income levels, snail rearing,

hunting and gathering, bee-keeping, petty trading, retail shops serve as alternative income generating venture for most people in the study area. The implication are that there is a gradual diversification of the economy which will eventually ease pressure on the forest resources and improve upon the livelihood sources available to the people.

4.7 Adaptation Mechanisms in the Asunafo North Municipality

4.7.1 Adaptations strategies against deforestation process in the study area

From the survey, respondents indicated the various strategies they have employ to mitigate the effects of deforestation on their livelihood patterns. The study revealed that 50.93 percent of the respondent have resorted to application of fertilizer to address decline in soil fertility and improve the yields. Furthermore, 49.67 percent of the respondents are engaged in other alternative livelihood activities such as rearing of livestock, fish ponds, snail and grass cutter rearing, bee-keeping to help supplement their major livelihood venture (farming) which has seen some decline over the years. In addition, it was realized that, over 60 percent of the respondents have employed multiple strategies to cope with the situation. (See Table 4.10). This imply that the forest resources provide alternative sources of livelihood to over 60 percent of the fringe communities in the study area. Hence, the need to protect and sustained the forest.

Table 4.10: Adaptation strategies of the effects of deforestation in the study area

Coping strategy	Frequency	Percentage (%)
Application of fertilizer excessively	191	50.93
Rearing of livestock	95	25.33
Fish ponds	32	8.54
Snail/grass cutter rearing	57	15.20
Total	375	100

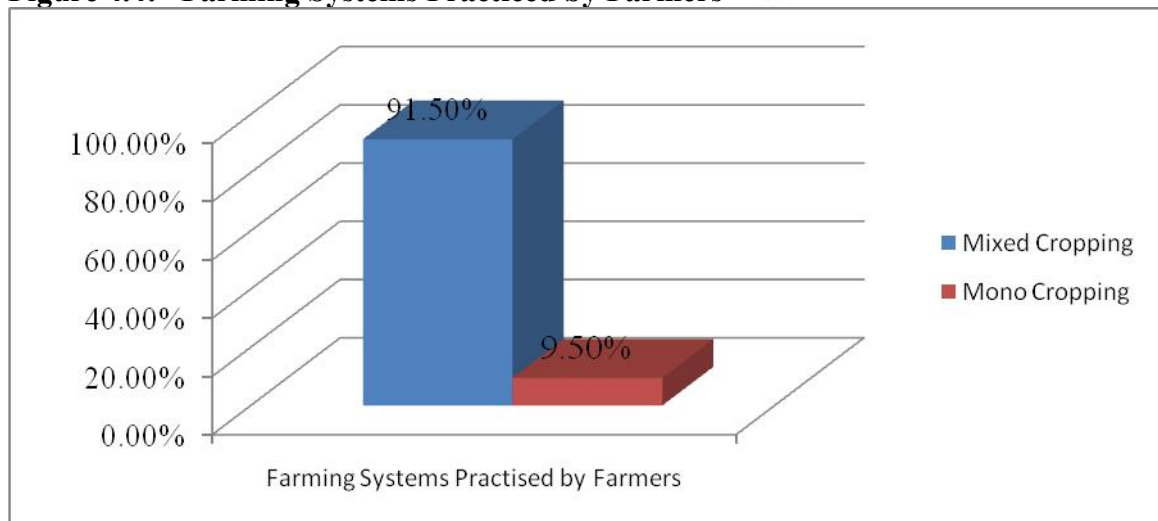
Source: Field Survey, 2013

4.7.2 Farming Systems

The two major farming systems which are practiced by the respondents are mixed cropping and mono cropping. The survey showed that 91.5 percent of the crop farmers prefer mixed cropping to mono cropping (Refer to Fig 4.7). This indicates that mixed cropping is the predominant practice for both staples and cash crops. Mixed cropping is where variety of crops are grown on the same piece of land unlike mono cropping

where only one crop is grown. The reasons being that 91.5 percent of the respondents prefer mixed cropping to mono cropping, this is because it helps farmers to get a variety of crops which can be sold at different prices to get more profit, encourages farmers to cultivate all year round and reduces the risk of loss of yields due to unfavourable climatic conditions. This serves as adaptation mechanism for the people by way of reducing their vulnerability and their dependency on forest and its resources for livelihood. (See Figure 4.4)

Figure 4.4: Farming Systems Practiced by Farmers



Source: Field Survey, 2013.

4.8 Challenges faced by Farmers in the Study Area

4.8.1 Sources of Finance

Average farm size of the farmers in the study area is 2 acres. The farmers indicated they could have cultivated larger farms, but for lack of funds they are unable to do so. The main source of finance for the respondents in the study area is through their personal funds. From the survey, 77.7 percent of the respondents finance their farms through their personal savings, 15.8 percent borrow from family and friends and 3.8 percent obtain their funds from money lenders. It was revealed that, no respondent financed his farm through the help of any financial institution (See Table 4.11). According to the respondents they do not deal with these financial institutions because; they do not hold account with them and cannot raised the required collateral security necessary to secure financial assistance with them. This imply that there is low savings culture among the people that deny them access to loanable funds. Also, the financial institutions needs to identify and provide financial incentives that will stimulate their

interest to save. Medium to long term loan with flexible payment and low interest rates should be offered to those who want to invest in farming.(See Table 4.11).

Table 4.11: Sources of Finance of Farmers

Source	Frequency	Percent
Personal savings	291	77.7
Family and friends borrowing	59	15.8
Money Lenders	25	6.9
Total	375	100

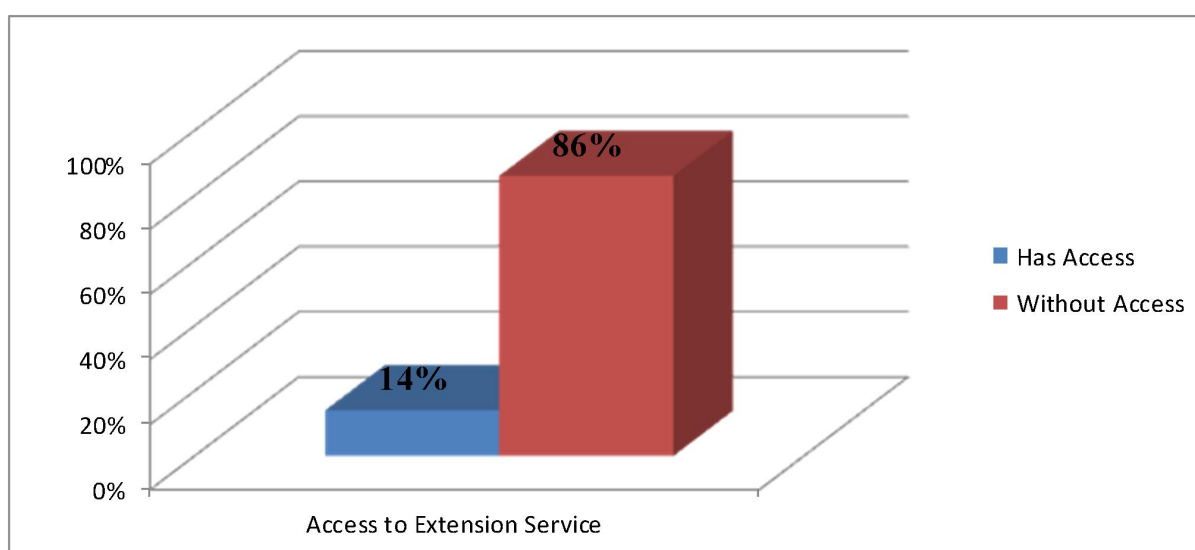
Source: Field Survey, 2013.

4.8.2 Access to Extension Services

The availability and accessibility of extension service in an agriculture environment is a key to influences the farmers' knowledge in agricultural development programme. Even though the situation is said to be improving the current extension officer to farmer ratio in the District is 1:5600 compared to the national ratio of 1:600.

From the analysis, 86 percent of the respondents said they have no access to extension services at all while 14 percent has access somehow as depicted in Figure 4.8. The low access to extension services explains why most of the farmers continue to practice crude farming methods with no regard to modern practices. According to the Municipal Director of Agricultural Development Unit, the situation contributes to the unregulated and excessive application of fertilizers, pesticides and weedicides which promote the climate challenges in the Municipality.

Figure 4.5: Access to Extension Services



Source: Field Survey, 2013

According to the Agricultural Extension Officer, some of the challenges that hinder their smooth operations include; inadequate means of transport, inadequate fuel allowances and absence of risk allowance do not make them effective in the discharge of their mandate as expected. The implication are that lack and access to extension services mean the illiterate majority farmers will excessively apply and accelerate the depletion of our natural resources endowment which has serious repercussion for the rural livelihoods. Hence, the need for more extension officers in the municipality. (See Figure 4.5)

4.8.3 Marketing of Agricultural Produce

The data revealed that 84.7 percent of the respondents sell their produce within the Municipality. They usually sell their produce to urban based middlemen and women who then transport the produce (i.e. food crops) to market centers for further marketing. Accessibility to most of the hinterlands within the municipality was poor, especially road network in Akwasi-Addai, Apenkro and Gyasikrom. This present's serious obstacle for the farmers to transport their outputs to the market centers for sale. The pricing of agricultural produce is usually through intensive bargaining between the buyers and the sellers. In the process, farmers get exploited due to lack of choice and perishable nature of their produce. This imply that the deplorable nature of our forest roads affect transportation and marketing of farm produce. It also has possible implication for the livelihood sources available to the youth on the basis that their

produce cannot easily reach the market centers for sale leaving them more impoverished.

4.8.4 Pricing of Agricultural Produce

The pricing of agricultural produce is usually through intensive bargaining between the buyers and the sellers. In the process the farmers get exploited due to low pricing, lack of choice and the perishable nature of goods they produce. This underline why alternative livelihood derived from the forest resources remain useful and important to the sustenance of the forest fringe communities in the study area.

4.9 Programmes Undertaken to Reduce Deforestation in the Study Area

In keeping with the objectives of the study, the various activities and programmes that are being undertaken or implemented by the respective agencies responsible for ensuring the quality of our environment in order to reduce the effects of deforestation in the Municipality were reviewed. The various measures or programmes which were identified in the Municipality are discussed below:

4.9.1 Education and Sensitization

The officials at both the Environmental Protection Agency (EPA) and Municipal Agriculture Development Unit (MADU) indicated that they have been organizing sensitization programmes for the farmers in the study area. The MADU undertakes this sensitization programmes through the Extension Officers who go to the field to interact and educate farmers on best and modern methods of farming. The education is done to educate the farmers about the causes of deforestation and how to reduce the phenomenon. The educational programme was confirmed by 14 percent of the farmers who have access to extension services at some intervals. (See Figure 4.5)

4.9.2 Promotion of Ecological Farming System

As part of the efforts to reduce deforestation in the Municipality, the officials at MADU reveal that the outfit has embarked on programmes to encourage the farmers to practice ecologically friendly land preparations methods. According to the officials, officers from the units are often dispatched to the field to educate farmers on the need to adopt ecological method of land preparation such as agro-forestry (taungya system) and green manuring instead of slash and burn and shifting cultivation which destroys vast tracks of farmland through bush fire. The success of this effort have reflected in the fact that

6.8 percent of the respondents use ecological method of land preparation in the farming activities.

4.9.3 Institutional Capacity Building

It was realized from the study that both the EPA and MADU embark on capacity building to improve upon the skills of their staff in the formulation and implementation of projects to reduce deforestation. In the view of the institutions these capacity training workshops help in keeping the workers abreast of current and innovative ways of reducing the effects of deforestation. Through these the workers especially the field officers are better placed to transfer their knowledge to those whose activities contribute to deforestation. According to the officials of the two institutions, training workshops are organised for the staff at least twice in a year. However the impact of the capacity building has been minimal as only 14 percent has access to the extension officers leaving the majority to continue their ecologically unfriendly farming practices.

The National Forest Plantation Programme being implemented by the forestry Commission as a means of recovering the loss vegetation and forest resources have chalked tremendous success in the municipality. It has accordingly integrated tree crops with agricultural crops which has eventually promoted food productivity in the Municipality.

4.10 Challenges in Mitigating Climate Change

The study uncovered the presence of several challenges which impede the efforts by all stakeholders in reducing deforestation in the Municipality. These challenges emanate from diverse sectors and spheres of life of the people while others are institutional. According to the officials at both MADU and EPA, the challenges obstruct attempts to thwart the problem of deforestation on the life of the people especially food production which is the source of livelihood for majority of the residents in the Municipality. The key challenges were identified or inferred from the study are presented in the subsequent paragraphs.

4.10.1 Low Educational Level of Farmers

The low level of education attained by majority of the farmers in the district was identified as a critical challenge to efforts in fight deforestation. According to the MADU and EPA, this characteristic of the farmers make them to prefer traditional methods of land preparation such as slash and burn which further leads to destruction

of the forest. The high illiteracy level further limits the farmers' ability to read and understand the instructions on the pesticides and fertilisers hence resulting in their excessive application. It was vehemently expressed by the AEAs at the MADU that most of the farmers they visit have difficulty in appreciating and grasping the modern and environmentally friendly methods of farming and they attributed them to the low level of education among them.

4.10.2 Unfavourable Farming Practices

As indicated earlier, the dominant land preparation methods used by the farmers are tillage and slash and burn. Also the study identified that inorganic fertilisers are the type applied by majority of the farmers. However, due to the low educational attainment, they usually apply them disproportionately as indicated by the official at the EPA and MADU. The dominance of these unfavourable practices thwarts the attempts to mitigate the problem of climate change the District.

4.10.3 Low Institutional Capacity

The low capacity of the various public institutions responsible for spearheading the programmes for fighting deforestation also came up as a very critical challenge. It was realised from the study that all the key stakeholders namely the MADU, EPA and DPCU were handicapped in the areas of staff and logistics which affect their ability to operate effectively. This situation hinders the ability of the institutions to undertake surveillance and roll out and implement programmes and policies to effectively deal with deforestation in the district. The capacity analysis of the three key institutions showed that they all have backlogs with equipment's and staff (See Tables 4.12, 4.13 and 4.14 for the details of the capacity assessment). The shortage of staff at all the institutions was attributed to the current public sector employment policy which prohibits all public sector institutions from recruiting new staff. According to the officials at the above mentioned institutions, the shortfalls in the logistics is mainly due to the unavailability of funds for such purposes coupled with the complex public sector procurement processes. These therefore explain why the institutions are unable to organize public forums to educate the farmers and the people in general on the implications of their activities on climate change in the district.

Table 4.12: Resource Base of EPA

Resources	Available	Required	Backlog	Remarks
Staff (technical and support)	22	34	12	Understaffed
ICT Equipment	7	12	5	Inadequate
Vehicles, example pick ups	2	5	3	Inadequate

Source: Field Survey, 2013.

From table 4.12 it can be realized that EPA has a shortfall of 12, 5 and 3 in staff, computers and vehicles respectively all of which militate against its efforts in mitigating climate change in the district and the region as at large.

Table 4.13: Organizational Capacity of MADU

Resources	Available	Required	Backlog	Remarks
Staff (technical and support)	24	35	11	Inadequate
Extension officers	9	16	7	Inadequate
Vehicles (eg pick up)	1	3	2	Inadequate
Tractors	Nil	2	2	Lacking
ICT Equipment	3	7	4	Inadequate

Source: Field Survey, 2013.

Table 4.13 also reveals that the MADU just like the EPA has a backlog in all the resources which it needs for better operations. It is as a result of this that the unit is unable to embark on extensive public education programmes to enlightened farmers on effective application of fertilizers, pesticides and weedicides as well as better farming practices.

Table 4.14: Capacity Assessment of DPCU

Resources	Available	Required	Backlog	Remarks
Staff (technical and support)	6	10	4	Understaffed
Vehicles	2	3	1	Relatively adequate
ICT Equipment eg. Computers	2	4	2	Inadequate

Source: Field Survey, 2013.

It is clear from table 4.14 that the DPCU is also under resources and this likely to affect policy formulation and implementation including those for climate change mitigation.

4.11 Summary of Data Analysed

From the analysis, it is evident that farming is the major occupation and the most depended livelihood means in the study area. The analysis has shown clearly that most of the respondents have been in farming for at least six years and therefore have reasonable experiences though many of them are illiterates. Again, a significant number of farmers (68%) produce crops on both subsistence and commercial scales, however; majority rely on the use of primitive methods and tools like cutlass, hoes which in most cases are unable to produce at optimal levels. Since most of the farmers (73.3%) do not have access to machinery for their cultivation, they heavily rely on slash and burn method to cultivate their farms. This popular method is however detrimental to the forest, soil fertility and living organisms that nourish the soil, hence, the gradual destruction of livelihoods. Though most of the farmers are conscious about the adverse effects of this method, they have remained adamant. They attribute this to poverty as the underlying reason for their inability to hire machinery for their land preparation.

The analysis also pointed out that, majority of the farmers (80.2%) produce food crops relative to cash crops. Some of the major cash crops cultivated include cocoa and oil palm, whilst major food crops produced are cocoyam, rice, plantain, yam and maize. Many of the respondent farmers (77.7%) in the study area rely on their personal savings to finance their farming activities; hence, they are unable to modernize their agricultural activities. Average monthly income in the district ranges between GHC 100 and GHC 120 which is below the minimum monthly wage of GHC 150 according to the Ghana Labour Commission. This low income level confirms the fact that, many peasant farmers remain among the poorest class of our society.

Additionally, with the slash and burn method predominantly used in the study area coupled with the ever-increasing clearing of forest to increase the size of farmlands, collectively poses threat to the local weather in the area as well as the overall climate. The study revealed how there has been erratic nature of rainfall which has affected the planting seasons of the area in recent past. Due to the difficulty in predicting weather and climate, making day-to-day and medium-term planning of farm operations have become more difficult. It's therefore becoming increasingly difficult for the respondents to predict the date for the commencement of farming in the study area which leads to late planting of crops. This late planting according to the farmers has been having negative repercussions such as low and poor quality of yield from their

crops. Beside the erratic rainfall pattern and poor yields of crops as some of the effects of forest degradation in the area, NTFPs that include medicinal herbs, game, snails and whatnot that supplement the livelihoods of the forest communities have dwindled significantly.

Consequently, the respondents have employed various strategies like fish farming, grasscutter and livestock rearing as additional livelihoods alternatives to support the crop farming which have been experiencing some decline in recent past.



CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The chapter provides summary of the results of the study discussed in detail in the previous chapter. The presentation is done in line with objectives of the study and recommendations are made thereon. The recommendations are aimed at giving possible measures that could assist reduce the effects of deforestation on the livelihood patterns of the fringe communities by improving on the socio-economic conditions of the region at large.

5.2 Summary of Findings

Major findings on the crop productions and its effect on livelihood patterns are summarized under subheadings and in line with the objectives of the study. These major findings are presented in the subsequent sub headings.

5.2.1 Extent of deforestation in the study area

The study showed that, there is a significant deforestation process in the study area. This is as a result of the fact that, most of the dwellers in the study area depend on agriculture, especially crop cultivation; which required the clearing and converting of vast forest areas into farmlands. From interviews with some of the farmers, it was pointed out that, the principal way they expand their farm sizes is by clearing additional virgin lands, which are usually forest areas. It was shown in the analysis that, just between 2006-2010 is 64.53 percent, implying an annual forest loss of 6.453 percent. This gives a clue about the spate of deforestation in the study communities. Conversely, the increase in farm sizes has not necessarily resulted in any significant increase in agricultural outputs. This phenomenon is distressing because, going by the current rate of change in the lands under cultivation of food crops alone will increase by 645.3 percent in the next ten years; which as a result, forest cover will experience a similar margin of deforestation.

5.2.2 Causes of Deforestation in the study area

The major causes of deforestation and forest degradation in the study forest communities include bad farming practices such as slash and burn method and clearing of vast forest lands for agricultural purposes. Though some of the farmers indicated that, illegal logging of trees are rampant in their communities; however they could not provide concrete evidence/data on the activities of such chain-saw operators. Additionally, the study showed that, hunting and gathering of NTFPs are other critical livelihood activities in the study area that divests the forest of its resources such as wildlife including game, mushrooms, snails, and among other things.

During the field survey, it was also realized in the study communities that, charcoal production was widespread and thus, serve as another livelihood activity that precipitates deforestation in the study area. During the survey, it was made known to the researcher that; many of the charcoal producers undertake their production in deep forests, which makes it challenging to track and forestall their activities.

5.2.3 Sources of Livelihood for Forest Communities in the Study Area

The study revealed that the crop farmers are engaged in the cultivation of both food and cash crops with a greater proportion of 83.3 percent producing solely food crops. The major food crops which are cultivated include cassava, maize and vegetables such as tomatoes, beans, groundnut, pepper and okro. The cash crops were mainly oil palm and tobacco and were grown on large scales as plantation farming.

It was identified from the study that the farmers cultivate the crops either subsistence or commercial basis or both. The study showed that 32.7 percent and 10.7 percent of the farmers produce crops for home consumption and commercial purposes respectively, while 57.3 percent undertake it for both purposes. Labour intensive was identified to be the major mode of production with family members as the type of labour used. The predominant land preparation method found in the region was slash and burn (80.7 percent of farmers) while ecological farming and tillage were practiced by 6.8 percent and 12.5 percent of the farmers respectively.

The study unraveled that the two farming systems practiced were Mixed Cropping and Mono Cropping. The study revealed that a greater majority of 91.5 percent of the farmers preferred Mixed cropping to Mono cropping. The mixed cropping is considered

to be less risky in the face of deforestation and hence the high preference for it. The study demonstrated that access to extension services by the crop farmers in the region is generally low.

5.2.4 Effects of deforestation on Crop Production

5.2.4.1 Decline in Crop Output Levels

Crops yield is one of the major yardsticks in crop production which can be used to assess the effects of changing forest cover on livelihoods. Data gathered from the District Agricultural Development Unit revealed that the yield of most crops including maize, rice, cassava, cocoyam and plantain saw a decline in their production with the exception of yam which increased by 0.01 percent of 13.87 metric tonnes per hectare (refer to table 4.7). The study has demonstrated that, the yield of major crops in the study district have been decreasing over the years while the ones which experienced increases increase at a decreasing rate. For example the yield of maize which is one of the major crops cultivated in the study area experience a marginal drop of 0.74 percent from 2009 to 2010. (Refer to table 4.7 for details of the output levels of the various crops). This trend was similar with all the other crops that are cultivated in the District. The situation was confirmed by the farmers as 84.2 percent of the respondents described the yield or output levels from their farms to be decreasing when they were asked to assess it. This is because; rainfall is one of the major determinants of crop yield in the district due to over reliance on it. However, other factors that might have accounted this situation are:

5.2.4.2 Unpredictability of rainfall patterns and planting seasons

From the literature review, it was discovered that forests play a crucial role in enhancing both microclimate and local weather of an area. The study has confirmed this, as 56 percent of the respondents indicated that, they have observed changing patterns in the period for commencement of farming activities. Figure 4.8 presents more information about the phenomenon. This assertion was further corroborated by the Regional Meteorological Department that the study area has been characterized by erratic rainfall pattern in recent times. The two major rainy seasons in the area starts from April to July and August to November and the farming seasons coincides with the rainy seasons due to the over reliance on rainfall for cultivation. In recent past, due to the erratic nature of the rains, it has therefore affected the planting seasons of the crop

farmers in the study area. Due to the difficulty in predicting weather and climate, making day-to-day and medium-term planning of farm operations have become more difficult. It was observed that it was becoming increasingly difficult for the respondents to predict the date for the commencement of farming in the study area which leads to late planting of crops. This late planting according to the farmers has been having negative repercussions such as low and poor quality of yield from their crops.

In addition, there have been several incidents of diseases and pests, especially alien ones as a result of change in temperature and humidity and long droughts was identified as one of the most obvious impacts of the climate change on crop production. The prevalent pests identified are aphids, beetles, birds, cockroaches and rodents among others. The commonest crop diseases which were found are black spot, blast, maize dwarf, mozaic, root rot and stem rot among others. The attack by these pests and diseases causes damage to the crops which reduces the quality and quantity of their yields the study unraveled.

5.2.4.3 Low income levels

The study indicated that the average monthly income of the farmers in the district is GH¢100.00 lower than the National Minimum Wage of GH¢150.00. From the various interviews held with some of the farmers, their low income levels are attributed to the low yields of crops and the profuse application of fertilizers to restore soil fertility of their farmlands, which is very expensive to them. Thus, as a cycle they are unable to save enough money to help them get proper and variety of seeds and seedlings for their farming activities. This shown that, only 43.3 percent of the farmers are able to save an average of GH¢5.00 per month. The study further reveled that moneys saved by farmers are often invested in the education of wards and petty training which are considered to be the adaptive and alternative livelihood mechanisms by the farmers.

5.2.5 Adaptation strategies to the changing forest cover in the study area

As the forest communities under study are conscious and actually experiencing the effects of the changing forest cover on their livelihoods, various coping strategies to salvage their livelihoods, have been devised and employed to put up with this unfavourable situation. The study showed that, 50.93% (refer to table 4.8) of the farmers interviewed apply fertilizers excessively to their farms in order to restore the loss soil fertility so as to boost the yields of their crops. From the survey, one of the

farmers intimated that, “previously, he was not applying any fertilizer to his farm and yet, get enough crops to feed his family and also, make enough income from the sale of the remaining. However; nowadays, he applies substantial amount of fertilizer before he can reap enough crops like the previous days that he was not applying any fertilizer”. Again, some of the respondents (25.33%) are now engaged in livestock production while those who are into it already have scaled up their livestock rearing activities to supplement their crop productions. Furthermore, some of the farmers too are engaged in snail and grass-cutter rearing, which are all fetching them some guaranteed source of income, which is now acting as a backstop to the dwindling problem in crop productions.

5.2.6 Measures/Programmes for Reducing deforestation in the Study Area

The study identified a number of programmes that have been implemented or undertaken to reduce the effects of deforestation in the study area. Education and sensitization of farmers on the correct and safe methods of fertilisers, pesticides and weedicides application by the Extension Officers was identified as one of the key programmes. The national plantation programme and the promotion of Taungya/ ecological farming system are being implemented as against slash and burn methods which leads to bush fires are discouraged. The study revealed that both the EPA and MADU embark on capacity building to improve on the skills of the staff to enable propose and operationalized innovative ways of reduce the effects of deforestation.

5.3 Recommendations

Based on the findings of the study, a number of recommendations are being made to help reduce deforestation and its effects on crop production and productivity and consequently livelihood alternatives in general. The recommendations have been offered to serve as explicit examples of strategies and measures that can be adopted to reduce deforestation and its impacts on crop production.

5.3.1 Education and Sensitization of Farmers

The respondents should be seriously educated about the rules governing the forest reserve, methods of tree production, sustainable forest management practices, conservation and livelihood based approaches. There is the need to introduce the extension services which is undertaken by the Ministry of Food and Agriculture to educate the farmers. These extension officers will educate the respondents about forest

conservation practices, how to sustain the forest reserve, good practices in handling of tree crops and the rules governing the use of forest reserve. The extension should be stationed in each of the communities in order for the person to easily accessible to the respondents.

5.3.2 Diversify the Local Economy through Training of the Respondents in Alternative Livelihood Ventures

The farmers should be trained in other alternative livelihood approaches such as Bee-keeping, grasscutter and snail rearing, garry processing and mushroom farming. This is so because of the high demand for honey, grasscutter, snail and mushroom in urban centers across the country. That is there is easy market for these products. For a start, five people each from the fringe communities should be selected, they should be giving training about bee-keeping, grasscutter rearing, garry processing and mushroom farming. The members who are willing to be trained are grouped in batches of fifteen and they are giving the necessary training. This should be a partnership between the community and the forestry commission. After that the trainees are helped to set up a business of their own through the revenues that are accruing from timber. The progresses of the trainees are monitored at least twice a month to see how they are faring. When this is done the respondents will become less dependent on the forest reserve for their survival and this will diversify the local economy.

5.3.3 Enhanced Access to Long-Term Financial Resources

There is the need to enhance action on the access to long –term financial resources and investment to support action on mitigation. The various institutions and the stakeholders must be provided with the requisite financial resources by the government and sector ministries to enable them design, implement and enforce their mitigation programmes and strategies effectively.

There should be increased funding for technical assistance and critical planning data to state and local governments from agencies responsible for climate, weather, and hazard mitigation. Support improved climate model results that provide more localized information and predictions. Support standardized monitoring and reporting GHG emissions.

Also training of personnel, organising sensitisation programmes for farmers and supporting farmers to acquire modern and adaptable varieties of crops should be

strengthened. This will help improve crop production and productivity immensely in the region and the country at large.

5.3.4 Strengthening of the Public Institutional Stakeholders

There is the need to promote active private sector participation in the mitigation of the impacts of climate change on crop production. This will help expedite the development of innovative and cost-effective approaches to reduce deforestation. In this regards, it is imperative to enhance this role and ensure that partnerships are directed toward the most mutually beneficial outcomes. This will go a long way to contribute in addressing the negative impacts of changing forest cover on livelihood patterns.

Again to help ensure effective mitigation of the impacts of deforestation on crop production it recommended that resource capacity of the institutions be strengthened to enable them function effectively. The institutions must be equipped with the necessary logistics like computers and vehicles which can enhance their operations. In doing this it is recommended that adequate funds are made available to the EPA, and Agricultural Development Units of MoFA to enable them procure the necessary equipment. Also routine capacity building programmes must be organised for the staff of the institutions. This can be the form of in-service or of-service training programmes which to acquaint the staff with innovative and modern ways to mitigate climate change. Personnel from the Department of Environmental Science and the College of Agriculture and Natural Resources Kwame Nkrumah University of Science and Technology can be contracted in this direction to organize this mandatory professional training for the employees of the institutions.

5.3.5 Promotion of Action Research

There are many scientific and technological challenges regarding costs, environmental impacts, and public acceptability that must be resolved before deforestation in crop production technologies can reach their full potential. Long term research which seeks to promote the integration of scientific results with stakeholders, farmers, private sector and NGOs is recommended to help these challenges. It is recommended that several improvements are needed to help collect information that will help to best understand how crop production system is responding to current weather and year-to-year variability as well as long term changes in the climate system. This might be accomplished through the following types of activities:

Development of stronger presence of ag-meteorology or agro-climatology programmes in institutions of higher learning in the country with course that would train the next generation of environmental scholars looking at the connections between climate change and crop production;

Design funding scheme's/programme that will ensure adequate information on on-farm information on fertilizer/pesticide usage, farm management practices and yield responses are collated to serve as a database that will be available to researchers in future.

5.4 Conclusion

In conclusion, the study established that deforestation imparts the life's of respondents in many areas including affecting crop production in the areas of delayed commencement of planting seasons, pest and diseases infestation, level and quality of crop yields, access to water for irrigation farming and reduction in the income levels of farmers. Although several efforts have been initiated to mitigate these impacts the study revealed that they have been thwarted by challenges such as low institutional capacity, unavailability of funds, unfavorable farming methods and low educational background of farmers. Given the critical role crop production in the livelihood of the residents as well as economy of the region, it is imperative that pragmatic measures are adopted to mitigate the negative impacts that deforestation is having on it. In this regard the study recommended continuous education and sensitization of farmers, strengthening of the public institutional stakeholders and promotion of active research as some of the ways for mitigating the impacts of climate change on crop production.

REFERENCES

- Abane, H. (2007). Livelihoods in a forest community in Southern Ghana: Intervening policies and community resistance, Department of Sociology and Anthropology, University of Cape Coast, Ghana (2009). Livelihoods in a forest community in Southern Ghana: Intervening policies and community resistance. *Journal of African Studies and Development* 1(2): 028-035.
- Acheampong, E. and Marfo, E. (2011). "The impact of tree tenure and access on chainsaw milling in Ghana." *Ghana Journal of Forestry*, Vol. 27: 68-86.
- Aduse-Poku, K., Nyinaku, F., Yao, A. V., Awuah, R., Owusu, M. E., Dwobeng, N. H., Owusu, K. and Agyenim-Boateng, (2003). Improving Rural Livelihoods within the Context of Sustainable Development Case Study of Goaso Forest District, Tropenbos International, Wageningen, and the Netherlands.
- Agyeman, K. O., Amponsah, O., Braimah, I., and Lurumuah, S. (2012). "Commercial Charcoal Production and Sustainable Community Development of the Upper West Region, Ghana." *Journal of Sustainable Development*, Vol. 5 (4).
- Agyeman, V.K., Marfo, K.A., Kasanga, K.R., Danso, E., Asare, A.B., Yeboan, O.M., and Agyeman, F. (2003b). *Revising the taungya plantation system: new revenue-sharing proposals from Ghana*, Unasylva 212, Vol. 54, 2003.
- Agyemang, M.M.O. (1996). 'The leaf gatherers of Kwapanin, Ghana', *Forest Participation Series* No. 1, IIED, London, 12p.
- Akyeampong-Boakye, K. and Affum-Baffoe, K. (2008). Trends in forest ownership, forest resources tenure and institutional arrangements. Case study from Ghana. In: *Understanding forest tenure in Africa: opportunities and challenges for forest tenure diversification*. FAO, Rome, Forestry Policy and Institutions Working Paper No. 19, p. 151-174.
- Amanor, K.S. (1999). Global restructuring and land rights in Ghana. Forest food chains, timber and rural livelihoods. Nordiska Afrikainstitutet Research Report No. 108.

- Amanor, K.S. (1996). *Managing Trees in the Farming System: The Perspectives of Farmers*. Forest Departments Planning Branch Kumasi, Grelan Printer, Dublin, Ireland.
- Amisah, S. Gyampoh, A. B., Sarfo-Mensah, P. and Quagrainie, K. K. (2009). "Livelihood trends in Response to Climate Change in Forest Fringe Communities of the Offin Basin in Ghana." *Applied Science and Environmental Management*, Vol. 13: 5-15.
- Amor, D. and Pfaff, A. (2008). *Early history of the impact of road investments on deforestation in the Mayan forest*. Working Paper, Nicholas School of the Environment and Sanford School of Public Policy, Duke University, and Durham, NC, USA.
- Anderson, G. (1993). *Fundamentals of Educational Research*. Falmer Press, London, pp: 152- 160.
- Anonymous 2001c. *Climate Change (2001). Synthesis Report. Contribution of working groups I, II, III to the 3rd assessment report of the IPCC*. IPCC, Cambridge University Press, Cambridge.
- Anonymous, (2001a). *Global Forest Resources Assessment 2000-Main Report*. FAO Forestry Paper 140. Rome, Italy.
- Anonymous, (1990d). *Rainforest destruction: causes, effects and false solutions*. World Rainforest Movement, Penang Malaysia.
- Anonymous, (1991). *The Forest Sector*. The World Bank, Washington DC.
- Anonymous, (1994b). *Breaking the logjam: obstacles to forestry policy reform in Indonesia and the United States*. World Resource Institute, Washington.
- Anonymous, (2007). *Three Essential Strategies for Reducing Deforestation*. Alianca da Terra, Amigos da Terra, Instituto Centro de Vida, IMAZON, Instituto de Pesquisa da Amazonia, Instituto Socio Ambiental, Nucleo de Estudos e Pratica Juridica Ambiental, Faculdade de Direito- Universidade Federal de Mato Grosso, Woods Hole Research Center and David and Lucile Packard Foundation.
- Anonymous, (1994a). *Deforestation Technical Support Package*. Third International Conference on Environment Enforcement, Oaxaca Mexico April 25-28, 1994. World Wildlife Fund; U. S. Environmental Protection Agency and U. S. Agency for International Development.

- Anonymous, (2001b). State of the World's Forest 2001. FAO, Rome Italy.
- Anonymous, (2011b). Mining, deforestation cause severe drought. March 5 *the Asian Age*, New Delhi.
- Appiah, M., Blay, D., Damnyag, L., Dwomoh, F.K., Pappinen, A. and Luukkanen, O. (2009). Dependence on Forest Resources and Tropical Deforestation in Ghana. *Environ. Dev. Sustain.*, 11: 471-487
- Asare, R. (2005). Cocoa agroforests in West Africa. A look at activities on preferred trees in farming systems. Forest & Landscape Working Papes No. 6, Forest & Landscape, Horsholm, Denmark.
- Asdrasko, K. (1990). *Climate Change and Global Forests: Current Knowledge of Political Effects, Adaptation and Mitigation Options*. FAO, Rome.
- Asiedu, E. (2004). "The Determinants of Employment of Affiliates of US Multinational Enterprises in Africa." *Development Policy Review*, Vol. 22, No 4, pp. 371-379.
- Asunafo North Municipal Assembly (2009). Medium Term Development Plan.
- Ayine, D.M. (2008). Developing legal tools for citizen empowerment: social responsibility agreements in Ghana's forestry sector. Report International Institute for Environment and Development, London, UK.
- Babbie E. (2007). *The Practice of Social Research* (5tr Ed). Wadsworth Publishing Company, United Kingdom proaches (3rd ed.). Thousand Oaks, California: Sage Publications California.
- Bawa, K. S.; Nadkarni, N.; Lele, S.; Raven, P.; Janzen, A.; Lugo, A.; Ashton, P. and Lovejoy, T. (2004). Tropical ecosystems into the 21st Century. *Science* 306: 227-230.
- Benhin, J.K. and Barbier, E.B. (2000). Forestry, deforestation and biodiversity in Ghana, Inc. Perrings (ed.), *The Economics of Biodiversity Conservation in Sub-Saharan Africa*, Edward Elgar, London, pp. 177-224
- Blay, D., Appiah, M., Damnyag, L., Dowomoh, F.K., Luukkanen, O. and Pappinen, A. (2008). Involving local farmers in rehabilitation of degraded tropical forests: some lessons from Ghana. *Environment, Development, Sustainability* 10: 503-518.

- Carney, (1998). Implementing the Sustainable Rural Livelihoods Approach. Sustainable Rural Livelihoods: What contribution can we make? D. Carney. London, DFID: 3-23.
- Centre for International Forestry Research (CIFOR) (2005). Contributing to Africa's development through Forests Strategy for Engagement in Sub-Saharan Africa. Center for International Forestry Research, Bogor, Indonesia.
- Chambers, R. and Conway, G. (1992). 'Sustainable Rural Livelihoods: Practical concepts for the 21st century'. IDS Discussion Paper 296, Brighton: IDS, Pp. 1-15.
- Chambers, R. and Conway, G. (1992). Sustainable Rural Livelihoods: Practical concepts for the 21st century. IDS Discussion Paper 296, IDS, Brighton, UK.
- Charney, J. G. (1975). Dynamics of deserts and drought in the Sahel. Quarterly Journal of Royal Meteorological Society 101: 193-202.
- Chomitz, K. M., Buys, P., Luca, G. D., Thomas, T. S. and Wertz-Kanounnik, O. S. (2007). At loggerheads? Agricultural expansion, poverty reduction and environment in the tropical forests. World Bank Policy Research Report. World Bank, Washington DC.
- Colchester, M. And Lohmann, L. (1993). The Struggle for land and the fate of forest. Zed books, London.
- Contreras-Hermosilla, A. (2000). The underlying causes of forest decline. CIFOR Occasional Paper No. 30. CIFOR, Bogor, Indonesia.
- Creswell, J. W. and Miller, D. L. (2000). Determining validity in qualitative inquiry. Theory into Practice, 39(3), 124-131.
- Cristina, C. and Amanda Navickis-Francois (2010). Deforestation & loss of Biodiversity Oxford: Oxford University Press.
- DeJong, T. U. (2012). Property Rights and Artisanal Diamond Development (PRADD) Environmental Rehabilitation and Artisanal Diamond Mining: A Case Study of Land and Livelihoods in the Central African Republic. Prepared for the United States Agency for International Development, USAID.
- Denzin, N. and Lincoln, Y. (1994). Handbook of Qualitative Research. Sage Publication, California, pp: 3-5.

- DFID (1999). The Sustainable Livelihood Framework; *a Guidance Sheets on Sustainable Livelihoods*
- Dickinson, R. E. (1981). Effects of tropical deforestation on climate. In blowing in the wind, deforestation and language implications. Studies in third world societies, Publ. No. 14. Dept of Anthropology, College of William and Mary, Williamsburg Virginia. Pp411-441.
- District Agriculture Development Unit (2010). Major crops cultivated in the Asunafo North Municipality, Brong Ahafo Region- Ghana
- Docena, H. (2010). Philippines: Deforestation through mining subsidized by CDM project. WRM's bulletin N° 161, December 2010.
- Domson, O. (2007). "A Strategic Overview of the Forest Sector in Ghana." Louisiana Forest Products Development Center Working Paper, No. 81.
- Dregne, H. E. (1983). Desertification of Arid lands .Harwood Academia Publishers, London.
- Ellis, F. (2000). Rural Livelihoods and Diversity in Developing Countries. Oxford: Oxford University Press.
- FAO (2006). "Global Forests Resources Assessment: Progress towards Sustainable Forests Management." Rome: FAO.
- FAO. (2010). Global Forest Resources Assessment. FAO, Rome.
- Farrington, J., Carney, D., Ashley, C. and Turton, C. (1999). 'Sustainable Livelihoods in Practice: Early Applications of Concepts in Rural Areas'. *Natural Resources Perspectives*, Number 42, ODI, London.
- Food and Agricultural Organization, (2010). Global Resources Assessment 2010. Country Report, Ghana. *FRA 2010/077*, Rome 2010
- Food and Agriculture Organization (FAO) (2004). Global forest resources assessment update 2005 Terms and definitions (Final version), Food and Agriculture Organization of the United Nations, Rome. Available at: <http://www.fao.org/docrep/007/ae156e/AE156E00>. (Accessed on 4-9-13)
- FORIG. In prep (2008). Forestry Statistics Handbook
- Fraenkel, J. R. and Wallen, N. E. (2000). How to design and evaluate research in Education. New York: McGraw-Hill.

- Frankel, J. and Wallen, N. (2000). How to design and evaluate research in education.
Boston, MA: McGraw-Hill
- Griffiths, T. and Hirvelä, V. V. (2008). India: Illegal aluminum refinery in Tribal lands in Orissa. *WRM's bulletin N° 126*, January 2008.
- Gummesson, E. (1991). Qualitative Methods in Management Research. Sage Publication, California, pp: 83-156.
- Gupta, A.; Thapliyal, P. K.; Pal, P. K. and Joshi, P. C. (2005). Impact of deforestation on Indian monsoon- A GCM sensitivity study. *Journal of Indian Geophysical Union* 9: 97-104.
- Haggett, P. and Frey, D.C. (1977). Locational Analysis in Human Geography (2nd Ed). Edward Arnold Ltd, London.
- Hansen, C.P. and Treue, T. (2008). Assessing illegal logging in Ghana. *International Forestry review* 10(4): 573-590.
- Hartley, J. (1994). Case Studies in Organizational Research in Casell and Symon 1994 Qualitative Methods in Organizational Research. Sage Publication, London, pp: 208-229.
- Hiremath, B.N. and Raju, K.V., (2004). Livelihood Security: A Prerequisite for Sustainable Natural Resource Management ON Srivastava (ed.) Management of Natural Resources for Sustainable Livelihoods and Poverty Alleviation, Volume I 1 Hyderabad: National Institute of Rural Development, pp 95-111.
- Houghton, R. A. (2005). Tropical deforestation as a source of greenhouse gas emissions. In: *Tropical deforestation and Climate change*, eds. Moutinho, P. and Schwartzman, S. Pp 13-20. Amazon Institute for Environmental Research, Belem Brazil, 2008 <http://www.careusa.org/vft/ghana>, (Accessed on 8-7-13)
- International Tropical Timber Organization (ITTO) (2005). "Status of Tropical Forest Management 2005." *ITTO Technical Series*, No 24. Available at: http://www.itto.int/direct/topics/topics_pdf_download/topics (Accessed on 15-10-13)

- Jempa, C. J. (1995). *Tropical Deforestation: A Socio-economic Approach*. Earths can Publications Limited, United Kingdom.
- Johnson, D. (1994). *Research Methods in Educational Management*. Longman Group, Essex, United Kingdom.
- Kaimowitz, D. (2003). Forest law enforcement and rural livelihoods, *International Forestry Review*, 5, 199-210.
- Kaimowitz, D. and Angelsen, A. (1998). *Economic models of tropical deforestation. A review*. Center for International Forestry Research, Bogor Indonesia.
- Krantz, L. (2001). *The Sustainable Livelihood Approach to Poverty Reduction: An Introduction*. Division for Policy and Socio-Economic Analysis, Swedish International Development Cooperation Agency.
- Kreuger, L. W. and W.L. Neuman (2006). *Social Work Research Methods: Qualitative and Quantitative Applications*. Pearson Education, Boston.
- Kumekpor, T.K.B. (2002). *Research methods and techniques of social research*. SonLife Press and Services, Accra.
- Lawton, R. O., Nair, U. S., Pielke Sr., R. A. and Welch, R. M. (2001). Climatic impact oftropical lowland deforestation on nearby Montane Cloud Forests. *Science* 294: 584-587.
- Mahar, D. (1988). *Government policies and Deforestation in Brazil's Amazon region*. World Bank, Washington DC.
- Marfo, E. (2009a). *Security of tenure and community benefits under collaborative forest management arrangements in Ghana. A country report*. Accra, Ghana, 81 p
- Marfo, E. (2009b). *Chainsaw milling in Ghana. An overview of the issues*. Tropenbos International, Wageningen, the Netherlands & Kumasi, Ghana, 12 p.
- Marfo, E. (2010). *Chainsaw milling in Ghana: context, drivers and impacts*. Tropenbos International, Wageningen, the Netherlands. Xii + pp. 64
- Mather, A. S. (1991). *Global Forest Resources*. International Book Distributors, Dehra Dun.
- Ministry of Lands and Forestry (1994). *The Forest and Wildlife Policy of Ghana*
- Ministry of Lands and Natural Resources (MLNR), August 2012, *Climate Investment Funds. Forest Investment Program, Ghana Investment Plan, Version 3.5*, Accra, Ghana.

- Mohd Noor, K. B. (2008). A Strategic Research Methodology, Universiti Industri Selangor, 40000, Shah Alam, and American Journal of Applied Sciences 5 (11): 1602-1604,
- Mugenda, O. M. and Mugenda, A. G. (1999). Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press
- Mugenda, O. M. and Mugenda, A. G. (1999). *Research Methods: Qualitative and Quantitative Approaches*. Nairobi: Acts Press.
- Mullick, B. and Griffiths, T. (2007). India: Indigenous movement in Jharkhand challenge plans for industrial development that threatens to destroy Adivasi forests, farmlands and way of life. *WRM's bulletin N° 116*, March 2007.
- Naoto, J. (2006). "International trade and terrestrial open-access renewable resources in a small open economy." *Canadian journal of Economics*. Vol. 39, No.3, pp.790-808.
- Norman, M. (1991). The world's forests and human populations: The environmental interconnections. In Davis, K. and Bernstam, M.S. (eds). *Resources, Environment and Population: Present Knowledge, Future Options*. Oxford University Press, New York, pp. 237 251.
- Opoku, K. (2006). Forest governance in Ghana: an NGO perspective. Forest Watch Ghana, Accra, Ghana
- Panayotou, T. and Ashton, P.S. (1992). *Not by Timber Alone: Economics and Ecology for Sustaining Tropical Forests*. Washington, DC: Island Press.
- Patton, M. Q. (1987). *How to use qualitative methods in evaluation*. Newbury Park, CA: Sage.
- Pinker, R. (1980). The microclimate of a dry tropical forest. *Agricultural Meteorology* 22: 249-265.
- Population and Housing Census (2012). *Summary Report of 2010 final Results*, Ghana Statistical Service
- Putz, F. E., Blate, G. M., Redford, K. H., Fimbel, R. and Robinson, J. (2001). Tropical Forest management and conservation of biodiversity: An overview. *Conservation Biology* 15: 7-20.

- Repetto, R. (1990). *Deforestation in the Tropics*. Scientific American April, p. 37.
- Roseann, E. (1990). A Global Approach to the Protection of the Environment: Balancing State Sovereignty and Global Interests, 4 TEMP. INT'L L.J. 271, 273.
- Rowe, R., Sharma, N. P. and Bowder, J. (1992). Deforestation: problems, causes and concern. In: *Managing the world's forest: looking for balance between conservation and development*, ed. Sharma, N. P. Pp 33-46. Kendall/Hunt Publishing Company, Iowa.
- Sands, R. (2005). *Forestry in a Global Context*. CABI Publishing.
- Savelugu/Nanton District Assembly, Draft District Medium Term Development Plan 2010-2013, Savelugu Nanton.
- Schmink, M. and Wood, C. (1992). *Contested Frontiers in Amazonia*. Columbia University Press, New York.
- Scoones, I. (1998). 'Sustainable Rural Livelihoods: A Framework for Analysis.' *IDS Working Paper 72*, Brighton: IDS, pp. 3-22.
- Shackleton, C. and Shackleton, S. (2004). The importance of non-timber forest products in rural livelihood security and as safety nets: A review of evidence from South Africa, *Rhodes Centenary: South African Journal of Science*, Vol. 100, 658-664.
- Shepherd, G., Arnold, M. and Bas, S. (1999). Forests and Sustainable Livelihood: Understandings in: Tropenbos International (2005), *Alternative Livelihoods and Sustainable Resource Management*.
- Sheram, K. (1993). *The Environmental Data Book*. The World Bank, Washington DC.
- Slesazeck, B. (2008). The role of timber trees in the livelihood strategies of farmers in Ghana's high forest zone. MSc thesis, Wageningen University, the Netherlands
- Sumit, C., Ghosh S. K., Suresh C. P., Dey A. N. and Gopal, S. (2012). Deforestation: Causes, Effects and Control Strategies, *ICAR Research Complex for Eastern Region, Research Center, Plandu Ranchi India*
- Sunderlin, W.D., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L. and Wunder, S. (2005). Livelihoods, forests, and conservation in developing countries: An overview, *Elsevier Ltd, World Development* Vol. 33, No. 9, 1383–1402.

- The "Rainforest Facts": The Healing Power of Rainforest Herbs by Leslie Taylor, copyrighted 2005 by Square One Publishers, Inc
- Tropenbos International, (2005). *Alternative Livelihoods and Sustainable Resource Management* Wageningen, the Netherlands.
- UNa (2009). "UNDP 2009 Report on Millennium Development Goals" <http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2008/MDG_Report_2008> Accessed: 15th November 2009. D.C.
- UNECA. (2005). "Goal 7 – Ensuring Environmental Sustainability." <<http://www.uneca.org/mdgs/goal7.asp>> Data accessed: 19th October 2009.
- Van Kooten, G. C. and Bulte, E. H. (2000). *The economics of nature: managing biological assets*. Blackwells.
- Wilkie, D., Shaw, E., Rotberg, F., Morelli, G. and Auzels, P. (2000). Roads, development and conservation in the Congo Basin. *Conservation Biology* 14:1614-1622.
- Wong, J. (1989). Ghana Forest Inventory Project Seminar Proceedings, 29-30 March 1989. Accra: Ghana Forestry Department
- World Bank. (2005). Ghana natural resources management and growth sustainability. World Bank, Washington.
- Yin, R. (1984). *Case Study Research: Design and Methods*. California, Beverly Hill, CA. sage
- Yin, R. K. (2003). *Case Study Research: Design and Methods*. California, Sage Publications, Inc.

APPENDICES

APPENDIX 1

DEPARTMENT OF PLANNING

COLLEGE OF ARCHITECTURE AND PLANNING

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

This research is to solicit for relevant empirical data for the completion of an academic exercise on the subject “*assessing the rate of changing forest cover (deforestation) and its effect on livelihood patterns on forest communities in the Asunafo North Municipality*” Achievements’ for the award of a Masters’ of Science degree in Development Policy and Planning from the Department of Planning, KNUST. Your cooperation is very much anticipated since data collected will be treated with complete confidentiality.

Name of respondent Community

SECTION A: SOCIO DEMOGRAPHIC CHARACTERISTICS OF FARMERS

1. Age of respondent.....
2. Sex of respondent a) Male b) Female
3. Educational level attained by respondent a) Primary b) JHS c) SHS d) Voc/Tech e) Tertiary f) Never
4. Marital status of head of household. a) Married b) Single c) Never married d) Widower/widow e) Separated f) Divorced g) Cohabiting
5. Size of household (*household refers to a group of people who eat from the same pot and share the same housekeeping arrangements*).
A.1 B. 2 C. 3 D. 4 E. 5 F. 6+

SECTION B: FARMING CHARACTERISTICS

6. How many years have you been farming? a) <1 year b) 1-5 years c) 6-10 years d) > 10 years
7. What types of crops do you grow? a) Cash Crops b) Food Crops c) Both
8. List the specific crops you grow?
 - a. Cash Crop.....

- b. Food Crops
9. How many farms do you have? a) 1 b) 2 c) 3 d) 4 e) 5 and above
10. What is the size of your farm(s)? a) < 1 acre b) 1-5 acres c) 6-10 acres d) > 10 acres
11. What type of farming system do you practise? a) Mixed farming b) mixed cropping c) mono cropping d) Bush fallow (shifting cultivation) e) Others (specify)
12. Please can you explain why you practice this system of farming?
.....
.....
.....
13. What is your mode of production? a) Labour intensive b) Capital intensive c) Both
14. What type of labour do you use on your farm(s)? a) Owner only b) Nnoboa c) Family
d) Hire labour
e) Others (specify)
15. What farm tools or machinery do you use on your farm?
.....
.....
.....
16. Which of these land preparation methods do you use? a) Slash and burn b) ecological farming c) Tillage d) Others (specify)
17. Which of these cultural practices do you undertake? a) irrigation b) fertiliser application c) weedicide application d) pesticide application e) Others (specify)..... f) None
18. What type of fertilizer do you normally use? a) Natural b) Artificial

SECTION C: IMPACTS OF DEFORESTATION ON LIVELIHOOD PATTERN

19. Are you able to commence your farming activities on time during the planting season in recent times? a) Yes b) No
20. If no, why? a) Late rainfall b) Inadequate sunlight for burning c) Others (specify)
21. What effects does the late planting have on your farming activities?
a) Low output b) Poor quality of yields c) Pest infestation d) Rotting of produce
e) Others (specify).....
22. Can you estimate the total yield of your crops in the last planting season? Fill in the table below

Crop	Yield (tonnes/bags)

23. How will output or yield in compares with that of other past seasons? a) Decreasing b) Increasing c) Normal d) Don't know
24. If decreasing what do you think has accounted for that? *Please tick as many as possible*
a) Inadequate rainfall b) Excessive rainfall (flooding) c) Pest and diseases d) High temperature
e) Soil infertility f) others (specify)
25. What are some of the diseases and pests that attack your crops?
.....
.....
.....
26. How much do you earn from your farming activities per month/year?

- a) Less than Gh¢50 b) Between Gh¢50- Gh¢100 c) Gh¢100- Gh¢300 d) Gh¢300- Gh¢600 e) Gh¢500- Gh¢1000 f) Above Gh¢1000

27. Are you able to save? a) Yes b) No

28. Do you do other economic activities outside of farming?

- a. YES
b. NO

29. If YES, state them (Please tick as many possible)

Artisans only (Type of produce)

- a. Carpentry
b. Metal work
c. Basketry
d. Bead making
e. Sculpturing
f. Fitting

Others.....

30. Services only (Type of services rendered)

- a. Seamstress
b. Hair dressing
c. Food vending
d. Retail shop
e. Civil service

Others

31. If NO, give reasons

- a. Restrictions by institutions
b. Income is enough from forest activities
c. Does not have the means to venture into activities
d. Limitations by time
e. Not interested in any other activity outside the forest.

f. Others

32. If the answer is YES in question 32, what percentage of your income comes from off forest activities?

- a. Less than 10%
- b. Between 20%-50%
- c. Between 50%-70%
- d. Between 70%-90%
- e. Above 90%

Challenges of deforestation on the socio-economic development of forest communities in Asunafo North Municipality.

33. Does changing forest cover have any effect on your livelihood?

- a. YES
- b. NO

34. If the answer in 27 is YES, state the problems

- i).....
- ii).....
- iii).....

35. What has been done about the problem stated above?

- i).....
- ii).....
- iii).....

The extent to which deforestation affects other sectors and economic activities in the study area.

In what areas has the deforestation affected other activities in your community?

- i).....
- ii).....
- iii).....

APPENDIX II

DEPARTMENT OF PLANNING

COLLEGE OF ARCHITECTURE AND PLANNING

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

This research is to solicit for relevant empirical data for the completion of an academic exercise on the subject “*assessing the rate of changing forest cover (deforestation) and its effect on livelihood patterns on forest communities in the Asunafo North Municipality*” Achievements’ for the award of a Masters’ of Science degree in Development Policy and Planning from the Department of Planning, KNUST. Your cooperation is very much anticipated since data collected will be treated with complete confidentiality.

MUNICIPAL AGRICULTURE DEVELOPMENT UNIT

SECTION A

1. Name of respondent.....

2. Position of respondent.....

3. Name of institution.....

4. Name of Municipality.....

5. Vision of the institution

i.....

ii.....

iii.....

6. Mission of the institution

i.....

ii.....

iii.....

SECTION B

1. What are the causes of deforestation in the municipality?
A. Bush fires B. Farming C. lumbering D. Others specify.....
2. Have there been any changes in the crop growing/planting seasons in this municipality in recent times?
3. a) Yes b) No
4. If yes in which months does planting season now start in this municipality?
.....
.....
5. What was/were the starting month(s) for the old planting season in this municipality?
.....
.....
6. What has brought about the change in the planting seasons in this municipality?
.....
.....
.....
7. How has the change in the planting season affected agricultural production in this municipality?
.....
.....
.....
8. What are the causes of the changes in weather conditions in the municipality?
.....
.....
.....
9. What have been the effects of deforestation on crop production in the municipality?

-
-
-
10. What was the total output recorded for the following the major crops grown in this Municipality over the years indicated in the table below?

Crop	Yield (in tones)				
	2007	2008	2009	2010	2011

11. What are the dominant land preparation practices in this municipality?
- a) Slash and burn b) ecological farming c) Tillage d) others (specify)
12. Which of these cultural practices do farmers in this municipality usually undertake?
- a) Irrigation b) fertiliser application c) weedicide application d) pesticide application f) manual weeding
13. What measures has this outfit put in place to reduce the effects/roles of deforestation on agricultural production in this municipality?
-
-
-
-
14. How deforestation does affected crop/agricultural production in this municipality?
-
-
15. What are the policies governing deforestation in the municipality?
-

16. How effective has this policies affected forest management, sustainability and conservation of forest resources?

.....

17. What are the major constraints to deforestation in this municipality?

- (i)
 (ii)
 (iii)

18. (iv) What are some of the programmes/projects to improve upon afforestation in this municipality?

.....

- (v)

19. Please provide an inventory of equipments/staff of this outfit

Equipment/Staff	Number Available	Number Required
Extension/ veterinary officers		
Vehicles		
Office equipments		
Tractors		

20. What challenges does this unit face in carrying out its functions?

.....

21. How can these challenges be resolved?

.....

APPENDIX III

DEPARTMENT OF PLANNING

COLLEGE OF ARCHITECTURE AND PLANNING

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

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SECTION A

Forestry Commission

Name of respondent.....

Position of respondent..... Date

SECTION B

1. What was the forest cover in the municipality thirty years ago?

.....
.....
.....

2. What is the forest cover in the municipality presently?

.....
.....
.....

3. What has been the rate of forest depreciation in the municipality?

Lumber	Yield (in tones)								
	2005	2006	2007	2008	2009	2010	2011	2012	2013

SECTION C

1. The dominant social and economic activities in forest of forest communities.		
a.	Agricultural activities	Percentage
i		
ii		
iii		
iv		
v		
vi		
vii		
B	Non-Farm activities	Percentage
i		
ii		
iii		
iv		
v		

2.	Unemployment	Type (causes)	Percentage
		Health reasons	
i		Seasonal	
ii		Structural	
iii		Retirements	
iv		Voluntary	
		Others	

3. Mention the benefits forest communities derives from the forest

- i).....
- ii).....
- iii).....
- iv).....
- v).....
- vi).....

4. How many people does the forest offer employment to?		
a.	Agricultural activities	Percentage
i		
ii		
iii		
iv		
v		
vi		
vii		

B	Non-Farm activities	Percentage
i		
ii		
iii		
iv		
v		

5. How many people has the changing forest cover made unemployed?

.....

.....

.....

6. What factors account for their unemployment?

i).....

.....

ii).....

.....

iii).....

.....

7. What livelihood strategies have been put in place to give alternative livelihoods of displaced residence affected by the changing forest cover?

i).....

.....

ii).....

.....

iii).....

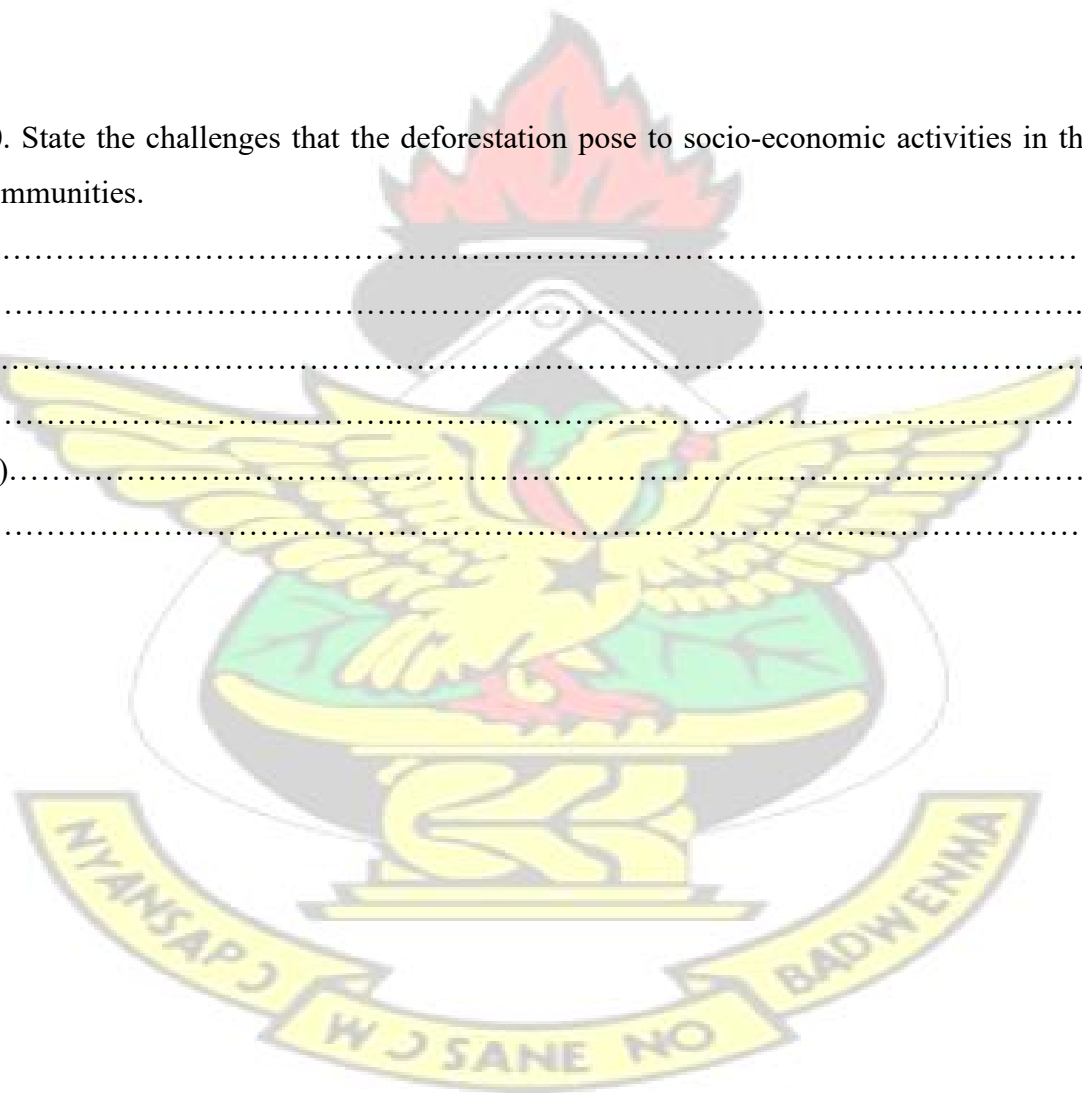
.....

9. State the contribution of your institution to give alternative livelihoods to residence within the forest communities.

- i).....
.....
- ii).....
.....
- iii).....
.....

10. State the challenges that the deforestation pose to socio-economic activities in the communities.

- i).....
.....
- ii).....
.....
- iii).....
.....



APPENDIX IV

DEPARTMENT OF PLANNING

COLLEGE OF ARCHITECTURE AND PLANNING

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COCOBOD

SECTION A

1. Name of respondent.....
2. Position of respondent.....
3. Name of institution.....
4. Name of Municipality.....
5. Vision of the institution
 - i.....
 - ii.....
 - iii.....
6. Mission of the institution
 - i.....
 - ii.....
 - iii.....
 - iv.....

SECTION B

1. What are the causes of deforestation in the municipality?
B. Bush fires B. Farming C. lumbering D. Others specify.....
2. Have there been any changes in the crop growing/planting seasons in this municipality in recent times?
3. a) Yes b) No
4. If yes in which months does planting season now start in this municipality?
.....
.....
5. What was/were the starting month(s) for the old planting season in this municipality?
.....
.....
6. What has brought about the change in the planting seasons in this municipality?
.....
.....
7. How has the change in the planting season affected agricultural production in this municipality?
.....
.....
8. What are the causes of the changes in weather conditions in the municipality?
.....
.....
9. What have been the effects of deforestation on crop production in the municipality?

-
-
-
10. What was the total output recorded for the following the major crops grown in this Municipality over the years indicated in the table below?

Crop	Yield (in tones)				
	2007	2008	2009	2010	2011

11. What are the dominant land preparation practices in this municipality?
- a) Slash and burn b) ecological farming c) Tillage d) Others (specify)
12. Which of these cultural practices do farmers in this municipality usually undertake?
- a) Irrigation b) fertiliser application c) weedicide application d) pesticide application f) Manual weeding
13. What measures has this outfit put in place to reduce the effects/roles of deforestation on agricultural production in this municipality?
-
-
14. How does deforestation affect crop/agricultural production in this municipality?
-
-
-
15. What are the policies governing deforestation in the municipality?
-

.....

.....

16. How effective has this policies affected forest management, sustainability and conservation of forest resources?

.....

.....

.....

17. What are the major constraints to forest conservation in this municipality?

- (i)
- (ii)
- (iii)
- (iv)
- (v)

18. What are some of the programmes/projects to improve upon afforestation in this municipality?

.....

19. Please provide an inventory of equipments/staff of this outfit

Equipment/Staff	Number Available	Number Required
Staff		
Vehicles		
Office equipments		
Tractors		

20. What challenges does this unit face in carrying out its functions?

.....

.....

.....

21. How can these challenges be resolved?

.....

.....

KNUST

