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EFFECTS OF LAND COVER CHANGE ON NON-TIMBER FOREST PRODUCTS AND LIVELIHOODS OF PEOPLE IN BIRIM CENTRAL MUNICIPALITY

BY

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DECLARATION

I, Osei-Bonsu Esther, declare that this thesis is the outcome of my research investigations and findings. This work has not been previously submitted for award of any type of academic degree from any other Institution, except where due acknowledgement has been made in-text and a reference list appended.

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DEDICATION

This thesis is dedicated to everybody who contributed in however small way towards its success.

ABSTRACT

It is known that forest degradation affects NTFPs thus dependants on such forest resources. To ascertain this claim, the study was designed to examine the effect of land cover change on selected non-timber forest products from different land use types in the moist semi-deciduous forest and their likely effects on livelihoods in the northern part of the Birim Central Municipality. Employing the cross-sectional approach, remote sensing/GIS, questionnaires and semi-structured interviews, the research unearthed responses to pertinent issues of land cover change, NTFPs and livelihoods. The target groups included residents in two forest communities, traders in the municipality's biggest market as well as key actors in the forestry sector chief among them being the Forest Services Division of the Forestry Commission. The study was based on Sustainable Forest Management concept and the livelihood framework. The analysis indicated that there was forest cover loss over the years 1991 to 2013 which was as a result of illegal logging, sudden reviews of harvesting schedules, slash and burn farming, climate variability and small scale mining. Analysis of NTFPs availability and livelihoods of people also revealed that collection and trade in NTFPs was a major livelihood activity undertaken by respondents in the study area. This meant that any action that would obstruct the continuous existence of the natural forest would equally affect the survival of those dependent on NTFPs. For this reason, the study suggested an evaluation of how all forest resources are extracted in the area, in order to preserve non-timber forest resources thus sustain livelihoods of people who depended on them.

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LIST OF ABBREVIATIONS

MLNR	Ministry of Lands and Natural Resources
FIP	Forest Investment Program
NTFP	Non-timber Forest Product
NTFPs	Non-timber Forest Products
JRC	Joint Research Centre
IUCN	The World Conservation Union
CERUT	Centre for the Environment and Rural Transformation
SFM	Sustainable Forest Management
BCM	Birim Central Municipality
BCMA	Birim Central Municipal Assembly
CWSA	Community Water and Sanitation Agency
PHC	Population and Housing Census
PROFOR	Program on Forest
GIS	Geographic Information System
FC	Forestry Commission
FSD	Forestry Services Division
SOFO	State of the World's Forests

CHAPTER ONE

GENERAL INTRODUCTION TO THE STUDY

1.1 Introduction

This opening chapter gives a general introduction to the entire study. It begins with a background and continues with problem statement, research aims and objectives, propositions, significance of the study, limitation of the study and finally, the thesis structure.

1.2 Background to the Study

The physical surface of the earth is in constant change; what was once forest is being converted to farmlands, settlements, bare land, and the like. According to FAO [n.d], land cover is the "observed (bio)physical cover on the earth's surface. When considering land cover in a very pure and strict sense, it should be restricted to a description of vegetation and man-made features". Vegetation here refers to either the pristine forest or human modified forest, in which case forest cover change is a sub component of land cover change.

Millions of people's livelihoods depend on forest products (Sunderlin *et al*., 2005 citing Brosius, 1997; MLNR, [n.d]). It provides livelihoods to more than a billion people, and ecosystem services that are important at local, national and global levels (FAO, 2005); but "throughout recorded history, the earth's forest area has been shrinking. The world's forests are still being destroyed, wilfully or ignorantly. The diminution of forest areas may have far-reaching consequences because forests provide not just wood but a host of other benefits or 'human utilities'" (Glesinger, 1960). For instance, the Congo Basin which is the second biggest tropical forest region of the world, with an entire area of

about 227.6 million hectares denotes nearly 60 percent of the total land area of six countries of the central African region: Cameroon, Central African Republic, Gabon, Equatorial Guinea, the Republic of Congo (Congo-Brazzaville) and the Democratic Republic of Congo (Ndoye & Tieguhong, 2004 citing FAO 2001). However, the forests of the Congo Basin are under increasing pressure and in the whole region, forests were decreasing in area at an average annual rate of 0.35 percent (Ndoye & Tieguhong, 2004 citing FAO 2001). The incidence of forest depletion in the Congo Basin is not the only recorded case in Africa.

The disappearance of natural forests in developing countries, according to Sunderlin *et al.* (2005), is a problem, among other reasons, because it negatively affects the livelihoods of people dependent on forest products and services. Forest products which include not only timber but also non-timber products are gathered from the forest to enhance human lives. The World Bank (2003) estimated that a considerable percentage of the world's underprivileged stay in or near forests. The forest resources in Ghana, according to FIP (2012), are being depleted at an alarming rate. FIP continued that even though the country's original forest was estimated at 8.2 million hectares at the beginning of the 20th Century, only an estimated 1.6 million hectares remain. It follows that the continuous existence of forests would mean availability of non-timber forest products while the depletion of forests will mean less non-timber type of forest product will be available for human exploitation.

Non-timber forest products generally refer to products apart from hard wood found in farmlands, bush fallows or natural forests. According to Ahenkan and Boon (2011) citing de Beer and McDermott (1989) one of the pioneer writers on the subject, non-timber forest products "encompasses all biological materials other than timber which are

extracted from forests for human use". Neumann and Hirsch (2000) also defined non-timber forest products as "all the biological materials (other than industrial round wood and derived sawn timber, wood chips, wood based panels and pulp) that may be extracted from natural ecosystems, managed by plantations and utilized within the household, marketed, or have social, cultural or religious significance". Although the other vegetation types also serve as suitable habitats to some of them, these products are abundant in tropical and sub-tropical forests of the world namely monsoon Asia, Africa south of the Sahara and South America. For instance, tropical rainforests contain an estimated 50 percent of all species on the earth (FAO, 2002). Non-timber forest products are collected from a wide range of ecotypes such as high forests, farm fallows and farmlands. Examples of non-timber forest products in literature include bamboos, canes, sponges, vines, fruits, mushrooms, wild games/ bush meat, nuts, seeds, oils, spices, resins, gums, wild yams, medicinal plants (tree barks, leaves and roots) and fibre.

"The significance of non-timber forest products effectively captured the imagination of conservationists around the world when an article by Peters *et al.* (1989) published in 'Nature' claimed that more money could be earned from tropical forests by collecting these products than from logging" (Ahenkan & Boon, 2011 citing Choudhury, 2007). The importance of these non-timber forest products either directly or indirectly to live and livelihoods, especially the socio-economic well-being of people in close proximity to them, cannot be overemphasized. Before the ban on collection of non-timber forest products for commercial use in The Soligas, India, cash income from non-timber forest products collection constituted 85.2 percent of the total cash income to the average household and was thus the most dominant cash income-generating activity in a household (Sandemose, 2009). Additional importance of non-timber forest products

include poverty alleviation (Giliba *et al.*, 2010), nutrition (Ahenkan & Boon, 2011), forest or biodiversity conservation (Pena, 2010), women empowerment (Ahenkan & Boon 2011, Awono *et al.*, 2010), food security and nutrition of smallholders afflicted by HIV/AIDS (Barany *et al.*, 2004), rural household income provision (Mulenga *et al.*, 2011), employment (World Preservation Foundation, 2010; Ndoye *et al.*, 1997), contribution to annual national GDP, health and medicinal purposes (Ahenkan & Boon, 2011), among others.

Numerous literature have looked at the potential of these non-timber forest products in Ghana too. According to Ahenkan and Boon (2008), non-timber forest products aid in ensuring food security, poverty alleviation, sustainable forest management and improving nutrition. Expounding on the many non-timber forest products that are found and used in southern Ghana, Bih (2006) and Falconer (1992) conducted an inventory of non-timber forest products in certain portions of the country. Again, the commercialization of non-timber forest products with regards to processing, packaging and marketing (Ahenkan & Boon, 2010); their contribution to people's livelihoods (Bell, 2010) as well as environmental sustainability and empowerment of rural women (Ahenkan & Boon, 2011) have been studied. Boafo (2013) in his studies on timber and non-timber forest products stated that the non-timber forest products are collected with the aims of earning income and for meeting household food needs in Offinso. According to Appiah (2009), the proceeds generated from the sales of non-timber forest products are used to supplement household food supply and family incomes. Majority (88.4 percent) of household members enter the Kakum National Park for non-timber forest product collection (Amoah and Wiafe, 2012). These non-timber forest products from the foregoing are an integral part of Ghanaian society's livelihoods (Birikorang *et al.*, 2009).

1.3 Statement of Problem

Ghana, lying slightly north of the Equator, has a wide range of ecological zones stretching from guinea and Sudan savannah in the northern parts to scrub and mangrove at the coast. This makes her one of the areas of animals and plants diversity which in turn assists the nation to have a great number of non-timber forest products. The ecological zones according to Hawthorne and Abu-Juam (1995) are classified into nine sub-divisions, each with a distinct association of plant species and corresponding rainfall and soil conditions, namely: wet evergreen zone; moist evergreen zone; moist semi-deciduous north east; moist semi-deciduous south east; upland evergreen; dry semi-deciduous inner zone; dry semi-deciduous fire zone; southern marginal and southern outlier. The FAO (2005) estimated the total forest area in Ghana to range from 2.72 million hectares to some 6.34 million hectares. However, Ghana's forestry sector is now at a critical crossroad and has two clear choices: continue on a path of forest depletion leading to quick decline in the sector's contribution to socio-economic and environmental contributions or shift towards other sustainable and untapped uses/benefits from non-timber forest products (Manso-Howard (2011) citing Tropical forests update Vol. 12 2002).

Various research on non-timber forest products conducted by Ahenkan & Boon (2008, 2010, 2011), Bell (2010), Amoah and Wiafe (2012) among others, have been done in Ghana. Majority of those research were conducted in high forest reserve areas located within the country (see for instance Bih, 2006; Ahenkan & Boon, 2011). This High Forest Zone (HFZ) which is mostly found in the south-western portions of the country includes the wet and evergreen forest in Western region, moist and dry semi-deciduous forests (FAO, 1998) in Ashanti, Eastern, Central, upper limits of Western, southern part

of Brong Ahafo and Volta regions. Other known studies were conducted in the forest fringes in the northern parts of Ghana (Acheampong, 2003).

In the discourse of the significance of NTFPs so far, a few studies have been conducted to specifically connect land cover change, non-timber forest products and livelihoods in the wet moist semi-deciduous forests. This study was therefore designed to examine the effect of land cover change on non-timber forest products for both food and non-food purposes derived from different land use types namely moist semi-deciduous forest, bush/farm fallows and farmlands. It also looked at the effect of collecting these non-timber forest products on livelihood option for rural household food and economic needs, in some selected reserve and off-reserve forest communities of the Birim Central Municipality of the Eastern Region of Ghana. The livelihood of households in this study is not only understood as cash earned through non-timber forest product activities but also the cash generated from collecting and selling non-timber forest products in addition to the food and other contributions of these non-timber forest products. Improving livelihood of rural folks should be considered a matter of significance, hence it requires little rationalization.

However, it is necessary to explain why forest degradation and its causes is a challenge to forest natural resources, prominent among these resources being non-timber forest products. This study sought to address the following research questions: what are some of the NTFPs found in the study region and their distribution according to land use types - forest and other modified ecosystems (farmlands, bush fallows, and so on)? What are the contributions of non-timber forest products to household's livelihoods?

1.4 Research Aim and Objectives

Aim: The broad intent of the study was to examine the effect of land cover change on selected non-timber forest products from different land use types in the moist semi-deciduous forest and their likely effect on the livelihoods of some forest dependent people of the Birim Central Municipality.

Specific Objectives: The study sought to:

i. delineate the possible forest cover types in the area and the causes of change.
ii. identify the characteristics of households that rely on NTFPs for domestic use and trade.
iii. find out the types of NTFPs sourced from the different land use types.
iv. examine the role of NTFPs in improving livelihood.

1.5 Propositions

The study was guided by these propositions:

1. Forest cover loss over the years has decreased quantity and quality of NTFPs collected.

2. The collection of NTFPs contributes significantly to household livelihoods.

1.6 Significance of the Study

Reviewing the literature, it was realised that most of the researches (see for instance Bell, 2010) were conducted in the tropical rainforest ecological belts, that is, the evergreen forests in the Western Region, a few in the forest fringe areas in the middle belt, Savannah areas and in the moist semi-deciduous forest regions which also contribute significant quantities of NTFPs. Hence, this study was situated in a moist semi-

deciduous forest area. This study further drew the connection among land cover change, NTFPs and livelihoods thereby filling the gap. It is also very relevant because the findings provide a guide on the types of NTFPs found in the Birim Central Municipality, where they are generated as well as their uses. Lastly, the study serves as basis for future researches on the topic.

1.7 Limitations of the Study

Naturally, in every human endeavour, there are bound to be certain setbacks. Key among the challenges the researcher encountered was the frustrating bureaucratic bottlenecks within government institutions visited. For instance, in accessing information from the Forest Services Division (FSD), the researcher was asked to see a number of people, some of whom were reluctant to speak before finally providing the information.

Other challenges were negative responses from some of the establishments contacted, the absence of the heads of some of the establishments, out-dated or lack of current data especially from the BCMA. On the part of interviewees, some market women were not willing to divulge any information with the mind-set that their responses could lead to increment in their daily tolls. Yet still others saw the exercise as time wasting because they would not benefit from it. Against all odds, the researcher patiently explained the necessity of the research to respondents in order to obtain useful information for the successful completion of this thesis.

1.8 Thesis Structure

This study is organized into six chapters. The first chapter is titled “General Introduction to the study”. It entails the introduction of the chapter, background to the study, problem statement, objectives and the relevant questions pertaining to the study. It also outlines

the study propositions, significance and limitations. The chapter concludes with an organization of the entire thesis. Chapter two presents a review of the literature including related and relevant information to NTFPs in general as well as the Ghanaian situation. It also presents a review of the livelihood framework adopted for the study. Chapter three provides a vivid description of the study area in the first part as well as the methodological approaches adopted in the second part. Chapter four is a report on the results of the remote sensing maps; questionnaires and semi-structured/structured interviews about the socio-demographic characteristics of respondents. Chapter five is titled "Discussion of results". It presents detailed discussions on the results obtained. Chapter six presents a conclusion for the study.

1.9 Summary

The chapter was made up of nine sections. The first section gave an introduction to the chapter while the second section was devoted to background of the study. The third, fourth and fifth sections focused on the problem statement, aims and objectives and propositions of the study respectively while the sixth section addressed the significance of the study. Limitations of the study can be found in the seventh section and in the final section, the structure of the study was discussed. The next chapter is dedicated to the review of related literature, as well as Theoretical and Conceptual Frameworks of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter provides relevant literature on existing information and contributions made by various researchers on the subject of NTFPs. Loopholes in each of the works and the connections between them are identified. Related literature is thus reviewed under these themes: global trends in land and forest cover change, remote sensing and GIS in forestry, definitions of NTFPs, and significance of NTFPs. The chapter ends with the theoretical perspective and conceptual framework adopted for the study.

2.2 Global trends in land and forest cover change

FAO (2005) estimates the total area of the world's forests at 3.69 billion hectares or about 30 percent of the global land area. Overall, there was a net decrease in global forest area of 1.7 percent or an average of 14.5 million hectares per year between 1990 and 2005, at an annual rate of change of 0.11 percent. This equates to an annual shift from forest land use to other land uses of 4.1 million hectares per year between 1990 and 2000 to 6.4 million hectares per year between 2000 and 2005 (FAO and JRC, 2012). Turner II *et al.* (1994) noted that land cover change stemming from human land uses represents a major source and a major element of global environmental change. The consequences of land use have been significant, not only for land cover but for many aspects of local, regional, and global environments, including climate, atmospheric composition, biodiversity, soil condition, and water and sediment flows (Turner II *et al.*, 1994).

Major regional differences were found in the net rates of forest area change; only Asia and North America experienced gains in forest area and all other regions saw net losses (FAO & JRC, 2012). South America had the highest net forest loss, losing some 3.3 million hectares annually between 1990 and 2005. Africa had the second highest net forest loss – 1.6 million hectares annually – during the same period. Europe, including the Russian Federation, had a net loss of 0.5 million hectares annually and Oceania lost just under 0.1 million hectares annually. North America experienced a net gain in forest area of 0.2 million hectares annually, while Asia had a net gain of 1.4 million hectares annually between 1990 and 2005 (FAO and JRC, 2012). Annual land cover change detection rates across the Albemarle–Pamlico Estuary System (APES) in USA over the study period (2002–2005) were estimated at 0.7 percent per annum and varied from 0.4 percent (2003) to 0.9 percent (2004) (Lunetta *et al.*, 2006). Regional variations were also readily apparent ranging from 1.6 percent to 0.1 percent per annum for the tidal water and mountain ecological zones, respectfully (*ibid.*). Deforestation in eastern Bolivia in 2004 covered 45,411 km², representing approximately 9 percent of the original forest cover, with an additional conversion of 9,042 km² of Scrub and Savannah habitats representing 17 percent of total historical land-cover change. Annual rates of land cover change increased from approximately 400 km² in the 1960s to approximately 2,900 km² per year in the last epoch spanning 2001 to 2004 (Killeen *et al.*, 2007).

Fu (2003) asserts that in the past 3,000 years, more than 60 percent of the East Asia region has been affected by conversion of various categories of natural vegetation into farmland, conversion of grassland into semi-desert and widespread land degradation.

Deforestation, it is believed, occurs faster in African nations with predominantly dry forests [n.a]. Killeen *et al.* (2007) stated categorically that land cover change in tropical

ecosystems is one of the most important ecological challenges facing modern society. This is re-echoed by FAO and JRC (2012) that the tropical domain had a net loss of forest area of 6.8 million hectares annually between 1990 and 2005.

In conclusion, deforestation and protection of biodiversity are key issues which ought not to be taken lightly. This is so because forests release oxygen; prevent erosion by reducing force of rainfall on land soil surface and surface run-offs; act as filters, collect and store water and recharge underground aquifers, sequester carbon, among several benefits.

2.3 Remote Sensing and GIS in forestry

The ability to manage and maintain our ecosystems depends largely on the development of new scientific information concerning ecosystem structure and function, new concepts and tools of ecosystem management such as Remote Sensing and Geographic Information Systems (GIS) and experience guided in applying concepts and tools to management (Franklin, 1994). Application of computer-aided technologies in assessing and monitoring forest cover change detection has increased tremendously in contemporary times. Two most effective modern technologies used in such change detections is the integration of remote sensing and GIS (Rogan and Miller, 2006). To Bruzzone and Cossu (2003), change detection is the process of identifying differences in the state of a phenomenon or an object by observing it at different times. With the help of remote sensing and GIS, Kumar *et al.* (2010) identified that in India for instance, there was a tremendous reduction in forest cover area by 565.02 hectares within a period of 12 years between 1996 and 2008 (equivalent to 10.76 percent decrease in the forest area).

This finding clearly showed that the total forest cover is continuously degrading and transforming into various land use/land cover categories.

Again, Sakthivel *et al.* (2010) in a study of forest cover change detection of the Kalrayan Hills in India using RS and GIS concluded that there has been drastic change in forest cover because of intensive agriculture during 2001 which may be due to illegal felling, forest fire and shifting cultivation. The results of Geospatial technology (that is, Remote Sensing and GIS) application in the management of forest fires in Batsumber in the Tov province of Mongolia according to Hussein *et al*. (2008) disclosed a decrease in forest cover as a result of the increased incidence of forest fire. For instance in the year 2000, a total of 11,688 hectares of land was burned by fire and a total of 15,363 hectares of land burned in 2007. The application of Remote Sensing and GIS in the management of Mangrove Forests within and adjacent to Kiunga Marine Protected Area in Kenya, Kairo *et al.* (2001) revealed that mangrove forests within and adjacent the protected area have been under uneven cutting pressures and the accessible areas adjacent the reserve have now been largely over-exploited.

Akingbogun *et al.* (2012) also discovered a large decrease in forest plantation of the Eleyele Forest Reserve in Ibadan North West Local Government area of Oyo State, Nigeria between 1984 and 2000 from 0.8808 hectares of forest plantation (12.5 percent) to 0.0094 hectares of forest plantation (0.13 percent) which is a loss of about 0.8714 hectares or 12.37 percent. There was a remarkable decrease in vegetation from the year 1972 to 2000, which is from 5.8 hectares of land in 1972 to 1.5 hectares in 1984 to 0.04 hectares in year 2000. They attributed this decrease to vegetation classes being converted to farmland. Furthermore, a study conducted by Frimpong (2011) on the application of Remote Sensing & Geographic Information Systems on forest cover change detection of

the Owabi catchment in the Ashanti Region of Ghana revealed a trend of decrements in High Density Forest and Sparse Forest. For instance, in 1986, High Density Forest occupied the highest percentage of area having 50.21 percent, Sparse Forest covered 21.29 percent while built-up and croplands occupied 13.01 percent and 1.73 percent respectively. However, in 2002, High Density Forest and Sparse Forest coverage reduced to 27.60 percent and 19.23 percent respectively, while built-up and croplands increased to 39.06 percent and 3 percent respectively. In 2007, there was a further reduction of High Density Forest and Sparse Forest to 15.75 percent and 16.85 percent respectively, while built-up area further increased to 50.26 percent which is the highest area coverage, and croplands also increased further to 5.21 percent.

The role of remote sensing and GIS in forest management hence achieving objective one of this research cannot be underplayed. As Franklin (1994) stated, remote sensing and GIS together are critical tools for the challenges resource managers now face.

2.4 Defining NTFPs

Globally, people depend upon natural non-timber forest resources for meeting a large number of their basic necessities of life. The type of resources and utilization patterns, however, vary by ecological zone and their socio-cultural area (Odebode, n.d). Generally, the contribution of non-timber forest products (NTFPs) to the forestry sector and rural household in most countries is significant (Odebode, [n.d]) citing Okafor *et al.* (1994). The term 'NTFP' has proved difficult to define due to a number of reasons including the blurred boundaries between timber and non-timber products. Perhaps it is as a result of the evolving nature of the concept consequently generating a lot of meanings and making it impossible to create a general system of congruent classification

based on a conventional terminology. The difficulty has led to a multiplicity of terminologies sometimes used interchangeably including Non-Wood Forest Product (Food and Agriculture Organization, 1997), Minor Forest Products (FAO corporate document repository citing Malhotra & Poffenberger, 1989), non-timber forest products or NTFPs (McLain & Jones, 2005), special forest products (FAO corporate document repository citing Thomas & Schumann, 1993), alternative and secondary forest products, specialty forest products, and many more. Ahenkan and Boon (2011) citing de Beer and McDermott (1989) defined NTFPs to encompass all biological materials other than timber, which are extracted from forests for human use. This therefore includes botanical and mycological products and associated services of the forest such as wild food, medicinals and floral greenery, arts and crafts materials, specialty wood products and small diameter wood (non-conventional), ethno-botanical teaching and ecotourism (Centre for Non-Timber Resources, 2008).

In the works of McLain & Jones (2005), NTFPs are stated to include (1) foods, such as wild edible mushrooms, fruits, and nuts; (2) medicinal plants and fungi; (3) floral greenery and horticultural stock; (4) fibre and dye plants, lichens, and fungi; (5) oils, resins, and other chemical extracts from plants, lichens, and fungi; (6) fuel wood; and (7) small-diameter wood used for poles, posts, and carvings. Again, the FAO in 1999, in an attempt to generate a common working definition of the subject, defined NWFP and NTFP to "… consist of goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests" with the exception that NTFP includes fuel wood and small woods given that NWFP excludes woody raw materials. In an effort to clarify the term NTFPs, Ahenkan and Boon (2011) stated that the debate over the concept of NTFPs is usually centred on five main issues namely;

1. The nature of the product – inclusion/exclusion of non-industrial timber and other wood products.
2. Source of the product – inclusion and exclusion of forest/tree plantations, managed forests, grassland, managed agro-forestry system within agricultural land.
3. The nature of production of the product – gathered only from the wild or includes those that are domesticated (examples: Rubber, mushrooms, snails, oil palm, and many others).
4. The scale of production – capital intensive, industrial scale versus small scale mixed systems.
5. The ownership and distribution of benefits.

Ahenkan and Boon (2011) further contend that at the centre of the debate over the term NTFP is whether or not to include woody plant material and products in the definition, whether the plant or service is produced in a forest environment and whether an NTFP is really an NTFP if it is cultivated. Additionally, in a study showing the classification of forest products and various forms of non-timber forest products, Okafor *et al.* (1994) made mention of two categories of non-timber forest products: woody and non-woody products. Woody forest products include fuel wood, poles and wood-derived NTFPs like sponge, charcoal, and others. They further pointed out non-wood forest products from flora namely tree parts [stems and barks (latex, gum, resin, fibre, wine, dye and medicine), leaves (vegetables, wrappers, forage) as well as flowers and fruits (food, oils, spices, condiment, fodder, honey)] and others from fauna [bushmeat (from mammals, reptiles, birds, insects, mollusks, fishes, amphibians), skin, fur, and so on].

Moreover, Ahenkan and Boon (2011) citing Belcher *et al.* (2005) acknowledged that given that worldwide, NTFPs are produced and cultivated under a broad range of management regimes from strictly wild, semi domesticated to more intensively managed

systems, the NTFPs continuum should be sub-divided into three categories namely: wild products gathered from fallow, secondary or matured forests; managed products from partially transformed forests and cultivated NTFPs from those deliberately planted as seeds/seedlings or breeding stock such as grass cutters and snails. Belcher (2005) provides extra clarification to embrace "…roots, fruits, medicinal plants, resins and essential oils, and fibres such as bamboos, rattans, and other palms used for weaving and structural applications" whereas Mbuvi and Boon (2009) describe NTFPs broadly to include all non-timber biological resource-derived products (animal, plant, or mushroom) harvested from forested lands.

It is quite obvious from the several and varied meanings for non-timber forest products provided above that the argument over what constitutes an NTFP is not about to end anytime soon. For the purpose of this study however, non-timber forest products was defined as all biological resources other than timber extracted from the forest for human welfare or marketed or have social, cultural or religious significance (Kisaka and Sitati, 2014 citing Wickens, 1991) and the term 'Non-Timber Forest Products' abbreviated to 'NTFPs' so as to conform to prevailing international convention (McLain and Jones, 2005).

2.5 Significance of NTFPs to individual livelihoods as well as national economies

The extraction, marketing and trading in non-timber forest products as a way of boosting income thereby improving livelihoods of the rural poor in the tropics have been pushed greatly over the years. Following Ahenkan and Boon (2010) citing Marshall *et al.* (2005), international trade in NTFPs is estimated at USD 11 billion annually. It has also been estimated that there are 60 million highly forest-dependent indigenous people in

Latin America, West Africa, and Central-east Asia, with an additional 400 million to 500 million people directly dependent on these natural products (IUCN, 2007). Internationally, from Asia to the Americas and Africa to Europe, non-timber forest products have become an essential component for rural dwellers' survival either for supplemental income or general sustenance (FAO, 1997). An estimated 80 percent of the developing world population heavily relies on non-timber forest products for their primary livelihoods (FAO, 1997).

In the works of Awe *et al.* (2011), it was revealed that rural households across the world have various reasons for which they engage in non-timber forest products gathering. These differ from one person to another, from one household to the other and from one region to another. The contributions of NTFPs to national economies are significant considering what their absence would mean. It is estimated that approximately 60 million indigenous people are almost wholly dependent on forests (World Preservation Foundation, 2010). NTFPs accounted for a significant amount of revenue while creating millions of jobs worldwide (World Preservation Foundation, 2010; Ndoye *et al.*, 1997). Several million households worldwide depend heavily on non-timber forest products for income and the estimated total value of world trade in non-timber forest products is approximately US$1,100 million (FAO, 1997). NTFPs contributed 10 to 40 percent of income to the 50 million tribal households in India (Sekar *et al.*, 1996 citing Shiva, 1993) and about 200 to 300 million villagers depend on non-timber forest products to varying degrees (Shiva, 1995b; FAO's Forestry Department). In the surveys of the United Nations Food and Agriculture Organization (1997), it has been estimated that 80 percent of the population of the developing world use non-timber forest products to meet some of their health and nutritional needs. Again, WHO (2003) estimated that the then global

market for herbal medicines stood at US$ 60 billion and that the global market was growing steadily, and today, 25 percent of modern medicines are made from plants first used traditionally. In Nepal, NTFPs are said to be used for subsistence as well as for trade contributing four percent of the total contribution of forestry to the national economy (FAO, 1997) and the rattan industry alone provides employment for 200,000 people in Indonesia (FAO, 1997). Similarly, in Bangladesh, non-timber forest products provide employment for nearly 300,000 people (Basit, 1995).

On cases documented in Africa, Aiyeloja *et al.* (2001) stated categorically that many non-timber forest products are commercial products that can make a significant contribution to the cash economy of households and national economies. CERUT (1999) contends that in some instances, the value generated by commercial timber exploitation is lower compared to that of non-timber forest products trade. Non-timber forest products constitute rural industrial raw materials for cottage industries, cultural symbols, ritual artefacts and traditional medicine in Nigeria (Nkwatoh *et al.*, 2010). Muzayen (2009) commenting on Ethiopia, revealed that "the income from non-timber forest products accounted for about 35 percent of the total household annual income aggregated across wealth categories". Results from a study carried out in Tanzania by Giliba *et al.* (2010) revealed that non-timber forest products have significant role, particularly contributing to fire wood (92 percent), fodder (63 percent) and bee keeping activities (40 percent), environmental goods and services (40 percent), construction materials and medicinal plants. This, they continued, indicated significant contribution in income and non-income poverty reduction and thus, provided ample incentive for sustainable forest management.

In a study by Anon (2000), he discovered 80 percent of the people in developing countries gather forest products for food and personal care and Andel (2006) maintained

that millions of people especially those living in rural areas in developing countries including Nigeria, collect these products daily. A lot of these people, according to Sale (2006) and Shomkegh *et al.* (2008) regard selling NTFPs as a means of earning a living. Throughout the world, millions of people make extensive use of biological products from the wild (Lawes *et al.*, 2004; Koziell and Saunders, 2001). Documented example by Timko *et al.* (2010) citing Fisher (2004) revealed that in Malawi, uncovered indications of high levels of dependence on forests for income, with sample households deriving approximately 30 percent of their incomes from forests, on average. Income from NTFP sales made a notable contribution to total incomes in Zimbabwe, comprising 35.4 percent of average total income per person in 1993/94 and 36.9 percent in 1996/97 (Cavendish, 2000). Recent research in Guinea by PROFOR (2007) also indicates that villagers derive up to 25 to 30 percent of their incomes from collecting and selling forest products. The above statistics based on the size of available forest cover is an impressive contribution of NTFPs to local economies of countries and an improvement of many household livelihoods (incomes). These resources were previously ignored but are attracting more attention in recent literature because they have been very important components of the forest, providing both income and contributing towards maintaining biodiversity.

In Ghana, the research findings are not different especially when the extraction of non-timber forest products in many rural communities is unavoidable. The extraction became necessary since most timber products are being exhausted. In forest fringe communities for example, settled primary activities stand in close proximity to forest resources in both reserved and non-reserved forests (Ardayfio-Schandorf *et al.*, 2007). Non-timber forest products have contributed in no small way to ensure that the lot of many forest dependent people is bettered. For instance, 86 percent of farmers in Sefwi-Wiawso

District depend on non-timber forest products for income, food and medicine (Ahenkan & Boon., 2008). Again, these products also play a significant role in providing nutrition, medicines, construction materials and forage for livestock to forest-dwelling peoples in many areas (Falconer, 1996). NTFPs accounted for about 6 percent of Gross Domestic Product and employed approximately two million people (Bank of Ghana, 2004). Furthermore, social benefits are provided through generating additional sources of income as well as helping to satisfy daily subsistence needs (Godoy and Bawa, 1993). It is also estimated that 20 to 25 percent of the economically active population in Ghana derives income from non-timber forest products (Ahenkan & Boon, 2010). This is particularly so when people, largely of the extractive occupations interact with their natural environment, with the aim of meeting their basic material needs of food, clothing and shelter (Chima *et al.,* 2012 citing Foli *et al.,* 1997). Additionally, Falconer (1992) reiterated that "for those who come face-to-face, without relief, with the harrowing experiences of ill-health, hunger and other forms of deprivation, the reality is the enormous contribution NTFPs in all their varied forms, make to all aspects of their lives".

In summary, non-timber forest products are an integral part of Ghanaian society livelihoods (Birikorang *et al.,* 2009) since they contribute to food, income, health, habitat and several other needs for people's survival.

2.6 Theoretical Perspective

This section aims at placing the study in a scholarly viewpoint by describing the theoretical foundation that guided it. Several theories and concepts have emerged to

explain forest cover dynamics. One such concept is Sustainable Forest Management (SFM) which was adopted and explained in the context of the current study.

It is undeniable that forests play a key role in economic development and survival of humankind. Forests undergo changes which is why an area once full of trees can become bare ground over some decades if nothing is done about the rate of tree loss and possible gain. In the heart of the debate on forest loss and possible gain is Sustainable Forest Management (SFM). The expression SFM is linked to the Forest Principles and Chapter 11 of Agenda 21 adopted at The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, and it has continued to evolve since then (FAO, n.d). SFM, according to the FAO is described as "a dynamic and evolving concept that aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations". In its simplest form, the concept can be described as seeking to strike a balance, that is, balance between society's increasing demands for forest resources (timber and non-timber products) and benefits, and the preservation of forest vitality and diversity. This balance is critical to the survival of forests, and to the prosperity of forest-dependent communities. By this description, it is evident that in the process of utilizing forests, key issues of sustainability, conservation and maintenance must be promoted.

The modern paradigm of SFM encompasses ecological (environmental), economic and socio-cultural components of management (Vierikko, 2010). Ecological issues comprise, among others, the survival of forest-dwelling species, ecological processes and the resiliency of ecosystem function whereas socio-cultural components denote internal forest ecosystem dynamics which are affected by abiotic and biotic factors and can be affected by external factors including human-caused disturbances (*ibid*.). Burton *et al.*

(2003) considered SFM from ecological, economic and social perspectives only leaving out the cultural dimension as noted by Vierikko (2010). SFM in totality as stressed by Pokem (2010) has several broad dimensions dealing with administrative, economic, legal, social, technical, environmental, cultural and spiritual aspects related to natural and planted forests for ensuring that the values derived from the forest meet present-day needs while at the same time ensuring their continued availability and contribution to long-term development needs.

SFM is beneficial in several ways to forest actors. One, Sustainable Forest Management curbs forest degradation and deforestation. Two, it increases direct benefits to people and the environment through sound policies and sustainable practices. At the local level, SFM contributes to peoples' livelihoods, income generation and employment (FAO, 2005). Sustainable forest management therefore involves planning the production of wood for commercial purposes as well as meeting local needs for fuel wood, poles, food, fodder and other purposes (FAO, 1993). In this respect, SFM can be considered as one of the most important contributions, which the forestry sector can make to the sustainable development objectives of any nation, particularly those richly endowed with forest (Pokem, 2010).

2.7 Conceptual framework

The conceptual framework for the subject matter of this study draws principally from the livelihoods framework adapted from CARE, an International non-governmental organisation, although detailed review of the DFID livelihood framework was also done to consider its suitability for this study. Livelihoods perspectives have been central to rural development thinking and practice in the past years (Scoones, 1998) and the CARE

Household Livelihood Security (HLS) framework as shown in Fig. 2.1 is one of many concepts used.

The CARE framework is derived from Chambers and Conway definition of household and livelihood. Household refers to a group of humans who share the same hearth for cooking while a livelihood comprises people, their capabilities and means of living (Chambers & Conway, 1991). A livelihood in their view also comprises the capabilities, assets and activities required for a means of living. The term capability has been used by Chambers and Conway (1991) citing Dreze and Sen (1989) to refer to being able to perform certain basic functionings, to what a person is capable of doing and being. It includes, for example, being adequately nourished, comfortably clothed, avoiding escapable morbidity and preventable mortality, leading a life without shame, being able to visit and entertain one's friends, keeping track of what is going on and what others are talking about. Assets, as used in the framework, are tangible (for example stores like food stocks, and resources such as land) and intangible (for example claims, which are, demands/appeals, and access like opportunity to use a resource) which provide material and social means. Activities are what the people do.

On the basis of the definition given by Chambers and Conway (1991), CARE simplified livelihood security to mean adequate and sustainable access to income and other resources to enable a household meet its basic needs (Frankenberger *et al.,* 2000). These needs consist of sufficient food, potable water, health facilities, shelter, and minimal levels of income, basic education opportunities and time for community participation. The main purposes of HLS concept are to understand the nature of livelihood strategies of different categories of households, their levels of livelihood security, and the principal constraints and opportunities (Frankenberger *et al.*, 2000). Households have access to

both tangible and intangible assets (capitals) that are held by a household for use or investment which allow them to meet their needs. Three types of assets (capitals) were identified by CARE, namely human capital, social capital and economic capital. Human capital consists of skills, knowledge, good health and the ability to labour. These are very essential for the pursuit of livelihood strategies.

Social capital is the quantity and quality of social resources (for instance networks, membership in groups, social relations and access to wider institutions in society) upon which people draw in their pursuit of livelihoods and as safety net mechanisms for meeting shortfalls in consumption needs. The quality of the networks is determined by the level of trust and shared norms that exist among network members. People use these networks to reduce risks, access services, protect themselves from deprivation and acquire information to lower transaction costs. On the other hand, economic capital is the productive resources and stores namely savings, credit, remittances, basic infrastructure which includes transport, shelter, energy, communications and water systems, production equipment and other means that enable people to pursue their livelihoods.

To determine whether or not households are successful in pursuing their livelihood strategies, it is important to look at a number of outcome measures that capture need or well-being satisfaction. Nutritional status is often considered one of the best outcome indicators for overall livelihood security. Other livelihood outcomes that should be measured according to the framework include sustained access to food, education, health, habitat, social network participation, physical safety, and environmental protection and life skills capacities.

Analysis of these outcomes should determine not only what needs are currently not being met but also trade-offs existing between needs and the relationships among these outcome measures (Frankenberger *et al.*, 2000). Some main principles of the approach were identified. One, livelihoods are about people, so livelihoods analysis is based on understanding how people make their living (Oxfam, 2002). Two, the approach recognizes that there are important differences among households in a given community, and among individuals who make up the household (*ibid*.). Differentiation may involve relative well-being or it may focus on issues such as gender, age or ethnicity. The approach enables outsiders to better appreciate these differences, and to design processes that can cope with complexity and diversity. Three, the approach encourages holistic analysis, with attention to identifying factors inside and outside households that have beneficial or negative impacts on livelihoods (*ibid.*).

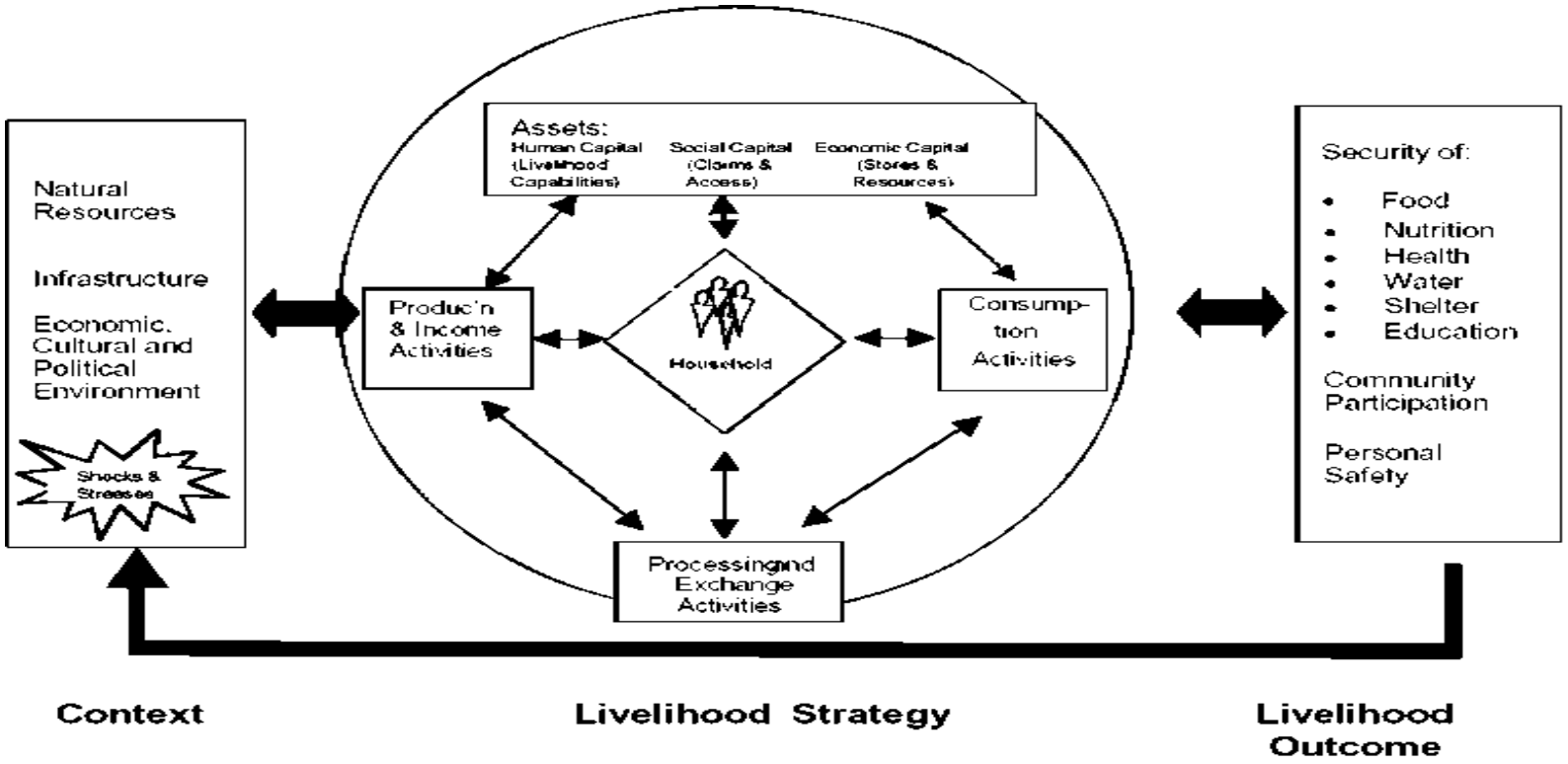

Figure 2.1: Household livelihood security framework

Source: CARE International (1996) adapted from Scoones (1998)

Several strengths of the framework were detected. Firstly, the framework is not too rigid (*ibid.*). There is freedom to concentrate on aspects within the framework that are particularly relevant and important to one's mission. The framework helps us to focus on particular aspects of a livelihood and make a real effort to understand what actually constrains livelihood opportunities (Oxfam, 2002). Again, it increases impact through improved understanding, targeting and use of resources (*ibid.*). This is possible when holistic analysis is done and interventions are effectively targeted. By understanding the realities of people's livelihood strategies and addressing their priorities, it becomes clearer which intervention is likely to have the greatest positive impact. This means that improved targeting of scarce resources can yield better benefits, for more people.

The CARE HLS framework, as adequate as it may seem, did not consider certain things. One of the weaknesses identified with the CARE framework is that it does not explicitly pinpoint 'transforming structures and processes' and places less emphasis on macro-micro links within the framework (Oxfam, 2002). Two, it does not consider the other two assets/capitals which are natural capital and physical capital as used in the DFID livelihood framework. Three, although both the CARE and DFID livelihood frameworks stress on the dynamic interconnections between all aspects of the framework, the former is more concerned with the household whereas the latter focuses mainly on vulnerability, institutions and processes, the poor and on people's strengths rather than needs and problems. Therefore, the CARE framework was chosen after careful consideration and adapted to adequately capture the objective of this study.

In the adapted framework as shown in Figure 2.2, land cover change which is an integral part of the study was incorporated. Also, natural capital and physical capital were added and seen as assets possessed by a household. In the study, much emphasis is laid on the

natural resources and natural capital herein referred to as the forest itself not exempting NTFPs. Natural capital consists of land, water, wildlife/livestock, trees, NTFPs and all other natural resources derived from the environment. They could be renewed or completely exhausted. Physical capital is seen as basic social amenities like shelter, energy, communications, production equipment and other means that enable people pursue their livelihoods.

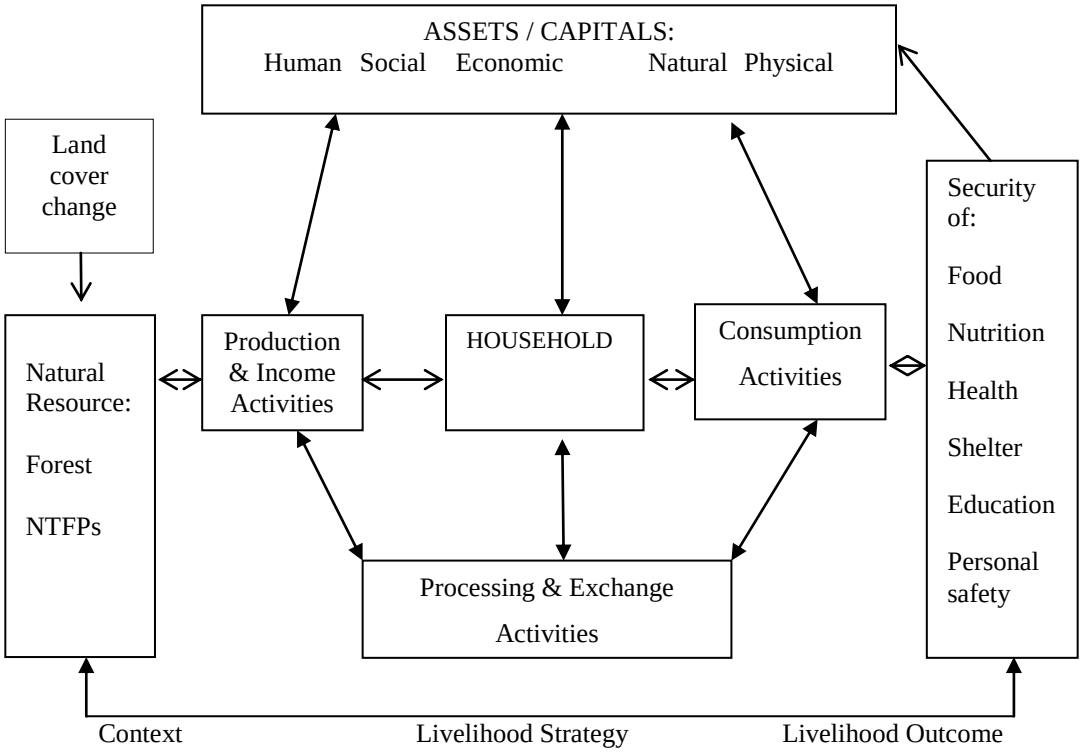

Figure 2.2: Adapted CARE livelihood framework

Source: Adapted from CARE (1996)

The study continued to look at 'assets' linking it to 'production and income activities'; 'consumption activities', 'processing and exchange activities' and their relevance on households. Outcome measure indicators such as food/nutrition, health, shelter, and education were also tackled. This study did not focus on cultural and political

environment or community participation as well as shocks and stresses as part of 'context'.

In conclusion, the adapted livelihood framework as used in this study is a tool in improving how people understand what livelihood in general entails.

2.8 Summary

This chapter reviewed related literature and looked at the theoretical and conceptual frameworks adopted for the study. The chapter began with an introduction. It then continued with reviewing literature around a number of themes including global trends in land cover change, defining NTFPs, rural livelihoods, and the significance of NTFPs on livelihoods and national economies. The sixth and seventh sections were devoted to the theoretical perspective and conceptual framework adapted for the study. The study reviewed the concept of Sustainable Forest Management and the livelihood framework adapted from Scoones (1998). The framework was generally described with its purposes, principles, advantages and disadvantages. The next chapter deals with thorough literature on the study area.

CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.1 Introduction

This chapter consists of two sub-sections. The first part entails detailed discussion on the biophysical and socio-demographic characteristics of the study area. This contributes to an understanding of some issues that will be discussed in subsequent chapters. The second part of this chapter covers issues on methodology that was used for the study.

3.2 Study Area

3.2.1 Location and size

The Birim Central Municipal is one of the 26 administrative districts in the Eastern Region of southern Ghana. It is bordered to the east by the Lake Volta, to the north by the Brong Ahafo and the Ashanti regions, to the west by the Ashanti region, and the Central and the Greater Accra regions to the south. The Birim Central Municipal Assembly was one of the newly created districts in 2008 established under L.I 1863. The municipality shares boundaries with Akyemansa and Denkyembour districts to the north; Birim South District to the south; to the east with West Akyem Municipal and to the west with Assin North Municipal. The total land surface area is estimated to be 1,090 km^2 (420 sq. mi) constituting about 3 percent of the total land area of the Eastern Region. The municipality's total population was 144,869 per the 2010 population and housing census (Ghana Statistical Service, 2010) with 69,304 males and 75,565 females. The municipal capital is Akyem Oda.

The legislative structure of the assembly is made up of 60 assembly members, of which 40 are elected and 20 are government appointees. The assembly has 7 urban/area/town

councils namely Akyem Oda, Akyem Asene, Akyem Aboabo, Akyem Akroso, among others. There are a total of 150 communities in the district, out of which three communities, namely Akyem Oda, Akyem Asene and Akyem Aboabo, were purposefully chosen for the study because forests in these areas were being tampered with greatly. Akyem Oda municipal market was also selected.

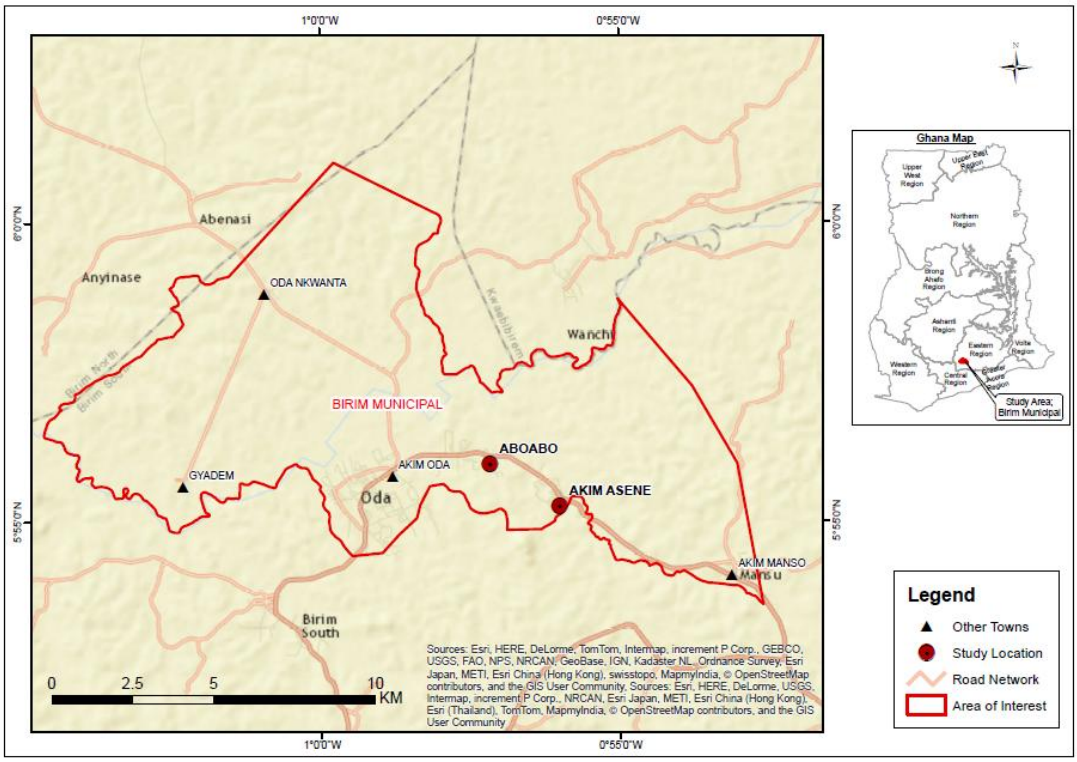

Figure 3.1: Map of study area

Source: Author's Construct using ArcGIS (2014)

3.2.2 Physical Features

3.2.2.1 Climate

The municipality falls within the wet semi-equatorial climatic zone. It experiences substantial amount of precipitation rainfall with total annual rainfall ranging between 150cm and 200cm reaching its maximum during the two peak periods of May-June and

September-October. This promotes farming activities within these two periods that is May-June and September-October. Relative humidity is about 56 percent during the dry season and 70 percent in the raining season. Atmospheric temperature ranges between 25.2˚C and 27.5˚C; hence creating a relatively good atmosphere for socio-economic activities like trade and farming in dry season and rainy season respectively (BCMA, 2010).

The basic requirement of temperature, rainfall, sunshine and other weather/climatic elements by plants for growth and development is very much important. Erratic atmospheric conditions negatively affect plants, of which NTFPs are part, hence their relevance in this study cannot be overemphasized.

3.2.2.2 Vegetation and Soil

According to Bih (2006), Ghana has three principal land cover types, namely coastal savannah, northern savannah and forest. The southern third of the country (including the area along the Akwapim-Togo Ranges) is predominantly covered with evergreen and tropical semi-deciduous forest. This area is also referred to as the high forest zone. There are tall trees of varying heights forming a closed canopy at the top, above which tower a few giant trees. The evergreen forest is in the extreme south-west while the semi-deciduous forest covers farther north.

The Birim Central Municipality falls within the semi-deciduous rain forest region of Ghana experiencing high rainfall for crop cultivation and human use. The vegetation is mainly characterized by tall trees with evergreen undergrowth and abounds in economic trees. Most of the larger trees namely *Triplochition scleroxylon* (Wawa), *Antiaris africana* (Kyenkyen), *Chlorophora excelsa* (Odum) and *Ceiba pentandra* (Onyina) are

now few and stand as scattered emergent. The municipality is endowed with well-managed forest reserves that are resourceful in the requisite flora and fauna, which are basic to the development of attractive wildlife sanctuaries and parks. The following are the major forest reserves in the Municipality: Bemu Block 19.6 square km, Bemu Block 1,113.18 square km, Bemu Block 11,120.90 square km, Birim 39.29 square km, Birim Extension 21.48 square km, Esen Epam 45.19 square km, Esuboni 26.70 square km and Pra-Birim North 14.34 square km (BCMA, 2010). Aside the reserved areas, there are also off-reserve areas characterized by minor vegetation. In both the reserve and off-reserve forests, resources other than timber are found. These resources are classified as NTFPs. Human activities such as poor farming practices, lumbering (especially chain saw and firewood operations), mining, and construction works have had negative impact on the vegetation over the years resulting in scattered parcels of secondary forest (BCMA, 2010).

The major soil of the municipality are: greyish brown loaming soils overlying red clay soils that occur at lower elevations of sloping hills which supports tree and arable crops especially cocoa farming (BCMA, 2010). Grey alluvial sand of thin layers and coarse sandy to fine gravelly topsoil and red coarse sandy subsoil support dry season vegetables, sweet potato, sugar cane and rice cultivation; red soil developed over lower Birimian rocks and silty dry loamy soils which occupy fairly - extensive flat lands adjacent to streams and rivers. Both features have the potential for cocoa, coffee, citrus, oil palm, avocado pear, mangoes, banana and mechanized rice irrigation farming and very deep pale brown or yellowish brown fine sand capable of supporting nurseries and vegetable production.

Passioura (2002) argues that "plants can respond to soil conditions in ways that cannot readily be explained". It follows that type and quantity of plants, for that matter NTFPs, found in a place will therefore depend on soil type and also vegetation cover.

3.2.2.3 Relief and Drainage

The topography of the Birim Central Municipality is mostly undulating and hilly, consisting of lava flows and schist. The underlying rock formation is mainly made up of the Upper Birimian rocks. They consist of inter-layered sedimentary and volcanic flow rocks metamorphosed to low green-schist facies (BCMA, 2010).

The municipality is drained by the Birim River and its major tributaries which in some cases rise to 61 metres above sea level. Most rivers draining the Birimian rocks hold alluvial gold deposits. The river rises in the east of the Atewa Range, flows north through the gap between this range and the Kwahu Plateau, then runs roughly south-west until it joins the Pra (BCMA, 2010).

Environmental factors like rainfall, temperature, soil, topography and drainage influence plant (including NTFPs') growth and development (Bareja, 2011). When growth and development of NTFPs is interfered with, it can either positively or negatively affect people in communities within the catchment area who depend on such NTFPs.

3.2.3 Demographic Characteristics

The population of the municipality was projected at 144,869 people (based on MPCU, 2009) with growth rate of 2.4 percent annually. Male population was estimated at 48.6 percent whereas the female population was estimated at 51.4 percent (74, 630 women) of the total population. The population is concentrated in about 5 communities while only 4 out of the 150 settlements are urban (CWSA, 2000; Ghana Statistical Service, 2010).

3.2.4 Economy of the municipality and livelihood activities

The Municipality, especially the capital Akyem Oda, is linked up with many districts. This promotes commercial activities among the district capitals and other nearby communities. About 50.6 percent of the total population is engaged in agriculture (BCMA, 2010). Major activities are food crop farming and livestock production. Factors which enhance agriculture production include the municipality's close proximity to River Birim, which is viable for irrigation farming, suitability of soil for large-scale food and cash crop farming.

The local markets play a vital role as far as agriculture produce and other consumer items are concerned. The municipality has markets located in the capital Akyem Oda, Akroso, Manso, Nkwanta, Akyem Asene, among others. Even though there are special market days in these towns, some of them operate on a daily basis in addition. Many items sold are derived from the natural environment. Some of these items are snails, mushrooms, canes, prekese, and medicinals, among several others.

3.2.5 Health Issues

In addition to orthodox health institutions, there are Traditional Herbal Practitioners (THPs) who contribute towards the health needs of the people in one way or the other (BCMA, 2010). The activities of THPs are made even more possible due to their close proximity to the forests where medicinal plant parts like barks, roots, leaves, and so on are easily extracted. Some medicinal plants are considered NTFPs and their role in preventive and curative healthcare cannot be overemphasized (Ahenkan & Boon, 2011).

The biophysical characteristics of the study area in effect make the study feasible.

3.3 Research Methodology

3.3.1 Philosophical Consideration

Research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used (Carr, 2006). Two broad methodologies exist for a research's philosophical consideration - ontology and epistemology. The term ontology is used philosophically to deal with the nature and structure of reality (Guarino *et al*., 2009) as opposed to epistemology which is the study of scientific knowledge from a critical point of view (Tennis, 2008). To this effect, the purpose of research is to transform the thing 'believed' to be in existence into things 'known' epistemic (Keller, 2006). A number of authors including Hussey and Hussey (1997) and Stern (2004) have argued that, two dominant traditional philosophies have widely been used in this instance. These are positivism and interpretivism and they are opposite of each other.

Positivist approach to research is based on knowledge gained from 'positive' verification of observable experience rather than introspection or intuition (Nightingale, 2012). The basic notion of positivism approach is to develop methods of social enquiry which are embedded within the frame of the natural sciences (Stern, 2004). Positivism maintain a clear distinction between science and personal experiences; fact and value judgement. Hence, in the study of people, it draws from the theoretical tools and methods of the natural sciences in order to measure facts objectively.

Positivism is then a framework through which human conditions are explained in an objective, value free and scientific process (Kura, 2012). It seeks objectivity and depends on the use of consistently rational and logical approach. Positivism believe that the world is external (Lin, 1998). Thus, it uses a controlled and structural approach in carrying out

research by identifying a clear research topic, construction of appropriate hypotheses and choosing an appropriate research methodology (Carr, 2006). The research builds on the philosophy of positivism and therefore takes the philosophical attitude of the natural scientist. The research worked with an observable social reality and that end product of such research can be law-like generations similar to those produced by the natural sciences. The reason underlying the selection of positivism approach is to help find cause and effect relation. The study observes reality and collects the facts. This makes it easy to portray patterns and regularities in realities and therefore can lead to general conclusions. However, human beings have individual feeling and actions than the study of objective which can be regulated by the natural scientist.

Hence, interpretivism, epistemic and ontological stances on the other hand believe that knowledge can be created by understanding individual actors (Goldkuhl, 2012). The position of interpretivism philosophical idea rests on the belief that reality is multiple and relative (Kura, 2012). According to Denzin and Lincoln (2011), these multiple realities also depend on other systems for meanings, which make it difficult to interpret in terms of fixed realities. Knowledge is derived from socially constructed mode rather than objectively determined and perceived way (Goldkuhl, 2012).

Interpretivism uses personal and flexible research structures which help in capturing meanings in human interaction and make sense of what is perceived as reality (Creswell & Plano Clark, 2007). With this philosophical idea, the researcher and his informants are interdependent and mutually interactive (Flowers, 2009). The interpretivist researcher enters the field with some sort of prior insight of the research context but assumes that this is insufficient in developing a fixed research design due to complex, multiple and unpredictable nature of what is perceived as reality (Lin, 1998). The researcher remains

open to new knowledge throughout the study and lets it develop with the help of informants. This is because humans have the ability to adapt, and that no one can gain prior knowledge of time and context bound social realities (Flowers, 2009). Important to this philosophical idea is the need to understand motives, meanings, reasons and other subjective experiences which are time and context bound (Carr, 2006).

From the preceding discussion on the two philosophical ideas, the study considers neither positivism nor interpretivism philosophies. Instead it adopted the pragmatic worldview which underpins the mixed methods, a philosophy Creswell and Plano Clark (2007) described as the "third methodological movement". This technique was adopted because the goal of the study was not only to quantify the effect of forest cover change on NTFPs but to also find out how people go about utilising these resources to improve their living standards which can only be understood from the people's experiences. The mixed methods, a strategy which integrates both quantitative (questionnaires) and qualitative (semi-structured interviews) methods and makes statistical and text analysis possible, was adopted in order to cross-validate one method against the other. "Thus, for the mixed methods researcher, pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis" (Creswell, 2014).

3.3.2 Research Design

Research design is the logical sequence that connects the empirical data to a study's initial research questions and ultimately to its conclusions. The research design the study employed was the cross-sectional or social survey design. Cross-sectional design entails the collection of data on more than one case and at a single point in time in order to

collect a body of quantitative data in connection with two or more variables which are examined to detect patterns of association. It involves the use of survey instruments such as self-administered questionnaire or semi-structured interview schedule. It is good for determining variation, patterns of associations, and may indicate causation by examining relationships between variables. The study looked at many variables at the same time hence the cross-sectional design was adopted.

3.3.3 Research Strategy

The research strategy adopted was the mixed methods. Mixed methods is a broad orientation to social research with the distinction between quantitative and qualitative strategies (Creswell, 2014). Mixed methods, according to Teye (2012) citing Bazeley (2004) is used in situations where both quantitative and qualitative methods are combined in a single research in order to cross-validate one method against the other. Specifically, the concurrent-explanatory strategy of the mixed methods was used. This strategy made it possible to gather the qualitative data alongside the quantitative data in order to get an in-depth opinion from participants.

3.3.4 Research Methods

Research methods are the tools used to collect data (Dawson, 2002). Data collected were from both primary and secondary sources. Quantitative as well as qualitative data were gathered by the help of questionnaires and semi-structured interviews.

3.3.4.1 Primary data source

For the primary source, self-administered questionnaires in both closed and opened forms and semi-structured interviews were used to gather quantitative and qualitative data on demographic (gender, age), size of household and socio-economic data of the

household heads and related issues. While close ended questionnaires have pre-written responses for respondents to choose from, open ended questionnaires allow respondents to answer in their own words (Dawson, 2002). This way, it is possible to determine how many people use NTFPs and what they think of NTFPs on the same form.

3.3.4.2 Secondary data source

To supplement primary data, secondary data and information from secondary sources including articles, journals, periodicals and text books about forests, NTFPs, livelihoods, and some other associated topics in the study were sourced from libraries and internet and included. Remote sensing data of old and current satellite images from LandSat TM (Thematic map) for the years 1991, 2002 and 2013 was also incorporated.

3.3.5 Sample Size

For quantitative studies, large sample sizes are required for quantification to be possible (Dawson, 2002; Teye, 2012 citing Bazeley, 2004) and also to ensure fair representations of populations in the study (Teye, 2012; Kumekpor, 2002). Considering the nature of the research objectives spelt out for the study, a total of 200 questionnaires was administered but only 140 was recovered from household respondents from the two communities of Akyem Asene and Akyem Aboabo. This comprised 70 heads of households in each community. In situations where the household head was not available, an adult member not less than 18 years was chosen. From the third community, Akyem Oda, 15 respondents who engaged in the sales of NTFPs in the municipality's biggest market were chosen. This was done only after the purpose of the study was explained to them and those willing to assist were given questionnaires to fill for a market survey.

Another 10 respondents were purposively selected from the communities for semi-structured interviews. Interviews as noted by Teye (2012) do not require large sample sizes as emphasis is placed on process and meaning. Semi-structured interview was used to gather qualitative data. In this type of interview, specific information that can be compared and contrasted with information gained from other sources (Dawson, 2002) was gathered. From a total of 10 respondents purposively selected for the qualitative research, one opinion leader each from the two communities was selected for interviews while 2 experts (1, a senior officer in the FSD office and the other, a junior officer called forest guard/range supervisor) from the municipal FSD of Forestry Commission were consulted for technical assistance as well. The forest officer normally works in the FSD offices and was therefore selected to source theoretical information while the forest guard is stationed in the forest and knows what actually happens on the ground. Other stakeholders interviewed during the field work included a respondent from the municipal planning office, a chainsaw operator, a timber merchant, a sawmill worker with considerable level of experience of the job, a small scale miner (an occupation popularly known as “galamsey”) and a farmer. Table 3.1 summarizes the number of stakeholders interviewed.

Table 3.1: Stakeholders and number of semi-structured interviews conducted

Stakeholders	Number Interviewed
Opinion leaders	2
Forest officer	1
Forest guard	1
Municipal planning office	1
Chain saw operator	1
Timber merchant	1
Sawmill worker	1
Small scale miner	1
Farmer	1
Total	**10**

Source: Author's construct (2014)

A total of 165 respondents were involved in the gathering of both quantitative and qualitative data.

3.3.6 Sampling Technique

In order to achieve objectives two and four, which are to identify the characteristics of households that relied on NTFPs for domestic use and trade and assess the role of NTFPs in supplementary income generation and regular source of income respectively, a mixture of sampling techniques was adopted. Dawson (2002) stated that it is possible to use a mixture of sampling techniques within one research which may help to overcome some of the disadvantages found within different sampling procedures. For this reason, the sampling technique adopted for this study is multi-stage sampling. It involved three

main stages. In Stage 1, Purposive sampling was used in choosing 2 communities from the district since it was practically impossible to include all communities due to time and financial constraints. In Stage 2, Systematic sampling was used in choosing households within the 2 communities. This was so because not every household engaged in NTFP activities. Nevertheless, few households that did not depend on NTFPs were also included. In Stage 3, the simple random sampling technique was used to select a household head or 1 respondent above the age of 18 years in each household for the study. This was to ensure each respondent in a household was given an equal chance of being included or excluded in the sample (Kumekpor, 2002).

With objective three, which basically is a market survey, explanation on the purpose of the study was given and traders were chosen at random and those who co-operated were interviewed.

3.3.7. Methods of Data Analysis

Both qualitative and quantitative methods were employed to analyse the data which was gathered.

3.3.7.1 Quantitative data analysis

Quantitatively, descriptive statistical tools including mean, frequencies and percentages of both Ms Excel and Statistical Package for Social Sciences (SPSS) software version 16.0 were used. In addition, inferential statistical tools of the SPSS package consisting of chi-square, cross-tabulation, multinomial regression among others were used to test for relationships among certain variables. These were later used to generate tables and various statistical diagrams to give good visual impression of the data.

3.3.7.2 Qualitative data analysis

The qualitative data on the other hand was analysed by the use of content analysis which refers to the way in which the particular meanings expressed by an object can be discerned and concluded (Gomez and Jones, 2010). That is, drawing systematic conclusions from the semi-structured interviews with the respondents. Additionally, aggregate responses from the interviews which constituted part of qualitative data were coded in themes and analysed manually.

3.3.7.3 Satellite Image Processing

Remote sensing was employed to map land cover transformations over the period 1991-2013 to know the implications of forest cover/loss to NTFPs production. The tools used for this analysis include ENVI 5.0, ArcMap 10.2 and Google Earth. The analysis entailed the use of LandSat data for 1991, 2002 and 2013. The satellite images acquired to know the possible land cover types in the area were geo-referenced using the Ghana Coordinate System. The BCM was digitised in Google Earth and exported to ArcMap to be converted from KML to shape file. This was used as a sub setting polygon. The images were then subsetted with the Birim Central area polygon. The subsetted image was then taken through pre-processing, supervised classification and accuracy assessment in which four classes were obtained. These classes included forest, vegetation/degraded areas, water and bare land. The classified images were then masked to produce an image bordered by the municipality area polygon. The trend of change in the various classes was ascertained by using the change detection tool in ENVI 5.0. This was done because the study also aimed at delineating the possible land cover types in the area and how they are changing. The images were analysed using ArcGIS software to determine the change detection of the forest cover which enabled easy comparison of the

extent of forest cover/loss by visual interpretation of the images. Also, quantitative analyses of these images were done to derive, in hectares, the area of forest cover/loss over the respective years.

To observe the trend of change in forest cover for 1991, 2002 and 2013, bands 5, 4 and 3 of ENVI 5.0 were calibrated to reflectance and stacked. Table 3.2 show the various forest cover types that was delineated.

Table 3.2: Meaning of forest cover types in satellite images using ENVI 5.0

Forest cover type	Explanation
Water body	Any significant accumulation of water. Example is R. Birim
Built-up & bare land	Land on which buildings are present & land without buildings or vegetation
Agriculture	A cultivated land
Shrub thicket	Woody plants less than twenty feet tall with thick undergrowth
Forest & woodland	Area of land covered with tall trees

3.3.8 Summary

The first part of this chapter was dedicated to detailed literature on the study area that will help in better understanding of the study as a whole. The second part discussed the data collection methods adopted under the following themes: the philosophical consideration that guided the study, the research design and strategy, data sources, sampling technique, sample size, and finally, analysis of quantitative and qualitative data not leaving out processing of satellite images obtained. Analysis and presentation of results is done in the next chapter.

CHAPTER FOUR

STUDY RESULTS

4.1 Introduction

Shamoo and Resnik (2003) perceived analysis of data "provide a way of drawing inductive inferences from data and distinguishing the signal (the phenomenon of interest) from the noise (statistical fluctuations) present in the data". The first part of this chapter is a report on results of satellite images processed. It is followed by data analysis and subsequent presentation of results of questionnaires administered to respondents in the Akyem Oda market, Akyem Asene and Akyem Aboabo townships. Semi-structured interviews conducted for stakeholders concerned were also analysed and results presented.

4.2 Land cover change using remote sensing/GIS

The image 4.1 below showed satellite image for the study area for the year 1991. The detailed area in hectares is spelt out. From the captured satellite image of land cover in the northern portion of the BCM in 1991, total land area was 13,530.24 hectares in all. The satellite image was then categorised into water body (dark blue colouration) covering approximately 306.49 hectares or 2.3 percent of the total surface area, built-up and bare land (grey colouration) making up 360.67 hectares or 2.7 percent, agriculture/cultivated land (light green colouration) constituting 1164.46 hectares or 8.5 percent, shrub thicket 2,246.53 hectares or 16.5 percent and natural forest and woodland (dark green colouration in images) covering area of approximately 9,452.11 hectares representing 69.8 percent of the total land area as seen in Image 4.1.

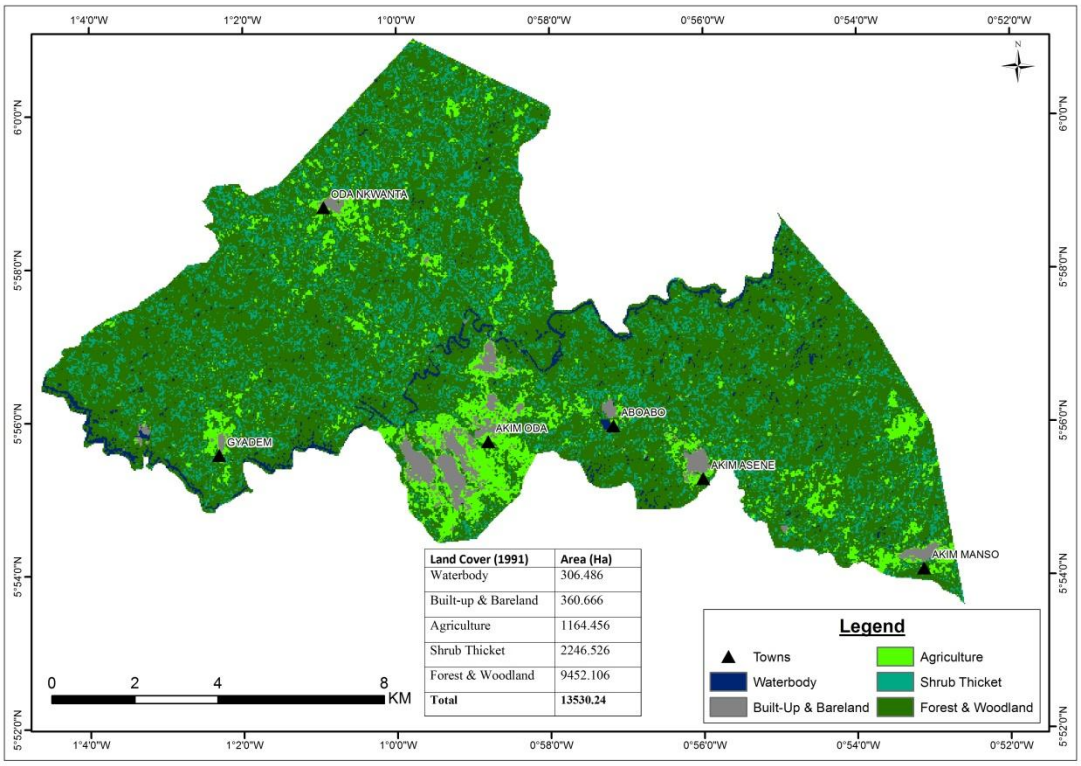

Image 4.1: Classified image of study area in the year 1991

From the above, it is clearly seen that a greater proportion of the total land area was until then covered by pristine forests. This was not so for the subsequent year, 2002, as highlighted in Image 4.2.

Compared to 1991, all classes of land cover except forest and woodland experienced percentage increment and expansion in their various land sizes as quantitatively computed for the year 2002. Within this year, water body made up 2.4 percent, built up and bare land 4.9 percent, agriculture 17.4 percent, shrub thicket 17.9 percent and forest and woodland 57.4 percent of total land area.

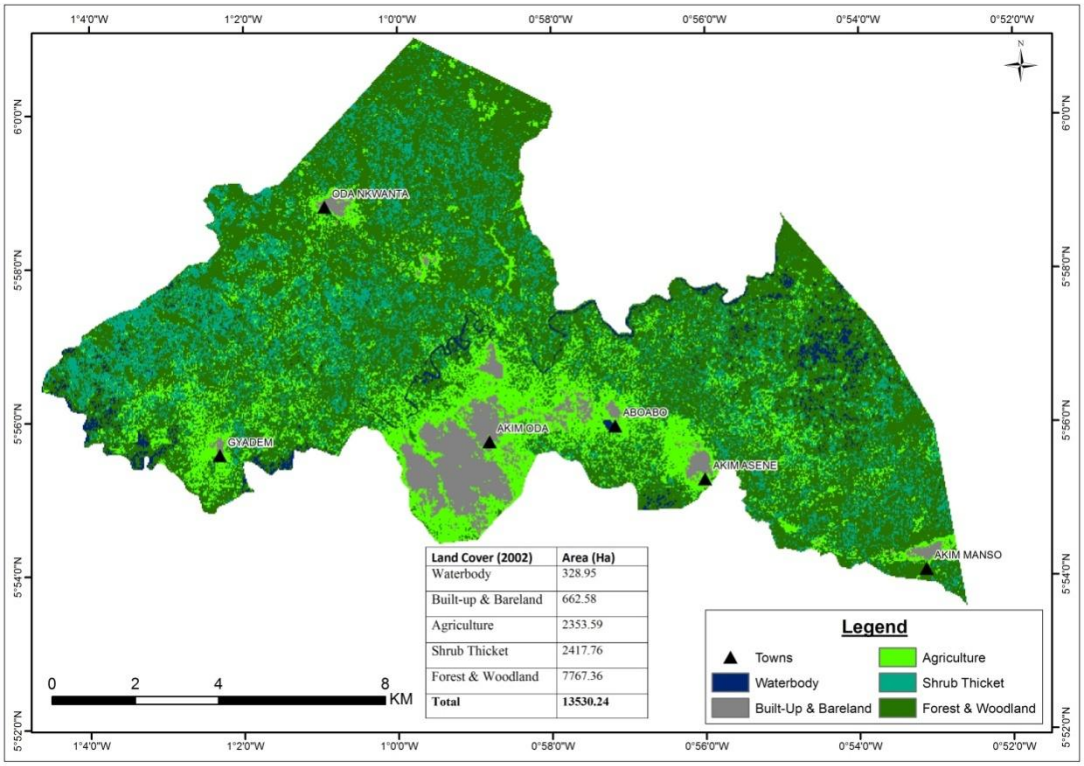

Image 4.2: Classified image of study area in the year 2002

Percentage changes between 1991 and 2002 in land cover among the four classes excluding water body were also calculated. Built-up and bare land environment, for instance, recorded an increase, covering an area of about 662.58 hectares. This figure shows 83.7 percent increase upon the 1991 land area. Agriculture and cultivated areas on the other hand expanded to 2,352.59 hectares constituting 102.1 percent over 1991 records whereas land size for shrub thicket enlarged to 2,417.76 hectares or just 7.6 percent over 1991 total which was 2,246.53 hectares.

The natural forest and woodland or dark green colouration in the captured satellite image 4.2 shows a decline from 69.8 percent total land cover in 1991 to 57.4 percent of total land cover in 2002. Thus there was a shrink in the dominance of the dark green

colouration denoting forest and woodland decreasing from 9,452.11 hectares in 1991 to 7,767.36 hectares in 2002 across the entire land area.

A critical analysis of land cover in 2013 (as shown in Image 4.3) even indicated further decline in forest cover in BCM.

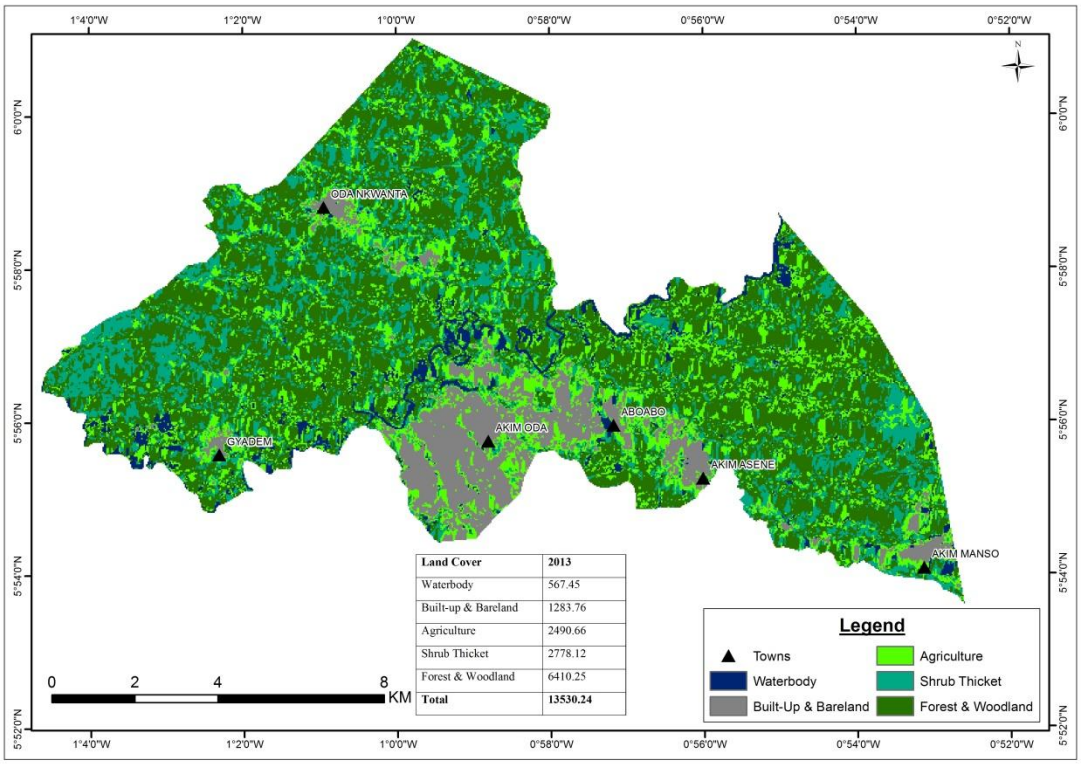

Image 4.3: Classified image of study area in the year 2013

Classified image of the study area in 2013 revealed more built-up areas and bare lands were distributed across the whole study area accounting for 1,283.76 hectares, which was 9.5 percent. Agricultural land size rose to 2,490.66 hectares or 18.4 percent and shrub thicket increased to some 2,778.12 hectares or 20.5 percent of total land area. Forest and woodland on the other covered 6,410.25 hectares or 47.4 percent of the total land area (Image 4.3).

Percentage changes between 2002 and 2013 in land cover among four classes excluding water body gave the following outcomes: built up and bare land 93.7 percent, agriculture 5.8 percent, shrub thicket 14.9 percent, a decrease in forest and woodland by 17.5 percent. Natural forest and woodland cover in the study area continued to show a marked decrease not only between 1991-2002 totalling a loss of 1,684.75 hectares or 17.8 percent but also between 2002-2013 accounting for about 17.5 percent or 1,357.11 hectares forest loss. Annual rate of change equalled 1.5 percent.

4.3 Land cover change detection from the views of respondents in the study area

In addition to remote sensing/GIS data analysed, the study sought the views of key informants on whether land cover was changing and what human activities were responsible for the changes. This was done to buttress objective one under 1.5 above and Figure 4.1 below shows responses provided. Out of the total number of stakeholders interviewed, 30 percent strongly agreed that illegal logging was the major cause of deforestation in the BCM. Another 20 percent attributed the problem to the unlawful revisions of harvesting schedules by the FC to the extent that immature trees were felled. 15 percent mentioned slash and burn farming methods/agriculture, 10 percent attributed deforestation to small scale mining, 10 percent cited over-extraction of firewood and remaining 15 percent mentioned prevailing weather conditions and development in infrastructure as contributing factors.

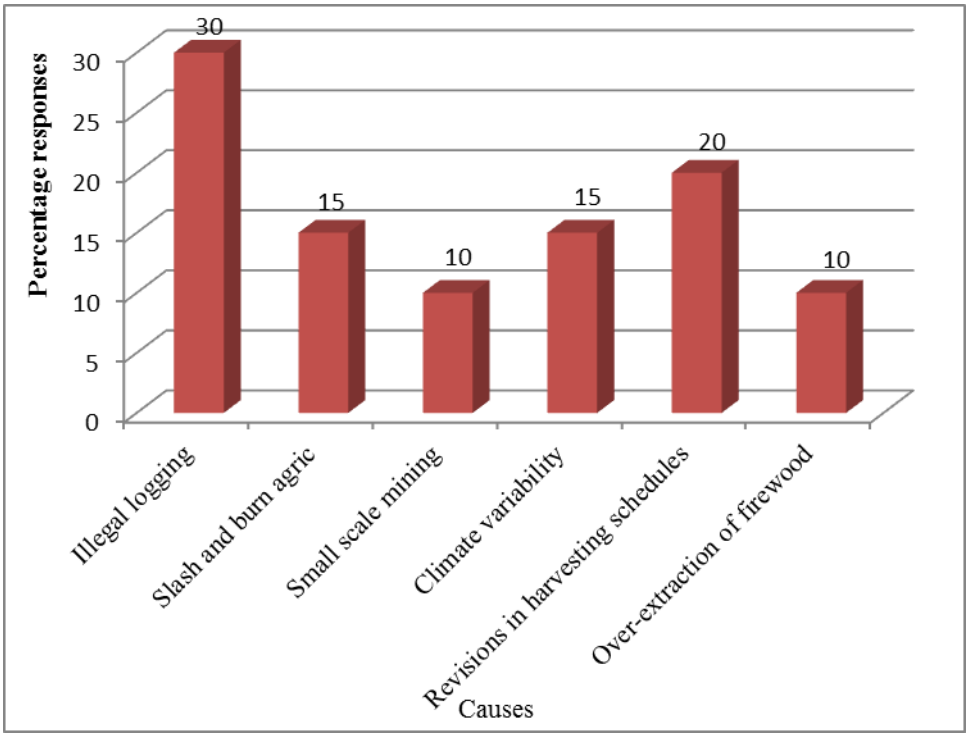

Figure 4.1: Causes of deforestation in BCM

Source: Field Data (2014)

Careful examinations of both the maps and stakeholder interviews showed the constant decline in forest and woodland cover in the BCM over the past 22 years.

4.4 Socio-economic characteristics of NTFP collectors and traders

This sub-section dealt with analysis of characteristics of households that relied on NTFPs by the questionnaires administered to respondents in the Municipality's biggest market and the two communities. The results were outlined in connection with the second research objective of the study. This was to identify the characteristics of households that relied on NTFPs for domestic use and trade as indicated in Chapter 1 (1.5). Frequency and percentage distribution tables, charts and graphs were the main descriptive statistics used in this study. Inferential statistics such as chi-square tests and multinomial regression were used to show relations among some variables. Data about the age and

gender of household heads, their level of education, household size, marital status, and natives as against non-natives were taken from the communities of Akyem Asene and Akyem Aboabo. This data which showed certain similarities and disparities as illustrated below was needed to understand types of households that relied on collection and trade of NTFPs for their livelihoods.

4.4.1 Age of NTFP collectors

One of the household characteristics chosen was age of NTFP collectors. The average age for collecting NTFPs in the two communities was identified as 41.4 years with a minimum age of 24 years and maximum of 55 years.

4.4.2 Gender of household head, level of education, marital status and household size

The study adopted the multinomial logistic regression analysis to statistically ascertain whether household characteristics such as gender of household head, level of education, marital status and household size were significant determinants of occupation, particularly NTFP occupation in each of the two communities. In other words, the study sought to investigate whether knowledge of gender of household head, level of education, marital status and household size could help to predict the kind of occupation that prevailed in a household. The multinomial logistic regression is deemed the most ideal for this analysis as the outcome variable or dependent variable is nominal with more than two levels. The variable NTFP collection was used as the reference category for the dependent variable (occupation).

In this analysis, occupation (which is a nominal variable has four levels, that is, Wage work, Farming, NTFP collection and Others) is the outcome or dependent variable

whereas gender of household head, level of education, marital status and household size were set as independent or predictor variables.

The multinomial logistic regression equation is of the form:

Occupation = B_0 + B_1*Household size + B_2*Level of education + B_3*Gender of household head + B_4*Marital status

The results of the analysis are presented in Table 4.3, and additional Tables 2a, 2b and 2c in Appendix Four.

Table 4.1 contains an omnibus Log likelihood Ratio (LR) chi-square test which attempts to determine whether the model being tested (that is, the model stated above) is significant or not for each community. From the table, the model returns a LR chi-square value of 17.674, $p > 0.05$ for Akyem Asene and 55.299 $p < 0.05$ for Akyem Aboabo. What this means is that the model is not significant for Akyem Asene but significant for Akyem Aboabo.

Table 2a provided the explanatory power of the model. The Cox and Snell Pseudo R-square associated with the model for Akyem Aboabo is 0.627 (62.7%) which means that the model helped to predict the occupation in a given household by a margin of over 60.0%. The Likelihood Ratio tests of Table 2b gave the specific variables in the model that are significant.

Table 2c offered the parameter estimates for the model. It presents the estimated co-efficients (under column labeled B), the corresponding Wald statistic and their significant probabilities (that is, p-values, under the column labeled Sig.) as well as the

exponent of the co-efficients [Exp (B)]. All the co-efficients that have p-values that is greater than 0.05 are not significant at the 5% significance level.

As noted earlier, the reference category for the dependent variable is NTFP collection. For this reason, each interpretation is made with reference to NTFP collection.

Table 4.1: Model fitting information

Community Name	Model	Model Fitting Criteria	Likelihood Ratio Tests		
		-2 Log Likelihood	Chi-Square	df	Sig.
Akyem Asene	Intercept Only	35.980			
	Final	18.306	17.674	12	.126
Akyem Aboabo	Intercept Only	122.755			
	Final	67.456	55.299	18	.000

Source: Fieldwork, 2014

4.5 Factors that affect NTFP activities in the BCM

4.5.1 Types and availability of NTFPs

Various types of NTFPs are available in the BCM. Respondents were asked to list five NTFPs they engaged in. Commonest, most abundant and most important NTFPs available in each of the two communities within the municipality were determined by number of times they were mentioned by respondents in the questionnaires administered as well as the NTFP's relevance to households for income or subsistence. The availability of the following non-timber forest products (as shown in the Table 4.4 below) in the district was thus ascertained. The results indicated that many of these

products can be found in substantial quantities in the two study communities and all were harvested on condition that they were available for meeting one need or another.

A list of NTFPs in order of number of times they were mentioned which was verified by the FSD is provided below.

Table 4.2: Inventory of some NTFPs found in the study area

Types of NTFPs	Availability in Akyem Asene	Availability in Akyem Aboabo
Firewood	A	A
Snails	A	A
Mushrooms	A	A
Charcoal	A	B
Bushmeat	A	A
Medicinals (Tree barks, roots, leaf, etc)	A	A
Canes	A	B
Bamboo	A	B
Nkontomire	A	A
Abeduru	A	A
Wild yams	A	A
Wild fruits	A	A
Wooden handles for equipment	A	A
Vines/Twines	A	A
Sponges	B	B
Ginger	A	A
Spices (sorowisa, femsiwa, hwintia, awerewa, etc)	A	A
Prekese	A	B
Akokun	A	B
Honey	A	B
Palmwine	A	B

Chewing stick	A	A
Wrapping leaves	A	A
Nuts	A	B
Light construction materials	A	A

Source: Fieldwork, 2014

Key: ***A***---*Very abundant* ***B***---*Not abundant*

From the list of NTFPs provided above, two of the NTFPs as seen in Plates 4.1 and 4.2 were of major importance for household consumption and economic use to the people of the study area. NTFPs such as canes, bamboos, prekese, and nuts were very abundant in Akyem Asene and were easily accessed by people. Stacks of firewood were seen in almost all houses entered in the two communities and also in portions of the forest visited during the field work. Some stacks of firewood were also piled along the main road for onward transportation to their final destinations while some were being loaded onto trucks. In parts of the forest too, several large tree trunks were being cut, tied and heaped. There is ready market for firewood in rural as well as urban centres and among NTFPs found in the study area; firewood is the most important source of income.

Plate 4.1: ***Firewood packed in the forest for onward transportation to the market. Firewood is of much importance among NTFPs for commercial use.***

Aside firewood, the importance of bamboos within the study area cannot be underrated. Many bamboo clumps were seen along the River Birim and around streams. Bamboos were harvested for construction purposes or erected as poles on which television antennae were fixed. While some people also collected and sold them as raw material to the local craft industry, others used them for pieces of household furniture, example chairs. Fences were also made from bamboo sticks.

Plate 4.2*: One of the many bamboo clumps found in the study area. Bamboos are harvested for construction of buildings, fences and also sold as raw material to local craft industries.*

4.5.2 Sources of NTFPs collected

In the household survey for both Akyem Asene and Akyem Aboabo, it was discovered that the main source of NTFPs collected was the natural forest; precisely the moist semi-deciduous forests in which the communities are located. In Akyem Asene for instance, 56.1 percent of NTFPs collected were from the natural forest. Comparatively, in Akyem Aboabo, 56.4 percent were from the natural forest too. NTFPs collected from cultivated areas stood at 31.7 percent and 29.1 percent while those from bush/farm fallows sum up to 12.2 percent and 14.5 percent for Akyem Asene and Akyem Aboabo respectively as shown in Figure 4.2.

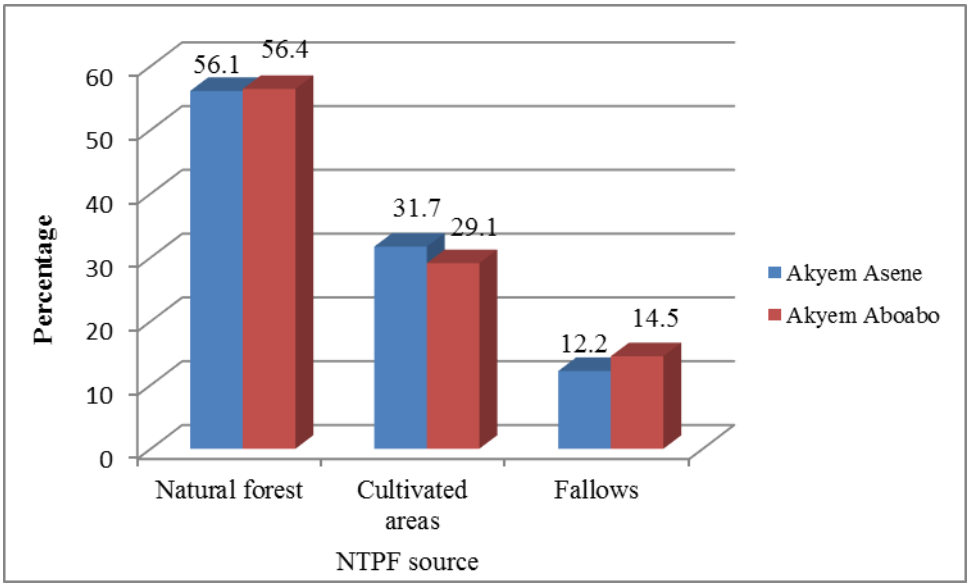

Figure 4.2: Sources of NTFPs collected

Source: Field Data (2014)

4.5.3 Sources of NTFPs sold

In the market survey conducted, 66.7 percent of NTFPs sold according to market women in the Akyem Oda market came from natural forests within the district whereas 33.3 percent came from places outside the municipality as observed in Figure 4.3 below.

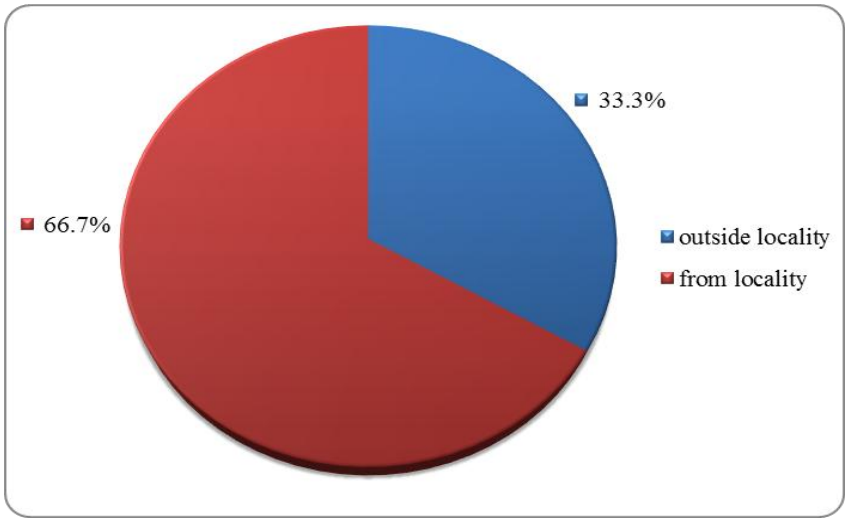

Figure 4.3: Sources of NTFPs traded in Oda market

Source: Field Data (2014)

4.5.4 Seasons and number of times for collecting NTFPs

According to respondents and from Figure 4.4, it is clearly seen that the greater quantity of NTFPs harvested in the study area was done all year round which accounted for 40.1 percent of total collection per annum. In only the rainy and dry seasons, 36.5 percent and 23.4 percent is collected respectively. The number of times a particular NTFP was collected within a season or a year was dependent on the type, availability as well as importance of the NTFP. Medicinal plants, for instance, were collected as and when the need arose, whether in the dry or wet seasons, while the collection of other NTFPs like mushrooms and snails was limited to the wet season alone.

Similarly, results from market women showed that over 60.4 percent of NTFPs were sold, whether by the roadside or in the market, all year round especially during the wet season which was the peak season.

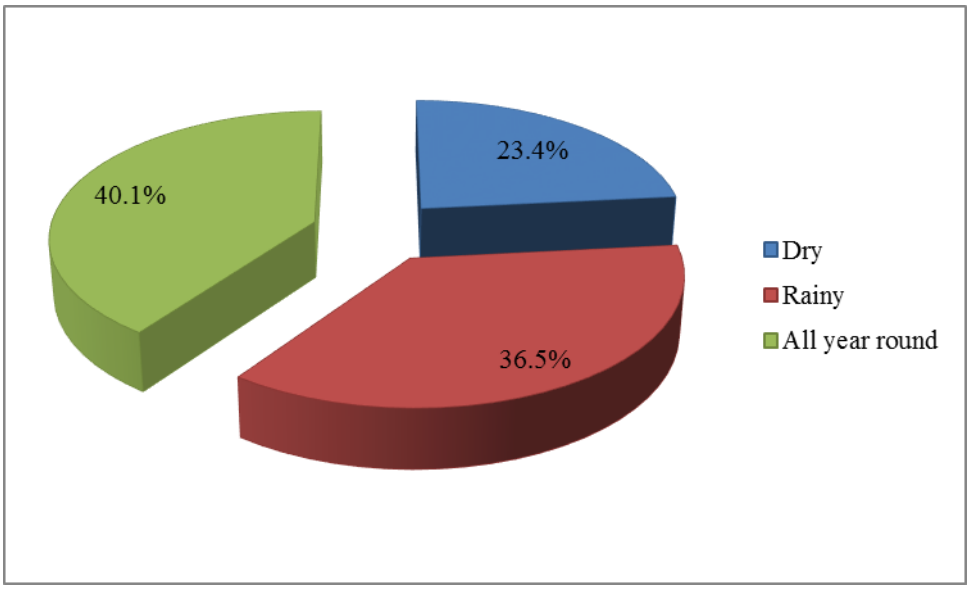

Figure 4.4: NTFPs collection by seasons

Source: Field Data (2014)

4.5.5 Access to the forest to collect NTFPs

Again, respondents were asked whether they had access to commercial quantities of NTFPs from the forest. The research work in this regard sought to investigate whether being a native or non-native of the locality had any statistically significant influence on access to NTFPs in the area. Below is a cross tabulation between native or non-native status and access to NTFPs collection. The data from the chi-square test in Tables 4.3 and 4.4 pointed out that there was no significant relationship between native or non-native status and access to the collection of NTFPs.

Table 4.3: Cross tabulation between native/non-natives status and access to NTFP collection

	Access to collecting NTFP		**Total**
	Yes	**No**	
Native	55	14	69
Non-native	25	3	28
Total	80	17	97

Table 4.4: Pearson chi-square test

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig.** (2-sided)	**Exact Sig.** (1-sided)
Pearson Chi-Square	1.263[a]	1	.261		
Continuity Correction[b]	.688	1	.407		
Likelihood Ratio	1.366	1	.243		
Fisher's Exact Test				.379	.206
Linear-by-Linear Association	1.250	1	.263		

a. 1 cells (25.0%) have expected count less than 5.
The minimum expected count is 4.91.
b. Computed only for a 2x2 table

Both the Pearson chi-square value of (1.263, $p > 0.05$) and the continuity correction value of (0.688, $p > 0.05$) are not significant at the 5% significance level. This demonstrates that one's status as a native or non-native of the area does not have any influence on one's access to enter the forest for NTFPs. As compared with the test on the various occupations in the area, it could be concluded that native or non-native status was not quite an issue when it comes to occupation in the study area.

Results showed a large proportion of NTFP collectors, 70.7 percent in Akyem Asene (see Figure 4.5) chose to collect these NTFPs from unreserved areas as against 12.2 percent in reserved areas. The situation was different in Akyem Aboabo where only 27.2 percent collect NTFPs from reserved forests and 40.0 percent citing both reserves and off reserves.

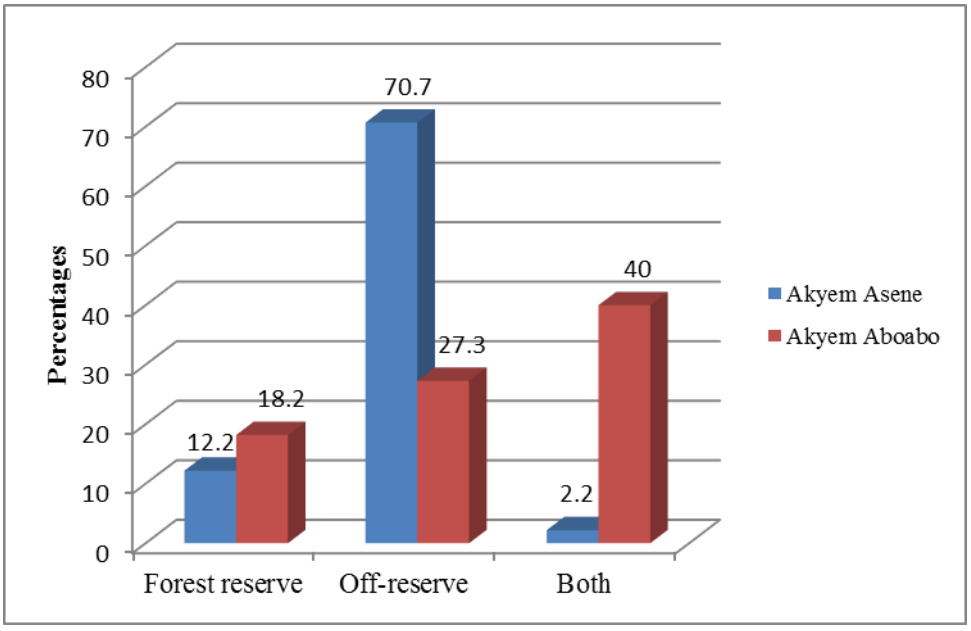

Figure 4.5:NTFPs collection in reserved or unreserved forests

Source: Field Data (2014)

4.5.6 Purpose of collection

The two local communities harvest NTFPs for two main reasons: household or subsistence use and for commercial purpose or income. In Akyem Asene, 48.8 percent of people depend on NTFPs for economic purposes more than they do for subsistence (31.7 percent). This is in sharp contrast with what pertains in Akyem Aboabo where people use 48.2 percent NTFPs on subsistence basis than they do on income basis (32.1 percent). A few households (19.5 percent) and (17.9 percent) at Akyem Asene and Akyem Aboabo respectively used them for both subsistence and income. These are illustrated in Figure 4.6.

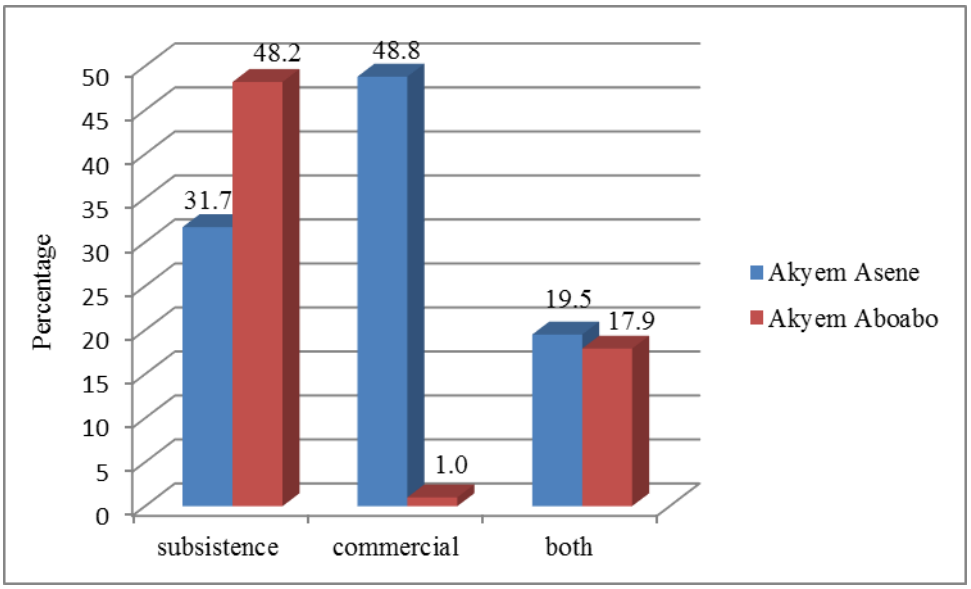

Figure 4.6:Purpose of NTFP collection

Source: Field Data (2014)

4.5.7 Profitability per location of NTFP trade

Respondents were asked about the profitability of NTFP trade to themselves and households, and as many as 66.7 percent of all respondents (Figure 4.7) contacted stated categorically that the trade in NTFPs was highly profitable. Out of the total munber of

respondents, just 13.2 percent indicated that per recent trade assessment, the trade had declined in its lucrativeness whereas 20.1 percent were in the midway, that is, sometimes they break even but other times, they hadly sold any of their products. The researcher further asked about the length of time these traders had been in business in order to ascertain whether that had any any effects on profitability of the trade in NTFPs. Only 20 percent of respondents among the traders had been in the NTFPs trade for less than 5 years. Those into NTFP trade between 5 to 10 years recorded 33 percent while the greater proportion of them, making 47 percent, had been in the business not less than 10 years.

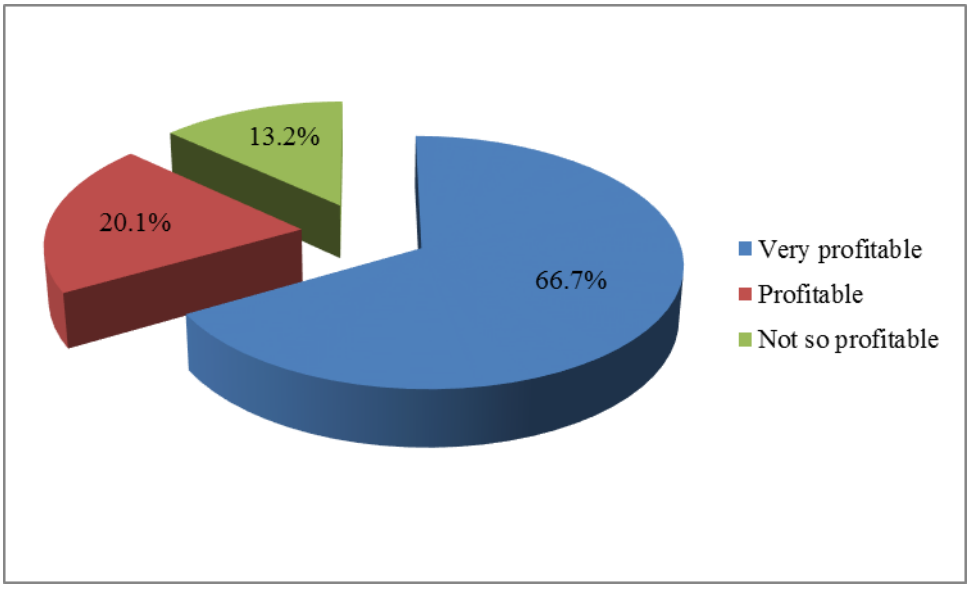

Figure 4.7: Profitability of NTFP trade

Source: Field Data (2014)

4.5.8 NTFP buyers

For the two towns, the research gathered that NTFPs collected by individual collectors were either sold directly to community members and village traders but none to co-operatives and the like (Figure 4.8). Community members constituted 26.8 percent for

Akyem Aboabo and 12.2 percent for Akyem Asene. Local traders in the two towns who were usually wholesalers and retailers of these products or sell in market places were 76.5 percent and 53.6 percent of respondents for Akyem Asene and Akyem Aboabo respectively. It was also realized that people in this locality did not trade with any co-operatives or industries that may need these products.

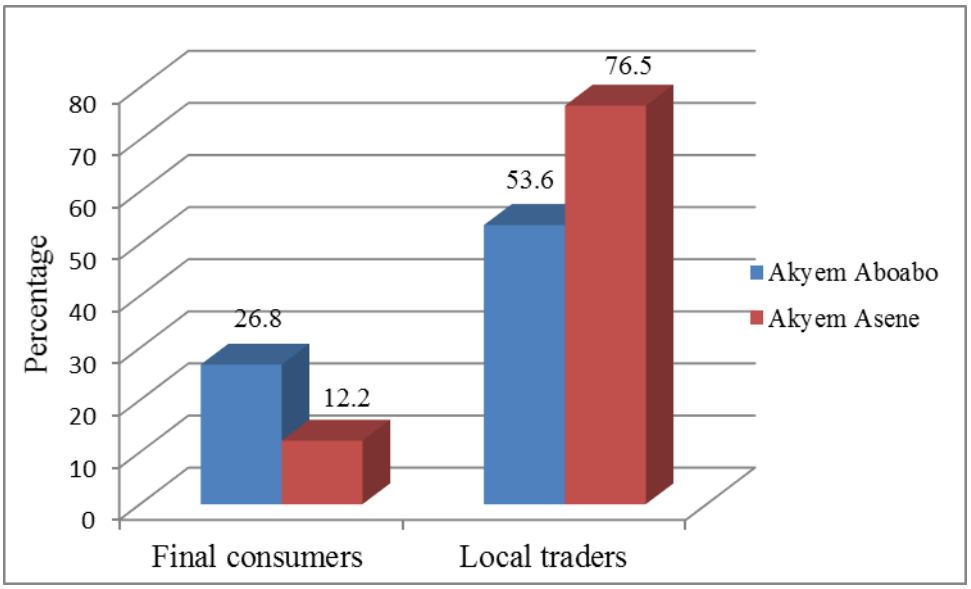

Figure 4.8: NTFP major buyers

Source: Field Data (2014)

4.5.9 Economic importance of NTFPs to households

Out of the total number of households (that is, for both Akyem Asene and Akyem Aboabo) that had income from NTFPs, a total of 55 percent of respondents derived income solely from firewood collection and sales (Figure 4.9). Following firewood, snails and mushrooms were the second and third most common NTFPs collected, providing income for about 17 percent of all households that had income from them. Other products apart from the three NTFPs - firewood and mushrooms/snails also contributed extensively to household income.

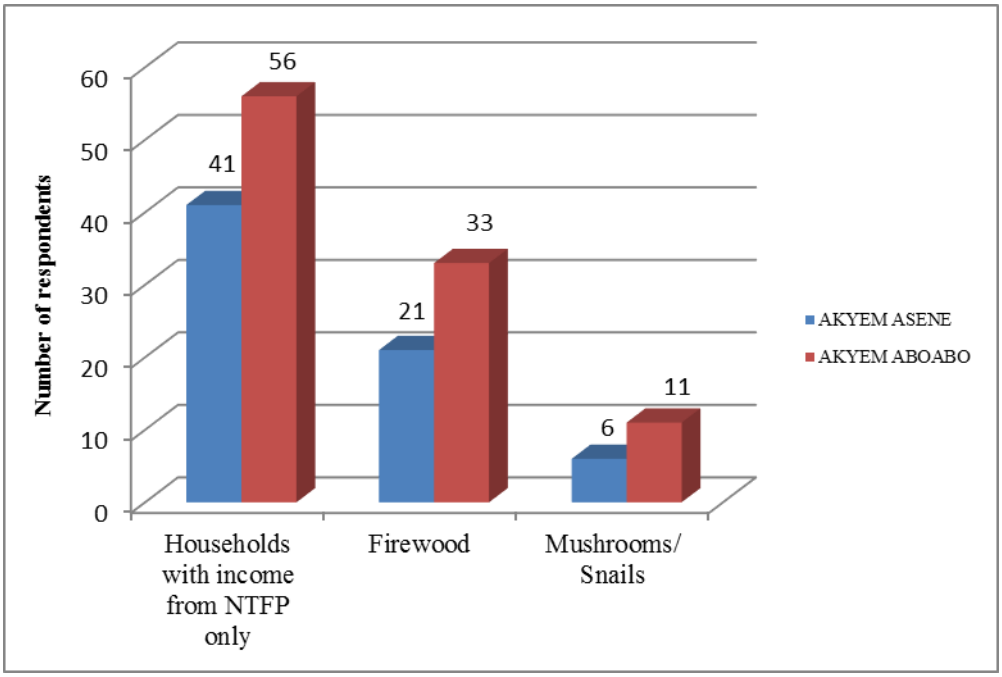

Figure 4.9: Household dependent on NTFPs for income by community and product

Source: Field Data (2014)

Aside sourcing information on economic importance of only NTFPs to respondents, income from other livelihood ventures of households in parts of the BCM was compared with income from NTFP activity only. As a result, the research at this stage sought to analyse how the various occupations (wage work, farming, NTFPs collection and the other works) affected the income of people in the area. It was also deemed desirable to investigate how specific NTFPs (bamboo, firewood, fruits and others) affected income of the people.

Table 4.5 below provides a descriptive statistics on the average daily income obtained by respondents from the various occupations that were included in the research. The average daily income was used to avoid overestimation or underestimation of respondents' total income. The analysis of variance (ANOVA) which is used to determine whether there is

any significant difference in the average values of two or more factors was also performed on each of the factors (occupation and NTFP type).

Table 4.5: Descriptive statistics of income per day and specific type of NTFP

Factors	Frequency	Mean	Std Deviation	Std Error
Occupation				
Wage work	17	39.29	17.204	4.173
Farming	22	39.59	14.205	3.028
NTFP collection	43	41.77	18.918	2.885
Others	15	37.93	10.767	2.780
Total	97	40.25	16.404	1.666
Type of NTFP				
Bamboo	4	23.25	12.738	6.369
Firewood	27	49.41	17.614	3.390
Fruits	14	34.43	14.059	3.757
Others	52	38.37	14.437	2.002
Total	97	40.25	16.404	1.666

Source: Field Data (2014)

The aim of the ANOVA procedure was to determine whether any significant difference existed in the earnings obtained across the four different occupation types listed as well as across the four different NTFP types (See Table 4.6).

Table 4.6: ANOVA table

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-ratio	*p-value*
Occupation					
Between Groups	204.607	3	68.202	0.2487	0.863
Within Groups	25627.455	93	275.564		
Total	25832.062	96			
Type of NTFP					
Between Groups	4079.307	3	1359.769	5.813	0.001
Within Groups	21752.755	93	233.901		
Total	25832.062	96			

Source: Field Data (2014)

The income analysis on occupation revealed that NTFPs collectors, specifically firewood collectors, earned one of the highest average daily income of GH¢41.77. This is followed by farmers, who earned GH¢39.59, and then people who engage in other trades who earn an average of GH¢37.93. The ANOVA for these earnings as displayed on Table 4.6 however returns a p-value of 0.863 which is not significant at the 5% significance level. What this means is that the income disparities identified with the different occupations is not statistically significant. The incomes from wage workers, farmers, NTFPs collectors and other workers were just about the same.

On the specific type of NTFP, it could be noted that firewood collectors with daily average earnings of GH¢49.41 were the highest earners. This is followed by GH¢38.37 which represents average daily earnings of those who collected other types of NTFPs and

then sharply followed by fruit collectors with GH¢34.43. The least earners were bamboo collectors with average daily earnings of GH¢23.25. Unlike occupation types, the ANOVA analysis revealed that there were significant income disparities among NTFPs collectors. Earnings of firewood collectors were significantly higher than earnings of the other three NTFP collections identified on the table. This further validated earlier statement made above that firewood is one of the most important sources of income to some people in the BCM.

4.6 Summary

This chapter began with processing of the remote sensing images of forest cover in the study area for 1991, 2002 and 2013 in the first section. This was followed by descriptive statistics - frequency & percentage distribution tables and figures and inferential statistics - chi-square tests of significance and multinomial regression of the SPSS statistical package which aided in the analysis of primary data gathered. Results arrived at were then displayed in pictorial forms for easy comprehension of the subject matter. The fifth chapter presents detailed discussions of the results represented in this chapter.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 Introduction

In this chapter, the researcher discusses in-depth results of the research according to set objectives.

5.2 Land cover and change

The discussions in this sub-section is in line with objective one which sought to delineate possible land cover and change in the study area with the application of remote sensing/GIS and from the viewpoint of selected key informants.

5.2.1 Land cover change analysis from 1991-2013 using GIS

The Birim Central Municipality is one of the moist semi-deciduous forest zones in Ghana with portions of well managed forest reserves. The area had most of its forest cover intact in 1991, totalling 9,452.11 hectares or 69.8 percent of total land cover. Eleven years later in 2002, this forest had decreased to 7,767.36 hectares accounting for a loss of approximately 1,684.75 hectares, that is, 17.8 percent forest cover loss between 1991 and 2002. Moreover, in 2013, this forest was further reduced to some 6,410.25 hectares adding up to a percentage loss of 17.5 or 1,357.11 hectares between 2002 and 2013. This means that about 1.5 hectares of forest is lost annually in the study area. The loss was more evident in forests immediately surrounding communities or built up areas.

The changing trends from 1991 to 2013, may actually be attributed to anthropogenic activities like intensive illegal logging or chain sawing as also noted by (Zaitunah, 2004), small scale mining, the conversion of forest areas to farmlands, evolving built-up areas

resulting from population increases (as depicted in Images 4.1-4.3), among others. The current rate of forest degradation does not only affect timber resources but certain types of non-timber forest resources too.

The findings from the LandSat images which demonstrated forest cover losses currently in the two (2) communities is consistent with the work of Kumar *et al.* (2010) and Sakthivel *et al.* (2010) in India, Akingbogun *et al.* (2012) in Kenya, FIP (2012) and Frimpong (2011) in other parts of Ghana.

5.2.2 Land cover change detection from the views of respondents in the study area

> "*To say the forests in this area are not changing would be a false statement*" (An officer in FSD, Akyem Oda).

This is because snails and mushrooms require cool places or shade. Mushrooms, in particular, sometimes require tree stems to grow or breed, but the destruction of the forest cover hampers the growth of such products. Those were the views of a FSD officer when asked about the current state of forests in the study area.

The FSD is mandated to ensure forest resources are exploited in the right way and acceptable quantities. In the BCM, timber concessions weregiven to companies like Birim Wood Complex Limited, Oprah Wood Ghana Limited, Timber and Consulting Limited, just to name but a few. Activities undertaken by these registered timber firms were well-known to the FSD in order to avoid wanton destruction of the forest. When questioned about the large quantities of wood being harvested in portions of the reserved forests as observed by the researcher, a forest guard replied that;

> *"Certain trees are not of any economic value to timber firms. Such trees though hard wood, wereconsidered more as NTFPs and they werefelled mostly for fuel wood. Also, fuel wood harvesting is permitted in places where timber contractors have already worked"* (A range supervisor, Akyem Oda).

Another respondent stated that;

> *"In reserved forests manned by the FSD, the main reason for harvesting any type or form and quantity of NTFPs is subsistence which is allowed even without prior notice to the FSD"* (A forestry officer, 2014).

Commercial collection of NTFPs is thus allowed in reserved areas only after permits have been duly acquired. And even after that, collection can only be done under the supervision of range supervisors and forest guards within the catchment area. It was again revealed in the interview with the forest officer that, parts and not wholes of economic trees wereremoved as NTFPs in reserved areas. In management of off-reserve areas, the FSD still oversaw all trees that grew naturally and were of economic value in spite of the fact that such trees may be found on individual or stool lands. The FSD seemed to be carrying out all of the above measures, yet the forest was depleting.

Analysis of interviews with all key informants revealed some causes of deforestation within the BCM as illustrated in Figure 4.1. 30 percent of stakeholders interviewed who do not work with the FSD, attributed the massive forest degradation mainly to revisions in harvesting schedules to favour loggers. This meant trees which were not matured to be felled weresometimes felled after 'special consultations' with forest officers in charge. This claim was rebuffed by the forest officer/guard, stating matter of factedly that, it is

rather illegal logging or chain sawing which continued to have serious implications on the land, hence forests in the municipality. Activities of chainsaw operators were seen as very detrimental to sustainability of all forest resources. Thus, forest resources, in the long run, were very much impacted by the activities of chainsaw operators. Separate interviews with a chainsaw operator, a timber merchant and a worker in one of the numerous sawmills located in the study area revealed that their activities were well regulated by the FSD, except for a few who were into the trade illegally. To curb this, certain measures were put in place. For instance, logs that were being transported were checked at the various police checkpoints on the roads.

In addition, military men have been deployed to the study area to check this menace. Therefore, when unauthorised persons were caught, they were compelled to leave the felled trees/logsin the forest. Besides, groups of local people and individuals report any persons caught for severe punishment. This last measure in the view of the local people is unapproved. In the chainsaw operator's statement, he lamented;

> *"The kind of punishment meted out to illegal chainsaw operators is unjust. This is our forest so if we decide to cut the very matured trees in order to cater for ourselves and families, what's wrong with that?"* (A chainsaw operator, 2014).

The sawmill factory hand on the other hand reported that;

> *"Authorities either mercilessly beat up illegal loggers, seize their logs of timber and even fine culprits"* (A sawmill hand, 2014).

All the above-mentioned measures were implemented in order to stop the indiscriminate felling of economic trees, thus preserving the forests, but the issue that is ignored in all

of this is what happens to the livelihoods of people living in or around these forests, who depend on these trees for economic gains as noted by ICUN (2007) and FAO (1997) too. There seems to be no proper liaising between the FSD and the local communities. Exposing the gap between foresters and dwellers around the forest, Owusu (1999) stated that local communities are marginalized and even alienated from the administration of forests.

Also, illegal cutting down of trees in large quantities for drums, artefacts, mortars, pestles, handles of farm implements and house tools, among others were also reported to have lots of negative impact on forest cover. Other activities included intensification of firewood collection in areas that were not meant for such a purpose. Knowing the economic gains of firewood, substantial quantities were collected and cut down in the district. Piles of this NTFP were seen along the roadside, some being loaded on trucks and some cut and tied up in the forest. This brings to the fore the question of whether this resource was not overexploited as observed by Kairo *et al.* (2001).

Another factor the data indicated to have negative impact on forest cover was bad farming practices notably slash and burn methods of farming and intensive agriculture. This finding resonates with Hussein *et al.* (2008) and Sakthivel *et al.* (2010). The practice of slash and burn farming was highly discouraged according to the farmer interviewed. Rather, the practice of agro-forestry where crops and trees co-exist on a piece of farmland, was highly encouraged. As to whether this was being adhered to is a different story given that the researcher noticed areas that were cleared and burnt by farmers who were awaiting the rains to start the farming season.

Aside illegal logging or chain sawing, excessive harvesting of firewood and bad farm practices, another activity identified by respondents as negatively impacting forest cover is unauthorized small scale mining or 'galamsey', where certain portions of forestland werecleared, the bare land is dug up and left uncovered. The resultant effect of such activity is the removal of nutrient-rich topsoil and exposure of pebbles and stones on the ground which would not support plant growth. Last but not the least, it was acknowledged by some interviewees that climate variability played a key role in forest issues hence survival of NTFPs. Upon further investigation, the researcher found that it was the removal of the forest that led to changes in climatic factorswhich in turn affected the local climate of BCM resulting in experience of erratic rainfall even in the rainy season.

In summary, forest cover in the study area was examined using remote sensing/GIS and separate semi-structured interviews with some stakeholders, chief among them being the FSD. The study found that forest degradation was a major issue affecting natural resources in the municipalty. Knowing this, a variety of measures have been put forward to maintain the forest. This finding supports the SFM theory adopted for the research. The remote sensing maps employed made it clear that over the years, there have been major changes in the forest cover giving way to expanding settlements, infrastructure, and more cultivated areas. The result on the continuous forest degradation in the study area is in consonance with a plethora of reasearches conducted by the FAO, FAO & JRC (2012), Shitima (2005), Kumar *et al.* (2010), Frimpong (2011), among others. These studies substantiate Boafo's (2013) study that the fall in quality and quantity of NTFPs is attributable to decline in forest cover. The question of how effective the various forest management interventions instituted over the years, notably from 1991 to 2013 and the

subsequent years had been, becomes vital. Consequently, there is the need tocarefully consider the ecological or environmental dimension of SFM which seeks the continued existence of species in the forest as noted by Vierikko (2010) to ensure sustainability as put forward by Pokem (2010). Since land cover change has impact on forest resources and livelihood outcomes as seen in the adapted CARE livelihood framework (Figure 2.2), conservation of the resources must be upheld to safeguard livelihoods of people in BCM. In view of this, objective one for the study which was to delineate the possible forest cover types in the area and how they werechanging has been achieved.

5.3 Socio-economic characteristics of NTFP collectors and traders

In this second sub-section that deals with objective two of the study, characteristics (age, gender of household head, education level, marital status and household size) of households that relied on NTFPs for domestic use and trade were identified.

The average age of NTFP collectors was identified to be 41.4 years with a minimum age of 24 years and maximum of 55 years. This finding corresponds with a similar finding by Gubbi and MacMillan (2008) who found that the mean age of most NTFP collectors was approximately 42 years. Employing the CARE livelihood framework in Figure 2.1, household assets (human capital, consisting of among other things good health and ability to labour, as well as physical capital, mainly energy) are very essential for the pursuance of any livelihood strategy. Therefore, the average age of 42 years implies that persons of that age were strong and energetic to carry out the arduous task of NTFP collection.

Per the responses obtained from the survey questionnaires, knowledge of household size, level of education, gender of household head and marital status, could not aid in

predicting occupation/NTFP activity in a given household in Akyem Asene. On the contrary, knowledge of at least one of these variables could help predict occupation in Akyem Aboabo. A look at Table 2b (in Appendix Four) gives credence to the earlier conclusion drawn from Table 4.1 that the model is not significant for Akyem Asene. This is because the p-values associated with all the independent variables were all greater than 0.05. On gender of household head, the variable labeled "Gender of HH" is the multinomial logit comparing households whose heads were males, to those whose household heads were females. Holding other household variables constant, it was found that gender of household heads did not determine type of occupation be it farming, wage work and other occupations relative to NTFP collection.

By looking at Table 2b for Akyem Aboabo, it could be noticed that household size, level of education and marital status were significant determinants of NTFP occupation – each of the p-value values is less than 0.05. However, the p-value associated with gender is 0.486, $p > 0.05$, which is not significant. This means that the occupation that prevails in a given household (be it wage work, NTFP collection, farming or other) is not dependent on the gender of the household head. Though gender is not a significant determinant of occupation, one would notice that the Exp(B) for gender of household head is less than one for farming and other occupations, but greater than one for wage work. What this means is that, households whose heads were females were more likely to farm and engage in other occupations instead of collecting NTFPs, whereas male headed households were more likely to engage in NTFP collection.

The Exp(B) values for level of education in Akyem Aboabo is greater than one for farming, wage work and other occupations relative to NTFPs collection. What this simply means is that, an increase in a person's educational level is likely to cause

him/her to engage in other occupations rather than go for NTFP activity. Education thus has a negative influence on NTFPs collection in Akyem Aboabo. Those who have received higher education wouldn't want to go to the forests for NTFPs collection. They would rather look for other occupations. Finally, marital status was seen to be very significant in the model. The marital status values on Table 2c are the multinomial logit estimates comparing single, married, widowed and divorced household heads with farming, wage work and other occupations relative to NTFPs collection while holding other household variables constant. One could gather from Table 2c in Appendix Four that all the Exp(B) values associated with the marital status variables for farming and other occupations were all less than one. The meaning derived from this is that married household heads were mostly NTFPs collectors. The co-efficient associated with household size is 0.293 (Table 2c). This means that the multinomial logit estimate for a one unit increase in household size for farming relative to NTFPs collection is 0.293 with a corresponding odds ratio [Exp(B)] of 1.340. What this simply means is that, a one unit increase in household size is likely to increase the number of farmers relative to the number of NTFP collectors in a household given the other household variables were held constant. On the other hand, the Exp(B) values associated with household size for wage work and 'others' were both less than one. What this implies is that a one unit increase in household size in Akyem Aboabo will cause the number of NTFP collectors to increase as compared to wage work and other occupations given the other variables in the model were held constant.

The result on household size and marital status agrees with that of Onomu and Akeem (2014). This could be due to the fact that larger household size meant more people to cater for and the married have more dependents that may help in the collection unlike

smaller households and the unmarried have less family burdens. The result on level of education showed that people with usually less or no form of formal education engaged in NTFP collection and this is corroborated by Odebode (n.d) whereas it contrasted with Onomu and Akeem (2014) that people with basic formal education took to NTFP collection as an occupation. This finding about male headed households engaging more in NTFP collection is confirmed by Onomu and Akeem (2014) although NTFPs collected by men were different from those collected by their women counterpart.

All the above household characteristics can be linked to human capital. As seen in the adapted livelihood framework (Figure 2.2), human capital is a much needed asset when considering NTFP activities of any kind, be it production, processing and exchange or consumption activities and this would help achieve the livelihood outcomes.

5.4 Kinds of NTFPs sourced from the different land use types

Several NTFPs were available in the BCM for either domestic use or earning income. Some were from animal and some from plant. The list provided (in 4.5.1) is about types of NTFPs found in the area under study and this result reflects inventory of NTFPs given by Bih (2006) and Falconer (1992). It can be observed that a great deal of information from the residents in the study area was used. Local knowledge as also found by Bih (2006) citing Guijt and Hinchcliffe (1998) has been employed in many NTFP inventories. It was found that firewood and charcoal topped the list of types of NTFPs collected for income and subsistence by majority of households within the two communities. Similar findings by Mulenga *et al.* (2011) revealed that the most common source of income for households in Zambia is charcoal/firewood totalling 65 percent. Firewood and charcoal were in high demand in rural areas for heat and energy. Similarly

in big towns and cities, the demand of firewood cannot be downplayed in meeting energy needs. Hence its abundance in Akyem Asene and Akyem Aboabo has made its exploitation profitable.

Availability of NTFPs in this case, is a natural capital when looked at from the livelihood framework. Households could then process and exchange the available NTFPs for income, or consume them directly.

5.4.1 Source of NTFPs collected and sold

The natural forest is of great importance to the two study communities when it comes to NTFP activities. In both the household and market surveys, it was pointed out that more than half of the quantity of NTFPs which were collected came from the natural forests, accounting for a total of 56.1 percent in Akyem Asene and 56.4 percent in Akyem Aboabo. The result proved studies elsewhere in Ghana by Ahenkan and Boon (2011), Acheampong (2003) and Andel (2006) that NTFPs were mostly sourced from natural forests. This means the damage of natural forest as is happening at present, has serious consequences on available NTFP activities now and in the future. Continuous slash and burn activities coupled with several other bad farming practices, mining activities and excessive lumbering cause the virgin forest to gradually turn into secondary forest in many areas and these have become major threat to vegetation and other natural resources, not excluding NTFPs. While some NTFPs have become scarce as a result, others such as snails and mushrooms that require cool habitats to grow were dwindling at a rapid pace.

Fewer NTFPs were obtained from bush/farm fallows because farming lands were becoming scarce in recent times. Hence, leaving a piece of land bare to restore its

fertility in 5 to 10 years in the views of some respondents was rather uneconomical especially in the wake of chemical fertilizers and animal droppings which can quickly restore soil nutrients.

From the livelihood framework used in the study, (see Figure 2.1, Section 2.6), it can be realised that the main source of livelihood and production activities for the respondents is derived from natural resources. In this case, the natural capital in the district is forest.

5.4.2 Seasons and times of collection and sales of NTFPs

Collection of most NTFPs took place all year but particularly in the wet season when the vegetation was fresh. In the market survey responses, market traders interviewed stated that a chunk of NTFPs, like snails and mushrooms which were sold, was during the rainy season. Hence, the seasonality of NTFPs also affects their availability, collection and usage. This result corroborates the findings of Ardayfio-Schandorf *et al.* (2007) citing Attua (2007) that the supply base of NTFPs could be altered by seasonal changes and therefore affects their availability for use in households. One harvester explained that;

> *"Within the rainy season, a particular NTFP or parts of a particular NTFP could be harvested as many times as possible because regeneration is fast unlike in the dry season when growth takes a longer time"* (NTFP collector in Akyem Asene community).

From responses gathered from the market, it was stressed that NTFPs such as snails, mushrooms, crabs, green leafy vegetables, medicinal plants, just to mention a few, were very abundant in the rainy season. This finding and that of FAO (1997) indicate that collection is higher in the rainy season. For this reason, maximum collection of such NTFPs is done during the rainy season thereby increasing total sales in that period. In

contrast, fewer quantities of NTFPs were collected in the dry season meaning that less sales is done. Around this time of the year, NTFPs were not relatively abundant.

5.4.3 Kinds of NTFPs' used for commercial and subsistence purpose

The study found that NTFPs serve commercial, subsistence or both purposes in a household. A NTFP considered by one person for commercial purpose may be what another person subsists on. Even among NTFPs marketed, some only produce additional incomes while others serve as the main source of income because of their importance. The finding on the commercialization of some NTFPs is echoed in similar findings by Aiyeloja *et al.* (2001), Muzayen (2009), Sale (2006), PROFOR (2007) and Ahenkan & Boon (2008, 2010). The finding on the subsistence usage is in consonance with Godoy and Bawa (1993). In both communities, firewood was collected mainly on commercial basis as also discovered by Giliba *et al.* (2010). Nkwatoh *et al.* (2010) noted that some NTFPs were sold as industrial raw material which is verified by the finding that canes and bamboos were sold as raw material to local craftsmen.

During the rainy season when most NTFPs, for instance nkontomire (cocoyam leaves), mushrooms, abeduru and wild yams were abundant, they were sold. The use of some other NTFPs sometimes even depended on quantity collected in a given period of time. In a situation where a collector of firewood, by chance, gets large quantities of snails while searching for firewood for example, he may decide to sell the left-over snails after meeting his or her family's demands. Prekese, Akokun, honey, palmwine, sponges and nuts were not very abundant in Akyem Aboabo hence were collected on small scale mostly for a family's use.

From the livelihood framework adopted for the study, (see Figure 2.2, Section 2.6), economic capital is assured after consumption activities. People have savings, credits and sometimes remittances to send relations far and near.

5.4.4 Access to the forest to collect NTFPs

It was found that people's access to the forest influences collection of non-timber forest resources as established by Andel (2006) also. In Akyem Asene, because the lands were communal lands, meaning they were usually stool lands belonging to the entire community, the allodial title which is the highest interest in land anybody can acquire, is vested in the occupants of the stool on behalf of the community. This gives inhabitants easy access to the forested areas particularly off reserved areas. In Akyem Aboabo on the other hand, collectors can access communal lands as well as private lands, be it reserved or off reserves wherever permitted. However, only 27.3 percent of total respondents engaged in their collection activities in reserved areas in order to allay the constant fear of being caught by foresters/forest managers even though in such areas, harvesters were free to pursue their activities on subsistence basis without any prior notice to the FSD. In conclusion, people in Akyem Asene and Akyem Aboabo have easy access to either the reserved or off reserved forests to collect NTFP for their sustenance. When they intend extracting the products from reserves for sale, due permission ought to be sought.

From the livelihood framework adopted for the study, (see Figure 2.2, Section 2.6), natural capital is assured after production activities.

5.4.5 NTFP buyers

For the two towns, the study gathered that NTFPs collected by individual collectors were either sold to people in the community or village traders but none to co-operative groups

(Figure 5.5). This result is supported by Ahenkan & Boon (2010). The local village traders usually stood by the roadside and sold the products to travellers and motorists, or sold them in marketplaces in both Akyem Asene and Akyem Aboabo whereas others sold their products in the municipal market. Selling of NTFPs along the main road from Akyem Oda, the municipal capital to Agona Swedru was a common sight especially in Akyem Asene. Those in Akyem Asene also traded more with local traders than community members because people in that locality tend to market similar items for consumption. The situation was different in Akyem Aboabo. Owing to the sprawl in Akyem Oda, lots of wage workers live in Akyem Aboabo and daily commute to work so these wage workers serve as ready market.

From the livelihood framework adopted for the study, (see Figure 2.2, Section 2.6), economic capital is assured after consumption activities but social capital which refers to quantity and quality of social resources (for instance networks, membership in groups, social relations and access to wider institutions in society) is lacking to some extent because the collectors do not have access to wider institutions and groups that can purchase their products.

5.4.6 Profitability per location of NTFP trade

There were seasons in which traders recorded very low profits due to the fact that they either obtained low quantities of NTFPs from collectors, or consumers do not buy much because they complained about the high cost of the NTFPs. In spite of this, traders were of the view that trade in NTFPs was good. This finding follows a similar outcome by Sandemose (2009). On the average, when mushrooms were in season, a trader in only

mushrooms on the roadside can make about 30 cedis daily compared to her counterpart in the Municipality's central market who can make about 50 cedis. One trader explained;

> *"Though those selling mushrooms in the market make more money than I do, when I take into consideration transport cost, tolls, and the like, I think being by the roadside is good"* (A trader by the roadside in Akyem Asene).

By this, it is known that NTFP activities help secure basic needs of food, water, nutrition, health, safety among others as observed in the livelihood framework, (see Figure 2.2, Section 2.6).

It was discovered that 47 percent of respondents had engaged in the NTFP trade in the two localities for more than 10 years. In the Akyem Oda market, a total of 73.3 percent traders engaged in NTFP trade only. This is particularly so because for majority of those who have been in the business for more than 10 years, the trade was passed on to them from their forebears (either a mother, grandmother, aunty and sometimes male relatives). However, others realizing how lucrative the business was in those days, according to them, chose to join the trade which accounts for the relatively small number of years they have been in the trade.

Again, drawing from the livelihood framework, (see Figure 2.2, Section 2.6), the number of years in this livelihood production translate into social asset, in that, membership in groups and social relations have been formed among individuals doing the same business, engendering or fostering a level of trust.

5.4.7 Challenges in marketing NTFPs

In spite of profitability of NTFP activity in general, difficulty in marketing perishable NTFPs was seen as a major challenge. This was compounded by the fact that no long term means of preserving NTFPs were employed. Several reasons were given to buttress this problem. In the words of one woman;

> *"The things I sell are highly perishable, when I don't get people to buy them in time, I incur losses and it greatly has an effect on my family's budget"*(A trader in the Akyem Oda market).

Another also spoke about inflation in the national currency, which was the case as at the time of gathering this data; thus, affecting her profit margin. This could be true since inflation rate for December 2014 was 17.0% (Ghana Statistical Service, 2014). A third trader bemoaned the fact that in recent times, plastic bags were replacing wrapping leaves for foods thus depriving locals a certain amount of income received from the sales of wrapping leaves as well. The above were just few out of many other traders who had same or similar complains. In spite of those complains, some traders were happy because business was good and proceeds were mainly used to cater for their family needs. The present study therefore revealed that adding more value to some NTFPs would go a long way to increase their prices on the market thus creating a small NTFP business thereby bringing in more income to traders of such NTFPs rather than just selling them in their raw states. The result on marketing challenge of NTFPs re-echoed Ahenkan and Boon (2010) findings.

Processing and exchange activities which are livelihood strategies within the adapted CARE livelihood framework (see Figure 2.2) were highly affected here. This could in turn affect security of some basic needs.

5.5 Assessing the role of NTFPs in improving livelihoods of households

NTFPs play a crucial role in the livelihoods of rural people, especially for those dwelling in the forest and its vicinity as also found by Edwards (1993). The outcome indicators for measuring livelihood used in this work include income, nutritional status and sustained access to food, health, education, habitat and physical safety. Analysis of these livelihood outcomes should determine not only what needs are currently not being met but also what trade-offs there are between needs (Frankenberger *et al.,* 2002). This study and others (for example Kisaka and Sitati, 2014) have shown that there is a level of dependence on this non-timber type of forest resources. The under listed components of livelihoods namely income, nutritional status and sustained access to food, health, education, habitat and physical safety were measured.

Households in Akyem Aboabo harvest NTFPs mostly for their own survival (subsistence) first, before thinking of marketing (commercial) unlike in Akyem Asene, where collection is mainly on commercial basis rather than subsistence. Issues raised under subsistence use included mitigating immediate financial needs of the family, seasonal unemployment, food shortage, crop failure or sickness of earning members. As to the kinds of NTFPs used for commercial and subsistence purpose only, a very thin line is drawn between those used for only income and those for only household consumption. As discussed early on, NTFP considered by one household for income becomes another

household's product for subsistence. This finding affirmed FAO (1997) finding which says that NTFPs provided both supplemental and regular sources of income.

Shackleton *et al.* (2007) citing Alexiades and Shanley (2004) noted that in spite of the low turnover of NTFPs, the cumulative value of hundreds of these small-scale forest commodities is considerable, forming the monetary base for millions of harvesters, processors and traders. There was no accurate means of expressing quantities of NTFPs, for instance the use of weights, scales and balances by collectors when selling the products and also no documented records of their activities. Hence the people were unable to quantify in monetary terms the exact contribution NTFPs made to their livelihoods. When asked, they mentioned figures that were either far below what they actually got or exaggerated their total monthly earnings. All the same, more than 50 percent of respondents were sure of the considerable contributions of NTFPs to their needs. Amoah and Wiafe (2012) also had similar results about the contributions of NTFPs to people's livelihoods.

In assessing the role of NTFPs in supplementary income generation and regular source of income, almost everybody interviewed stated as a matter of fact, that NTFPs have a central place in their households. This is because in whatever form NTFPs were harvested whether as a part of a plant for medicinal or food purposes, or a bush animal for food, they play a vital role when sold. Respondents contacted strongly asserted that they obtained incomes from the sale of NTFPs that augmented their major source of income, though not every household depended on NTFPs for regular income. This finding agreed with Ros-Tonen and Wiersum (2005) that NTFPs were gathered by people for either sustenance or supplemental income.

Another very important source of NTFP income was from the sales of artefacts. Some industrial raw materials were sourced from NTFPs and used by cottage industries in making artefacts in the BCM. Nkwatoh *et al*. (2010) also had similar results on the use and contribution of NTFP-related income.

With regards to nutritional status and sustained access to food, as many as 65 percent of respondents stated that proceeds from these products were used in buying food, supporting their spouses and meeting other household needs, while over 78 percent of households directly ate NTFPs to boost their dietary requirements. This result verified similar result by Ahenkan and Boon (2011) that NTFPs improved nutrition. Bushmeat, for instance, constituted a major source of animal protein in the diet of local people in the two study communities thereby meeting some of their nutritional needs. This finding resonates with Opare-Ankrah (2007) that bushmeat is extracted as a major source of protein. Mushrooms also are of high nutritional value to people in BCM. It was revealed that 41 percent of mushrooms sellers were collectors too. These products including snails and crabs were mostly eaten where available.

Plate 5.1: ***Mushrooms for sale in Akyem Asene. Selling is mostly done by women and children to supplement family incomes.***

From the livelihood framework used in the study, (see Figure 2.2, Section 2.6), it can be concluded that security of food and nutrition livelihood outcomes were met.

Health and educational needs of people cannot be neglected. Some 25 percent of the medication prescribed world-wide contains ingredients extracted directly from medicinal plants (Planet under pressure, 2012). Traditionally, herbs of all kinds were collected for treatment of various forms of ailments in the study communities. About 90 percent of all ailments in the district were first reported to herbalist/traditional healers for solution before orthodox help is sought if need be. This finding renonates that of BCMA (2010). For instance, the bark of the Mahogany tree and a local vegetable called "Abeduru" which grows by itself are known sources of blood in aneamic patients according to an

interviewee. This finding corroborates Ahenkan and Boon (2008) finding on the health benefits of NTFPs. Again, NTFPs contributed significantly to education needs of those engaged in it. Some 65 percent of respondents stated that proceeds from non-timber forest products were used in paying their wards/children school fees and buying some necessary school requirements like school attires, textbooks, pens/pencils, etc.

The findings on health and education is in line with security of health and education, two of the livelihood outcome components of the livelihood framework (see Figure 2.2, Section 2.6).

For habitat and physical safety, light construction materials like bamboos, twines, twigs, vines, and ropes aid in putting up buildings notably thatch and mud houses for human dwelling. In the municipality, structures such as schools, kitchens, barns, and places of convenience, were all constructed with the help of these light construction materials. This result consented to findings by Falconer (1992) and Chima *et al.* (2012) citing Foli *et al.* (1997) that shelter is for all people and it is catered for by the usage of some NTFPs. Shelter is a livelihood outcome as seen in the livelihood framework adapted for this study (see Figure 2.2, Section 2.6).

5.6 Summary

This chapter of the study was devoted to thorough discussion of results obtained from the fieldwork according to the four objectives set for the study. Land cover change detection was carried with the help of remote sensing/GIS and views of respondents. Results showed that the forest in the BCM was continuously declining over the years examined. The socio-economic characteristics of households dependent on NTFPs were identified. This was followed by types of NTFPs sourced and their availability. The section

concluded by exploring the role NTFPs played in improving livelihood of people in BCM. It was revealed that deforestation was a threat to NTFPs which ultimately impacted livelihoods of communities dependent on those resources. The subsequent chapter which is also the last chapter of the entire study presents a summary of the whole study and ends with conclusions and recommendations.

CHAPTER SIX

SUMMARY OF KEY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The study sought to assess the effect of land cover change on NTFPs, specifically livelihoods of people in the northern part of the Birim Central Municipality. Having covered the pertinent issues relating to forest cover, NTFPs and livelihoods in the previous chapters, there is the necessity to highlight the key findings and give relevant recommendations based on the findings of the study. This chapter therefore seeks to summarize the results realised at the end of the study and give due recommendations to that effect.

6.2 Summary of key findings

From results discussed in Chapter 5, sections 5.2.1 and 5.2.2 above, the following major findings were made.

First, land use types in the area included the natural forest, farmlands and fallows. Greater quantities of NTFPs were reported to have come from the forest, that is, the moist semi-deciduous forest type found in the study area. The other land use types namely farmlands and fallows also generated a reasonable amount of NTFPs. The natural forest cover was the leading source of NTFPs, but was changing with more forest resources being lost due mainly to illegal logging. In recent times, NTFPs were not readily available in the forests. Hence, the study established that measures, such as proper monitoring of activities of foresters, to mitigate the over-exploitation of these resources in the BCM be well implemented by the FSD in order to ensure resource

sustainability since there was little policy or legislation /specific to NTFPs in the study area. Deforestation in the BCM, as observed the researcher, when not checked can end up in dire consequences to all stakeholders.

Secondly, in relation to the livelihood framework, the study has shown that people in Akyem Asene, Akyem Aboabo and Akyem Oda, three communities located within the northern part of the BCM depended on forest resources. It was discovered that household heads with little or no formal education as well as households with more members relied heavily on NTFPs for their households' food and financial needs unlike their counterpart household heads who received a comparatively higher level of formal education or households that had less household members. The former engaged in harvesting of these products either to be consumed directly or sold, as a way of meeting their household needs of food, shelter and clothing, since there seemed to be fewer livelihood options to pursue. To this group of people, the role of NTFPs in their lives cannot be overemphasized. The latter tend to have other jobs aside harvesting and sales of NTFPs hence only obtained supplementary incomes from NTFP activities. Also, gender of household heads and the fact that a person was a native or non-native of the BCM did not in any way affect NTFP occupation nor type of NTFP collected. Rather quantity of NTFP collected was determined by ones strength and ability to work hard since all residents have equal access to the forests.

Thirdly, types of NTFPs derived from the three different land use types for the market and other uses were firewood, snails and mushrooms, bamboos, parts of medicinal plants like leaves, barks, roots, flowers, not excluding parts of edible plants like wrapping leaves, some green leafy vegetables and other useful plant parts among others. The most commonly harvested NTFP for the market in the BCM was firewood. Regarding seasons

of harvesting, the chunk of NTFPs were harvested in the rainy season because it was during that time that most NTFPs were in abundance and could be acquired in their fresh and appealing state.

Last but not least, the study has shown that NTFP activities in the BCM is one livelihood option that is not consistent and does not provide year-round source of income due to the fact that they were seasonal in nature and there was continuous decline in quantities harvested. As a result, other income-generating activities were combined with NTFP activities to enable some households meet their basic needs.

6.3 Challenges identified in the NTFP sector in these communities

Though many of the people living in the study communities expressed interest in NTFP collection and its trade, the following problems dissuaded some of them. Worsening forest degradation in the area posed a threat to sustainability of the NTFPs available. This was because when big economic trees were felled as timber or small trees were cut for firewood; they fell on NTFPs on the forest floor thereby destroying them, a harvesting practice that is highly unsustainable. Again, when tree canopies were broken, NTFPs that needed shades to grow were disturbed.

Modern techniques of processing and value addition of the NTFPs at the local level was lacking due mainly to financial constraints. Hence, various NTFPs were still sold in their raw states. Some like fresh mushrooms were smoked as a way of preservation and later sold. Others like traditional herbs were crudely processed and packaged making their quality and demand rather low and pricing poor. Consequently, the profits made on the sale of these products were low.

Lastly, NTFP management has been hampered by their multitude and variety, lack of appropriate methods of assessment, organizational and financial constrains (FAO, 2001).

6.4 Conclusions

The forests of the BCM provided a wide range of non-timber forest products to its inhabitants. These products thrived in their natural milieu and also in human modified environment. The study found that the forest was reducing due to current rate of forest degradation as indicated in 4.2, 5.2 and on Plate 4.1. With these evidences, research objective one, which sought to highlight land cover change in the study area by means of remote sensing data and indigenous knowledge, was achieved. The study elucidated that NTFPs were influenced by forest cover loss over the duration. Therefore, the first proposition regarding forest cover loss over the years having decreasing influences on NTFPs is accepted.

The objective of determining the characteristics of households dependent on NTFPs was met. This is because the study indicated that in Akyem Asene, apart from age, household variables of gender, level of education, marital status of household head and household did not determine people's preference for NTFP collection or not whereas in Akyem Aboabo, these household variables significantly influenced this decision.

The third objective sought to find out the types of NTFPs sourced from the different land use types. Here, it was discovered that firewood was the main NTFP collected and sold in the northern part of the BCM. Piles of firewood loaded onto trucks and packed by the roadside was a common sight in the study area. Aside firewood, snails, mushrooms, spices, medicinal plant parts among others were also collected in substantial quantities. Therefore, this objective was also realized.

Finally, in assessing the role of NTFPs in improving livelihoods, results demonstrated that aside providing food, materials for shelter, treatment of ailments and the like, NTFPs further contributed significantly to household incomes, be it supplemental or regular income. Through this, household needs which were not directly catered for by NTFPs were purchased with proceeds from their sale. Therefore, this objective has been met and this occurrence satisfies the second proposition drawn for the study that collection of NTFPs contributes significantly to household livelihoods.

6.5 Recommendations

From the discussion and findings above, the following constructive recommendations have been given for considerations that could positively influence policy.

1. The study calls for a critical assessment by the BCM on how forests are managed in the wake of continuous deforestation and degradation. This process can begin with proper liaising among NTFP collectors and forest officers who seek to protect the forest. This calls for more collaboration among these stakeholders to ensure better maintenance of the forest hence better maintenance of forest resources. Also, there is the need for a review of the FC's regulations to ensure sustainable harvests of these forest resources. Harvest schedules for timber must not be changed to suit an individual, rather, FSD should make sure tree resources are matured and ready to be harvested before they give permits. Yet again, afforestation should be the sole responsibility of timber firms/companies within the municipality while the FSD supervises.
2. Products collected were either sold in their raw states or processed locally, but better value addition to NTFPs is very necessary, not only in order to gain access

to external markets and earn more returns, but also preserve the large quantities of NTFPs that are collected in the rainy season. Re-packaging of some NTFPs is also required to make them attractive to consumers. This way, the market base will be widened.

3. NTFPs serve as regular source of income to some residents. What this means is that during the off season of some NTFPs, collectors are out of business. The study recommends that rural livelihood diversification programs, as promoted by the central government, should reflect positively on livelihoods options of rural dwellers so that those people whose only source of income is from collection and sale of NTFPs can diversify. For example, agro-based industries could be located in these areas and locals employed.
4. The role of NTFPs should be re-considered not only in research, but also in policy, management and implementation as development of this field could have major impact not only on people dwelling near them but the nation at large.
5. **Recommendation for future research on the topic:**

   The researcher made considerable effort to cover all important aspects of the topic. However, considering the scope of the research, a suggestion for future research is made.

   Further studies might, for example, look at land cover change, NTFPs and livelihoods as an interdisciplinary research in order to probe deeper into the issues highlighted.

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http://www.fao.org/docrep/w8210e/w8210e09.htm

APPENDIX ONE

QUESTIONNAIRE FOR THE COMMUNITIES

UNIVERSITY OF GHANA

DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT-MPhil

Thesis Questionnaire

This questionnaire is in aid of a student of the above-named University to meet the requirement for the award of an MPhil in Geography on the topic "***Effects of land cover change on non-timber forest products and livelihoods of communities in Birim Central Municipality"***. This study is strictly for academic purposes and respondents are guaranteed that all responses shall be treated confidentially.

Please tick or write where applicable.

PART ONE:

A. Profile

Town: _____

Gender: [ ] Male [ ] Female

Age: [ ] 18 – 30 [ ] 31-49 [ ] <50

B. Household characteristics

1. Gender of household head: [ ] Male [ ] Female

2. Educational level [ ] Illiterate [ ] < 4 [ ] 4 – 8 [ ] 8 – 12 [ ] > 12

3. Marital status: [ ] Single [ ] Married [ ] Widow [ ] Divorced

4. Marriage type: [ ] Monogamy [ ] Polygamy

4a. If polygamy, number of wives _____

5. Age of household in years_____

5a. Total no. of members in the family: _____

6. Households size:

Age range	**Number of Males**	**Number of Females**
0 – 5 years		
6 – 15 years		
16 – 49 years		
50 – 64 years		
> 65 years		

7. Are you a native of this district? [ ] Yes [ ] No

7.1 If no, where did you migrate from? _____

7.2 Why did you come here? [ ] Resettlement [ ] Own migration [ ] To seek for job

8. How long have you been staying here? _____

9. What do you do for a living? [ ] Wage work [ ] Farming [ ] NTFP collection [ ] other_____

10. If NTFP collection, type of NTFP collected. [ ] Firewood [ ] Bamboo [ ] Others (please specify) _____

11. How many members in your house go for NTFP collection?

_____

PART TWO: Information regarding NTFPs availability

12. What are the different types of NTFPs available in this area?

No.	Type of Non-Timber Forest Product	Responses
	Fruits	
	Mushroom	
	Medicinal Plants	
	Bamboo	
	Firewood	

Key for abundance: 1= very abundant, 2= abundant, 3= rarely abundant

13. Which NTFPs are used as subsistence and which are for income?.....

14. Where do you find these NTFPs? [ ] In the forest [ ] On farm lands [ ] On bush fallows

15. Fill in the blanks

No.	**Type of NTFP engaged in**	**Season available***	**Times of collection annually#**
1.			
2.			
3.			
4.			
5.			

Key: **wet =1, dry =2, both seasons =3*

#once =1, twice=2, more than twice =3

16. Do you have access right for collecting NTFPs from the forests? [ ] Yes [ ] No

16a. If No, why? _____

18. Under which land tenure system do you have access to forest land with non-timber forest products?

[ ] Private [ ] Communal holding [ ] Both

19. If private, is it in reserved or unreserved areas? _____

20. If reserved area, do you seek authorization for collection of this resource?

[ ] Yes [ ] No

20. Has forest degradationany negative effect on quality and quantity of NTFPs?

i. Strongly agree

ii. Agree

iii. Disagree

iv. Don't know

PART THREE: Role of NTFPs

21. What is the most important NTFP that your household sells?

[ ] Bamboo [ ] firewood [ ] fruits [ ] others …….

22. To whom do you sell your NTFPs?

[ ] Private trader [ ] State trading enterprise [ ] Co-operatives

23. Would you tell us on what basis you sell the NTFPs?

[ ] Cash [ ] Credit [ ] Advance payment [ ] Others (please specify)

_____

24. How much do you earn daily from NTFPs sold? …….

25. Do you see any changes in quality and quantity of NTFPs you gather over the years?

How?

_____

26. Is income generated your main source of household livelihood? [ ] Yes

[ ] No

27. What kind of NTFPs do you use for subsistence/commercial purpose in your daily life for example firewood or some fruits or medicinal plants, etc?

_____

28. Who sells NTFPs you collect in the market (man/woman/children) and who owns the money?

_____

29. Do you collect NTFPs to mitigate immediate needs like seasonal unemployment, food shortage, crop failure or sickness of earning members in the family?

_____

30. What kind of NTFP do you collect which may contribute to physical capital such as bamboos, leaves? _____

APPENDIX TWO

QUESTIONNAIRE FOR MARKET TRADERS

UNIVERSITY OF GHANA

DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT-MPhil

Thesis Questionnaire

This questionnaire is in aid of a student of the above-named University to meet the requirement for the award of an MPhil in Geography on the topic "***Effects of land cover change on non-timber forest products and livelihoods of communities in Birim Central Municipality"***. This study is strictly for academic purposes and respondents are guaranteed that all responses shall be treated confidentially.

Please tick or write where applicable.

1. Age: [ ] 18 – 30 [ ] 31-49 [ ] <50
2. Marital status: [ ] Single [ ] Married [ ] Widow [ ] Divorced
3. Gender of household head: [ ] Male [ ] Female
4. Total no. of members in the family: ……..

5. Household size:

Age	**Male**	**Female**
0 – 5 years		
6 – 15 years		
16 – 49 years		
50 – 64 years		
> 65 years		

6. How long have you engaged in this business? [ ] < 5years [ ] 5-10years [ ] >10years
7. Are all the NTFPs you sell gotten from this area? [ ] Yes [ ] No
8. Which of these NTFPs is the commonest in the Municipality? ……
9. In what season of the year do you mostly buy and sell it? Dry or rainy? ……
10. What difficulties do you encounter in NTFPs marketing? ……
11. Is this business good? ……
12. How is it helping your family? …….....
13. Do you do only this business or there is something else you do to get more money? …….....

APPENDIX THREE

INTERVIEW AND DISCUSSION GUIDES

A. Interview Guide for Key Informants

i. Forestry Commission Officers

Section One: Forest cover change

1. Do you perceive any change in forest cover? Why do you say so? …….……

   …….....

2. Whattwo activities cause forest cover loss? .....

   .....

3. Have such activities impacted the forest?

   i. Strongly agree
   ii. Agree
   iii. Disagree
   iv. Don't know

Section Two: NTFPs

4. What are the different types of NTFPs available in these forests? (as written in the supplementary sheet attached).

5. Could you tell how you perceive the impact of harvesting and utilization of some NTFPs on forest conservation? .....

6. What technical assistance/advice do you give the NTFPs harvesters? ……..……
…...…….....

7. What purpose of harvesting of the resource do you permit in the reserved forests? [ ] Domestic [ ] commercial [ ] both

ii. Other stakeholders

1. How long have you been engaged in this work? .....
2. Have your activities impacted the forest?

i. Strongly agree

ii. Agree

iii. Disagree

iv. Don't know

3. Do you perceive any change in quality and quantity of NTFPs over the years? [ ] Yes [ ] No Why do you say so? …….....
4. Whattwo activities cause NTFP loss most? [ ] illegal logging [ ] mining [ ] farming [ ] others (specify).....
5. What are the different types of NTFPs available in these forests? (as written on the supplementary sheet attached).

iii. Assemblymen & opinion leaders

1. Are the forests in this district of any economic importance to people here? .....

   .....

2. a. Do you perceive any change in forest cover over the years?[ ] Yes[ ] No

   b. What of NTFPs? [ ] Yes [ ] No Why do you say so?

   a……

   b…….....

3. What two activities cause forest cover loss most? [ ] logging [ ] mining [ ] farming [ ] other (specify) .....
4. What are the different types of NTFPs available in these forests? (as written in the supplementary sheet attached)

APPENDIX FOUR

Table 2a Pseudo R-square 1

Asene	Cox and Snell	.350
	Nagelkerke	.513
	McFadden	.376
Aboabo	Cox and Snell	.627
	Nagelkerke	.673
	McFadden	.366

Table 2b **Likelihood Ratio Tests**

Community Name	Effect	Model Fitting Criteria	Likelihood Ratio Tests		
		-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
	Intercept	18.306[a]	.000	0	.
	Household size	22.526	4.220	2	.121
Akyem Asene	Level of edu	20.430	2.124	2	.346
	Gender of HH	20.334	2.028	2	.363
	Marital status	28.748	10.442	6	.107
	Intercept	67.456[a]	.000	0	.
	Household size	75.356	7.900	3	.048
Akyem Aboabo	Level of edu	79.030	11.574	3	.009
	Gender of HH	69.898	2.442	3	.486
	Marital status	99.081	31.625	9	.000

Table 2c Household characteristics

Parameter Estimates

Community Name	Occupation[a,d]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp (B)	
									Lower Bound	Upper Bound
Asene	Farming	Intercept	-1.684	9626.323	.000	1	1.000			
		Household size	.434	1.404	.096	1	.757	1.543	.099	24.178
		Level of edu	.846	1.409	.360	1	.549	2.329	.147	36.880
		Gender of HH - Male	-18.397	5589.708	.000	1	.997	1.024E-008	.000	.[b]
		Gender of HH - Female	0[c]	.	.	0	.	.	.	.
		Marital status - Single	18.751	7837.170	.000	1	.998	139203689.4	.000	.[b]
		Marital status - Married	14.627	7837.170	.000	1	.999	2251665.725	.000	.[b]
		Marital status - Widowed	-.669	9626.322	.000	1	1.000	.512	.000	.[b]
		Marital status - Divorced	0[c]	.	.	0	.	.	.	.
	others	Intercept	-28.780	9049.586	.000	1	.997			
		Household size	2.687	1.505	3.186	1	.074	14.682	.769	280.514
		Level of edu	2.140	1.593	1.804	1	.179	8.499	.374	192.965
		Gender of HH - Male	.359	.000	.	1	.	1.431	1.431	1.431
		Gender of HH - Female	0[c]	.	.	0	.	.	.	.
		Marital status - Single	18.821	9049.585	.000	1	.998	149256935.9	.000	.[b]
		Marital status - Married	16.332	9049.584	.000	1	.999	12388678.91	.000	.[b]
		Marital status - Widowed	-1.071	10163.751	.000	1	1.000	.343	.000	.[b]
		Marital status - Divorced	0[c]	.	.	0	.	.	.	.
Aboabo	Farming	Intercept	17.187	2.848	36.422	1	.000			
		Household size	.293	.611	.229	1	.632	1.340	.404	4.442
		Level of edu	.874	.761	1.319	1	.251	2.397	.539	10.654
		Gender of HH - Male	-1.785	1.465	1.486	1	.223	.168	.010	2.961
		Gender of HH - Female	0[c]	.	.	0	.	.	.	.
		Marital status - Single	-19.164	1.831	109.535	1	.000	4.757E-009	1.314E-010	1.722E-007
		Marital status - Married	-17.236	1.479	135.853	1	.000	3.270E-008	1.802E-009	5.933E-007
		Marital status - Widowed	-17.077	1.971	75.067	1	.000	3.833E-008	8.050E-010	1.825E-006
		Marital status - Divorced	0[c]	.	.	0	.	.	.	.
	others	Intercept	17.647	2.455	51.663	1	.000			
		Household size	-1.163	.705	2.721	1	.099	.313	.079	1.244
		Level of edu	2.319	.860	7.280	1	.007	10.168	1.886	54.819
		Gender of HH - Male	-.876	1.613	.295	1	.587	.416	.018	9.834
		Gender of HH - Female	0[c]	.	.	0	.	.	.	.
		Marital status - Single	-18.341	1.226	223.706	1	.000	1.083E-008	9.789E-010	1.198E-007
		Marital status - Married	-17.680	.000	.	1	.	2.097E-008	2.097E-008	2.097E-008
		Marital status - Widowed	-36.695	9492.678	.000	1	.997	1.158E-016	.000	.[b]
		Marital status - Divorced	0[c]	.	.	0	.	.	.	.
	Wage work	Intercept	.358	10588.834	.000	1	1.000			
		Household size	-1.209	.666	3.292	1	.070	.299	.081	1.102
		Level of edu	1.736	.807	4.629	1	.031	5.676	1.167	27.603
		Gender of HH - Male	.081	1.595	.003	1	.959	1.084	.048	24.728
		Gender of HH - Female	0[c]	.	.	0	.	.	.	.
		Marital status - Single	1.279	10588.833	.000	1	1.000	3.593	.000	.[b]
		Marital status - Married	-1.711	10588.833	.000	1	1.000	.181	.000	.[b]
		Marital status - Widowed	-18.695	13407.042	.000	1	.999	7.600E-009	.000	.[b]
		Marital status - Divorced	0[c]	.	.	0	.	.	.	.

a. The reference category is: NTFP collection for split file Community Name = Asene.
b. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.
c. This parameter is set to zero because it is redundant.
d. The reference category is: NTFP collection for split file Community Name = Aboabo.