CONTRIBUTION OF FIREWOOD HARVESTING AND TRADING TO THE LIVELIHOOD OF RURAL HOUSEHOLDS IN THE NORTH EAST GONJA DISTRICT IN THE SAVANNAH REGION OF GHANA

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at the Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institutions.

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ABSTRACT

This study assesses the contribution of firewood harvesting and trading to the livelihood of the people of the North East Gonja District. The aim of the study is to investigate how firewood harvesting and trading contributes to the livelihoods of the people in the district. The study was hinged on the Sustainable Livelihood Framework. Data was collected using semi-structured questionnaire, focus group discussion, and key informant interviews. Mixed sampling techniques were used in determining the sample size and chosing households for questionnaire administration. Random sampling was used to select communities while cluster sampling was used to partition each community into sections to help obtain representativeness of views across the communities and systematic sampling was used to choose households for administration of questionnaires. Sources of income and employment identified in the study area include firewood harvesting and trading, self-owned trade, livestock rearing, crop farming, casual wage labour and remittances. Firewood was fourth in terms of magnitude of income contribution to household income with a share of 15.43% while self-owned business contributed (25.65%), livestock (23.39%) and crops (19.93%), but was second in terms of employment of household members after agriculture. Despite the comparatively low mean income of firewood harvesting and trading, it remains a key source of cash income depended upon by most households. Firewood harvesting and trading largely could not improve households' assets base particularly financial, physical and social capitals. There was however some improvement in human and natural capitals. This is marked by high basic school enrolment of children in households, majority of household members having valid NHIS cards, and high knowledge in the cultural environment (landscape, flora and fauna) of the area, access to land (though without tenurial rights) and ownership of some poultry respectively. Harvesting of firewood is mediated by traditional authorities where there exist some loosely monitored rules and taboos that regulate the harvesting of firewood but not the trade. Regulation of firewood harvesting is ineffective on locals because it constitutes a critical source of cash income to meet household daily ingredients needs, education, health bills and other domestic expenses. There is no transparency and accountability in the little revenue generated from external harvesters. Firewood prices for a season are determined by negotiation brokered by any first seller within the season. The major factors motivating the reliance on firewood include poor educational background of household heads / spouses, lack of access to high earning alternative livelihood sources such as non-farm strategies and lack of access to financial capital. Improved livelihood from dependence on firewood is far from being realized. Therefore for any policy intervention, it is important to increase investment in education as a long term measure to diversify livelihood sources for improvement in livelihood; access to credit integrated with training in alternative livelihood skills for women and undertake afforestation projects to sustain the resources base. It is also important to support firewood harvesters to work in organized groups to enable them tap into the wealth of benefits embedded in social capital.

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CHAPTER ONE
INTRODUCTION

1.1 Background

The contribution of forest to the livelihood of the world's poor has received increased attention in recent times. Forest constitutes a major source of livelihood for rural households, providing employment and income especially for those who have limited options to improve their living standards (Timko *et al*., 2010; Sunderlin *et al.*, 2005; Shackleton and Shackleton, 2004). Numerous forest products are depended upon by the poor, but firewood is most depended upon for both subsistence and cash needs (Belcher *et al.,* 2015; Yemiru *et al.*, 2010; Mamo *et al.,* 2007).

According to Rehman *et al*. (2006), it is estimated that close to three billion of the world's population and over 800 million people in India depend directly on unprocessed solid fuels such as firewood and cow dung for household energy and other livelihood activities. Over two billion of these poor people who depend on firewood and other forest products for livelihood support are from developing countries (Belcher *et al*., 2015; Pandey, 2012; Bhatt and Sachan, 2004). Cerutti *et al*. (2015), found that about 93% of households in Sub-Sahara Africa (SSA) depend on wood fuel for everyday cooking needs with firewood being the most preferred choice in rural villages and charcoal in the cities.

Firewood dependence has been so widespread and virtually accepted as the universally most important forest product used in all villages and in almost all households (Belcher *et al*., 2015). In a study in Tigray in Northern Ethiopia, Babulo *et al.* (2008b) reported that while they found many rural households without livestock, there was none not using firewood. According to Belcher *et al.* (2015), the contribution of firewood to rural well-being is predominant and quite startling. For example, in the Chiradzulu District in Malawi, Kamanga *et al.* (2009) found that firewood contributed as much as 66.4%–77.9% to total cash and subsistence income reported as forest income.

Most rural households depend on agriculture as their primary source of sustenance but agricultural produce especially in rural Africa, are seasonal. This seasonality of rural livelihood sources creates shortages of food and cash income. Often, this results in forest products becoming important sources of cash income particularly to the very poor (Wunder *et al.*, 2014; Timko *et al*., 2010). Many studies

(Adhikari, 2017; Belcher *et al.*, 2015; Yemiru *et al.*, 2010; Mamo *et al.*, 2007; Vedeld *et al.*, 2007) have found that close to 40% of poor people depended on the forest during such periods, yet others also depend on it as a response to shocks (Wunder *et al.*, 2014).

In Ghana, fuel wood consumption is rising for both urban and rural inhabitants. This invariably has motivated many people to engage in the commercial harvest of fuelwood. Estimates from the 2010 Ghana Population & Housing Census showed that 73% of rural households and 48% of urban households use firewood and charcoal respectively for cooking (Ghana Statistical Services, 2010). In the Northern Region of Ghana, while there is high similarity across the land space in terms of environmental, social, and economic characteristics, the major character, similar across the area is poverty.

The increasing incidence of poverty and poverty gap in the Northern region coupled with poor contextual factors such as social services, policy implementation, and infrastructure development, serve as a motivation for the inhabitants to seek livelihood empowerments in fuel wood commercialization (Mohammed *et al.*, 2016). The poverty gap in the Northern region is one in every two persons (Ghana Statistical Service, 2014).

The choice to depend on low-value forest products such as firewood which is less paying in terms of income, may not represent the preferred choice of the household but an indication that the household is asset constrained (Babulo *et al.*, 2008a; Sunderlin *et al.*, 2005). Kamanga *et al.* (2009) elaborated that, poor households remain directly more dependent on forest resources than wealthy households, but the rich earn more from forest resources than the poor due to the asset endowment of the better-off households.

Forest products are depended upon for several purposes (Arnold & Townson, 1998), however, from a sustainable livelihood perspective, forest products play three important roles in the livelihood of the rural poor (Babulo *et al.*, 2008a; Angelsen & Wunder, 2003). These roles include (i) as a safety net in times of foreseen and unforeseen calamities such as death or sickness of a husband, crop failure due to low rainfall or infestation, (ii) for consumptive purposes to help sustain current levels of consumption and to meet daily household needs including settlement of debts (Timko *et al.*, 2010; Sunderlin *et al.*, 2005; Arnold & Persson, 2003) and (iii) as a pathway out of poverty (Rayamajhi *et al.*, 2012; Kamanga *et al.*, 2009). This refers to the

ability to depend on forest resources to raise the needed income capable of diversifying into high earning livelihood activities for an improved and a sustained living (Kamanga *et al*., 2009; Babulo *et al.*, 2009; Vedeld *et al.*, 2007). Another important role of firewood resources to poor households is the gap filling function. This entails dependence on forest resource for cash and subsistence income to support living during off farming seasons when households experience food and income shortages for a couple of months (Wunder *et al*., 2014)

It is reported in many studies (Timko *et al.,* 2010; Yemiru *et al.*, 2010; Kamanga *et al*., 2009; Babulo *et al.*, 2008a; Arnold & Perssonm, 2003; Cavendish, 2000) that, the degree of dependence, utilization, and consequent benefit from firewood or forest products harvesting for socioeconomic well-being, vary among households. These variations in benefits are attributed to differences in household socio-economic characteristics such as household income, asset endowment, education level, family size, gender, sex, age, and other contextual factors such as access to the forest, access roads, access to credit facilities, and policy regime.

1.2 Problem statement

The harvesting and trading of firewood in the North East Gonja District (also called the Kparba Area) constitute a major livelihood activity in the district. It is a primary source of energy for households cooking and heating, livelihood security for the vulnerable, employment and income for the people especially women (Arnold & Persson, 2003). Harvesting and trading of firewood is a daily routine undertaken mostly by women basically to meet current-consumption needs and to provide a safety net in times of hardship (Belcher *et al*., 2015; Kamanga *et al*., 2009). In a similar fashion, many big size trucks cart firewood to neighbouring Tamale on a daily basis through out the year. The activity is much depended upon by most communities and households in the area and it makes important contribution to households' livelihood. While the harvesting and trading of firewood make important contribution to the livelihood of the people in the district, understanding of its role as well as the firewood situation in the district has been hampered by the paucity of reliable information. The majority of studies on forest livelihoods tend to focus on the charcoal with limited studies on firewood contribution to rural livelhioods (Agyei *et al*., 2018; Brobbey *et al*., 2019). The absence of this scientific information on the contribution of firewood harvesting and trading to the livelihood of the people in the

district, not only limit understanding of the activity as an important source of livelihood but also undermine understanding of the situation of firewood in the district. It also hamper the development of policies and other interventions that seek to contribute to the improvement in wellbeing of the people in the district. It is in the light of providing this scientific information that this study is conducted.

1.3 Aim and objectives

This study seeks to investigate how firewood harvesting and trading contribute to the livelihood of the people of the North East Gonja District of Ghana.

Specific objectives of the study are:

1. To assess the contribution of firewood harvesting and trading to rural household income and employment in the North East Gonja District of Ghana.
2. To assess the contribution of firewood harvesting and trading to the building of livelihood capitals (physical, financial, social, natural, and human capitals).
3. To identify factors that motivate reliance on firewood harvesting and trading.
4. To investigate the institutional arrangements that mediate access to firewood harvesting and trading.

1.4 Research questions

The following questions guided the conduct of the study.

1. How does firewood harvesting and trading contribute to household income and employment in the North East Gonja District?
2. Are households able to build or acquire a mix of livelihood assets from the harvesting and trading of firewood?
3. What are the factors that motivate people's reliance on firewood as a major source of livelihood?
4. What are the existing institutions that mediate access to firewood?

1.5 Significance of the study

Firewood is a renewable natural forest resource heavily depended upon for livelihood support in the North East Gonja District. Though renewable, the resource can be depleted when heavily depended upon for long in an unsustainable manner. Providing scientific information on the utilisation and resulting benefit is useful for planning and management decisions concerning the sustainable use of the resource. This is particularly important given the volumes that are transported out of the area on a daily basis through out the year. This study will be useful to many stakeholders to better understand and appreciate the welfare implications of degradation and over exploitation of natural resources like firewood. Sustainability of the firewood resource remains a key concern. Furthermore, the study on firewood harvesting and trading in the North East Gonja District will inform both local and national level policy decisions and actions relating to the design of forest-led poverty reduction strategies with the ultimate aim of improving livelihood. The study could provide relevant information for the District Assembly in the development of its Medium Term Development Plan. For instance the factors that drive reliance on firewood and its practical contribution to household income and asset building would inform the assembly for that matter government, on the specific areas that require investment to improve upon the lives of the people. Similarly, other agencies such as the Forestry Commission will require this information to pursue measures of conservation and rural livelihood improvement. Often NGOs and CSOs and othe development agencies are more attracted to issues of poverty, vulnerability, livelihood and sustainability, this study that inestigates poor sources of livelihhod as well as the threat to the sustainability of the firewood resource as a source of livelihood depended upon by many poor people, will find the information very useful for project planning and for community education. Undoubtedly, this study will also provide a basis for further research by researchers.

The absence of such scientific information is greatly hampering understanding of the trade and the opportunity for sustainable utilization. According to Arnold (2003) the absence of, or inadequacy of data on fuelwood is partly attributed to the fact that fuelwood trade is engaged in by the poor who do not have the capacity or have less concern to document quantities of firewood consumed and traded and also those engaged in it are remotely located, thus leaving an important information gap.

1.6 Scope of study

Geographically, this study covers the North East Gonja District of the Savanna Region. The content of the study is exclusively a firewood based study limited to four thematic areas, that is, contribution of firewood harvesting and trading to household income and employment; contribution to acquisition of livelihood capitals. The other areas include factors that motivate reliance on firewood and institutions that mediate access to firewood resource. The Sustainable Livelihood Framework as espoused by Chambers and Conway (1991; Scoones, 1998) serves as the conceptual framework for the study.

1.7 Organization of the thesis

The study is organized into six chapters. Chapter two reviews relevant literature, while chapter three presents a detailed methodology of the study. Chapter four presents the research findings and chapter five discusses the findings. Lastly, Chapter six covers the conclusion and recommendations from the study.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter reviews relevant literature on the contribution of firewood harvesting and trading to the livelihood of the rural poor. The review focuses on four major areas: (i) sources of rural livelihood in relation to employment and income (ii) the contribution of firewood to building livelihood capitals; (iii) factors motivating reliance on firewood; and (iv) institutional arrangements mediating access to firewood. The chapter ends with the conceptual framework of the study.

2.2 Definition of key terms used in the study

Firewood wood, has been defined to be wood whose form is rough and could be branches of trees, logs, sawdust, pellets, and twigs used mainly for energy generation (FAO, 2002 cited in Mohammed *et al*., 2016).

Livelihood: Livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is considered sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future without undermining the natural resource base (Chambers & Conway, 1991).

Livelihood strategy: This denotes the range and combination of activities including the choices that people make and undertake to achieve their livelihood goals (DFID, 1999 cited by Babulo *et al.*, 2008a).

Household income or total household income: This refers to the return on labor and capital owned (Yemiru *et al.*, 2010). The constituents of household total income consist of, crop income, livestock income, off-farm income, net remittances (transfers), business, and forest environmental income (Belcher *et al*., 2015; Wunder *et al*., 2014; Babulo *et al.*, 2008b). In a simpler form, Arnold and Perez (2001) also explained total household income as the sum of incomes from the various environmental sources - forest environment and non-forest environment. Examples of forest environmental products include firewood, fodder, leaves, herbs, and timber while non-forest environmental products, on the other hand, include livestock, agriculture, etc.

Forest environmental income (Forest income): This is defined as the sum of values resulting from the extraction of raw materials from forest, processing forest products, and wages for forest-related activities (Angelsen *et al.*, 2014; Rayamajhi *et al.*, 2012). Angelsen *et al.* (2014) explained that forest products refer to products whose supply depends on the existence of the forest and hence incomes generated from the sale of these forest products are referred to as forest incomes. Examples include firewood, fodder, honey, house building materials, etc. Sjaastad *et al*. (2005) and Cavendish (2000) expand forest resources to include other environmental resources like swampy areas which can be used for household welfare.

Relative forest income: This is the share of forest income across households' total incomes (Rayamajhi *et al.*, 2012) or the share of total household income contributed by forest extraction (Mamo *et al*., 2007).

2.3 Sources of rural livelihoods

Rural people derive income from multiple sources by pursuing or maintaining a wide range of economic activities or income portfolios (Vedeld *et al*., 2007) which involve on-farm, off-farm and non-farm activities to secure a living (Dalka, 2016; Ellis, 2000). They do this by engaging in several activities simultaneously or depend on a diversity of resources from the natural cultivated and non-cultivated environment for food, fuel, fodder, construction materials, medicine, and other products and activities (Angelsen *et al.*, 2014; Barham *et al.*, 1999; Ellis, 2000, cited in Belcher *et al*., 2015).

Income diversification is a distinguishing feature of rural livelihood strategies in poor countries (Ellis, 2000 cited by Vedeld *et al.*, 2007) because rural households cannot obtain sufficient income from a single economic activity and also reduce risks (Sunderlin *et al*., 2005). Diversification refers to a combination of different livelihood activities or income-earning activities to reduce risk and vulnerability (Yemiru *et al*., 2010). Barham *et al.* (1999) cite the mix of rural economic activities to include agriculture, fishing, hunting, gathering, and other forest product extraction. It may take place as a means to accumulate resources or as a means to cope with stress and shocks to prevent further impoverishment. The ability to diversify is much dependent on asset endowment and the level of risk associated with alternative livelihood options (Ellis, 1998; Scoones, 1998).

Households engage in diverse livelihood strategies to meet subsistence needs, generate income to improve wellbeing, obtain insurance in the form of safety- nets, and gap-filling, and also obtain a path-way out of poverty through capital accumulation (Vedeld *et al.*, 2007; Ellis, 1998). Diversification is thus a strategy associated more with the poor who are usually unable to specialize in a particular strategy for higher-earning (Vedeld *et al.*, 2007; Angelsen & Wunder, 2003).

According to Belcher *et al.* (2015), the most important sources of income (cash and subsistence) to the rural poor, are agriculture, forest products, non-farm (trade and salary, which includes wage jobs, small businesses, and petty trading), and off-farm (i.e. selling out labour to work on other people's farms). While livestock is part of agriculture, it is separated as an important asset and as a supplementary source of subsistence and cash income in many households (Belcher *et al.*, 2015). Other sources of income include receipts of remittances from migrant workers and transfer payments to households (Babulo *et al*., 2008a).

Asset endowed households are easily able to specialize or diversify strategies to earn a higher income than asset poor households (Angelsen & Wunder, 2003). The ability to diversify thus suggests a negative relationship between total income and forest dependence, where high total income is associated with less forest dependence and low total income comes with greater forest dependence (Vedeld *et al.*, 2007). Kamanga *et al*. (2009) elaborated that this view has however been challenged by many studies (Angelsen *et al.*, 2014; Kamanga *et al.*, 2009; Mamo *et al.*, 2007; Sunderlin *et al.*, 2005) that the better- off households rather depend more on higher-income from forest environmental resources than low-income households.

In pursuant of livelihoods, family labour as an important household socioeconomic asset is important in any of the livelihood strategies (Arnold & Persson, 2003) such as farm and non-farm activities, where the level of skill or training of labour greatly influences the type of strategy and its associated earnings (Rayamajhi *et al.*, 2012; Yemiru *et al.*, 2010; Kamanga *et al.*, 2009). Kamanga *et al*. (2009), report that the poorest households are found to depend more on agriculture, forest income, and off-farm activities (mostly selling their labor to other farmers) while the less-poor have higher incomes often from non-farm (self-employment and salary) activities. For example, in their study, Rayamajhi *et al*. (2012) found that 64% of households sold labour, out of which half were unskilled and as such offered off-

farm labour and 25% skilled labour who were mainly teachers, technicians, and others as NGO staff.

The degree of dependence of the poor on forest products makes natural resources very important to the poorest (Kamanga *et al*., 2009). Indeed, the capacity to diversify helps improve livelihood security and increases income in an environment where there is no single dominant income source available. However, this capacity to diversify is a function of asset endowment which the poor do not have (Kamanga *et al*., 2009). Dependence on forest and non-forest sources of income by rural households run on a continuum from households that depend entirely on these incomes to those that do not depend on them at all (Vedeld *et al.*, 2007).

To some households, subsistence and cash income from forest resources complement other major sources, (Babulo *et al*., 2008b; Arnold & Persson, 2003) but to others, it constitutes the main source of livelihood. This is particularly so for the poorest, such as female-headed and labor-poor households (Timko *et al.*, 2010; Yemiru *et al.*, 2010). Where forest resources are available, people use them to meet subsistence needs and also as tradable goods to generate cash income (Belcher *et al.*, 2015).

The primary source of income to the rural poor is agriculture, which by far is the prominent source of income that can help the poor accumulate assets to escape poverty (Rayamajhi *et al.*, 2012). According to Angelsen *et al.* (2014) agriculture comes second in terms of contribution to household income after non-farm income, which in their study accounts for 37% of total household income. When agriculture even dominates as the primary source of income, fuelwood collection remains an important source of supplementary income earning, mostly because home consumption could not be met through farming alone (Dalka, 2016). While agriculture represents such an important livelihood strategy capable of helping the poor to escape poverty, it is beset with the challenges of access to land especially by poor female-headed households or widows without male children (Kamanga *et al.*, 2009). In a related study Yemiru *et al.* (2010) stress that while the poor could have access to farmland, the poorest of the poor do not. Wunder *et al. (*2014) posit that such households are highly vulnerable to livelihood shocks.

On the other hand, non-farm income strategies comprise self-owned businesses, remittances, receipts, and rents; and other salary opportunities (Rayamajhi *et al.*, 2012). Kamanga *et al*. (2009) however simplified that, non-farm income

includes earnings from permanent employment and self-generated income activities. While this is an important source of income capable of taking the poor out of poverty, it is not so favourable to the poor because it often requires some amount of capital and some skills which very few households can afford (Kamanga *et al.*, 2009; Wunder *et al.*, 2014). In all this, the poor are known to be low in skills, poor in asset base and poor in educational qualification as well as health, tending to limit the ability of householders in utilizing high income earning non-farm employment opportunities (Babulo *et al.*, 2008b; World Bank, 2001; cited in Sunderlin *et al.*, 2005; Sunderlin *et al.*, 2005). As a result of these, the rural poor resort to semi-skilled labor such as construction, carpentry, restaurant, tailoring, and shoemaking and few cases of permanent jobs (Rayamajhi *et al.***,** 2012).

Once the poor are unable to raise the needed capital for high-income ventures, it is a rational choice to choose forest-related activities that do not need initial financial investment (Babulo *et al.*, 2008a; Cavendish, 2000). As a result of this, self-owned businesses such as teashops, grocery shops, liquor distilleries are more a preserve of households in higher-income classes (Angelsen *et al.*, 2014). In a comparative statement, Rayamajhi *et al.* (2012) indicated that non-farm income sources generate between 66-78% of total household income as against forest income which in the sample studied, generated between 2-8%. In agreement with the view that non-farm activities are the main option of getting the poor out of poverty, Kamanga *et al.* (2009) reported that the contribution of non-farm income was 47%, followed by agriculture with 28% and forest 15%.

However, off-farm and reported remittances contributed only 10%. Though in their study, Rayamajhi *et al.* (2012) found that non-farm income makes a significant contribution to household income (between 58% to 71 %), they categorically stressed firewood as being the most important forest product depended on by the poorest for subsistence and cash needs.

Remittances as a form of non-farm income refer to earnings made from family members who migrate, often to urban centers in search of better life opportunities (Rayamajhi *et al.*, 2012). In their travels to urban centers, they usually engage in artisanal or casual wage jobs for better incomes from which they remit their families home to mitigate the burden of poverty (Rayamajhi *et al.*, 2012; Babulo *et al.*, 2009). Receipts on the other hand, represent government transfers to the very poor to mitigate the impact of poverty (Sunderlin *et al.*, 2005). A good example in Ghana is

the Livelihood Empowerment Against Poverty (LEAP) program. However, such transfers contribute the smallest (about 1%) of the average household income (Babulo *et al.,* 2008b).

Off-farm wages represent earnings or wages from labor offered especially by working on other peoples' farms (Kamanga *et al.,* 2009) and related wage-earning opportunities. It is an important strategy used by the rural poor in coping with livelihood shocks (Wunder *et al.,* 2014). But this is particularly important to families with more available family labor (Yemiru *et al*., 2010).

2.4 The role of forest resources to rural livelihood

Forest constitutes a major source of livelihood sustenance for rural households who often have limited options to livelihood (Timko *et al*., 2010). The many uses of the forest to the poor include income and subsistence, as a means of coping with shocks and stresses, and as a means of asset/wealth accumulation to escape poverty (Yemiru *et al*., 2010). From a sustainable livelihood perspective, forests are natural assets that contribute to household cash income, food security, reduced vulnerability, and improved well-being through non-material benefits (Warner, 2000 cited in Yemiru *et al.,* 2010). However, the degree of benefit from forest resources is the interplay between contextual factors, as institutions controlling access to forest resources, access to markets, proximity to forest resources, access to credit and household characteristics such as income, available family labour, asset endowment, sex, age, family size, education, etc. (Yemiru *et al*., 2010).

It is important to stress that firewood is the most important forest product for all households, accounting for about 55% of forest income of poor households (Mamo *et al.,* 2007). Based on the share of forest contribution to household livelihood, Kamanga *et al*. (2009) define forest dependence as the share of income derived from forest environmental sources relative to all other sources. Thus the proxy used for household dependence on natural forest resources is the share of absolute household income or relative income that is derived from the forest (Mamo *et al.,* 2007).

According to Vedeld *et al.* (2007), the poor are more dependent on forest income, and this income has a strong equalizing effect on local income distribution. They note however that, very high dependence is the result of a lack of livelihood options. It is explained that the poor remain dependent on forest products partly because they do not have the requisite capital to start a private business to earn higher

income (Babulo *et al.*, 2008a; Cavendish, 2000). Though the choice to depend on forest resources such as firewood may be less paying in terms of income, the decision is considered most rational under circumstances of limited livelihood options. Kamanga *et al.* (2009) however, note that poor households remain directly more dependent on forest resources than the wealthy households though the rich earn more from forest resources than the poor.

Illustrating the relative dependence of the poor and the rich on forest resources, Timko *et al*. (2010) report that the better-offs who depend on forest resources generate about 50% more cash than the poorest. On the contrary, the majority of the poor depend more on firewood but generate less compared to the better-off. In Madagascar, Timko *et al*. (2010) report that 90% of the poorest collect firewood compared to 80.2% of the less poor and 76.8% poor, with minimal or no alternative livelihood options.

Similarly, Mamo *et al.* (2007) found that while forest income represents 59% of poorest households' income, the proportion declines to 30% for the wealthiest households. On the same latitude, Cavendish (2000) supports that, the poor are more natural resource dependent than the rich where the poor derive a greater share of their overall needs from forest products and activities. The subsistence value of the forest is of particular importance to the poor than the cash value (Belcher *et al*., 2015), though both Cavendish (2000) and Awono *et al*. (2010) stress that, sale of forest products particularly firewood helps meet basic household economic transactions.

Contrary to popular findings, results from Adhikari (2017) suggest that, wealthier households are more dependent on Common Property Resources (CPR) than poorer households. He explained that the rich have the capacity to extract more and transport more and hence earn greater benefit than the poor. In connection with this, Mamo *et al*. (2007) confirmed that the wealthy are often the heaviest users of forest resources. However, with relatively unrestricted access to forests, the poor usually derive a greater share of their overall needs from forest products and activities than the wealthier.

From a sustainable livelihood perspective, forest products play three important roles in the livelihood of the rural poor (Babulo *et al*., 2008a): first as a safety net second, for consumptive purposes. and third as a pathway-out of poverty (Babulo *et al.*, 2009; Kamanga *et al*., 2009; Vedeld *et al.*, 2007). The safety net function refers to the livelihood support that forest resources provide to the vulnerable in times of

emergencies such as the death of a family head. While Wunder *et al.* (2014) find forest as natural insurance for the poor in meeting periodic income and subsistence needs, Mamo *et al.* (2007) however, assert that forest is not merely a safety net, to be utilized in times of predictable or unpredictable downturns, but an essential, perennial livelihood source for poor and "wealthy" households alike.

Wunder *et al.* (2014) elaborate that forests not only provide a safety net to shocks but also resources for seasonal gap-filling. Gap-filling is a response to predictable and unpredictable seasonal fluctuations in resource flows, where it refers to the periodic income support during off farming seasons or other intervening situations during which a household is at its lowest production and will require a social safety net. While firewood dependence may be limited in its importance, it is a strategic source of income during shortfalls (Wunder *et al.*, 2014).

It is acknowledged however that, the safety net function of the forest is particularly important to the poorest, to the extent that, any overuse, degradation, or depletion of the resource becomes more detrimental to the survival of the poor than the rich (Vedeld *et al*., 2007). In other words, pursuing conservation programs that restrict access to forest resources may relegate rural people towards livelihood deprivation (Babulo *et al*., 2008b).

The consumptive purpose of forest seeks to sustain current levels of consumption and meet household needs and also prevent further impoverishment but indeed unable to promise a means to step out of poverty (Rayamajhi *et al.*, 2012; Kamanga *et al.*, 2009). The use of the forest as a pathway out of poverty refers to the ability to depend on forest resources to raise the needed income capable of diversifying into high earning livelihood activities for an improved and a sustained living (Kamanga *et al.*, 2009). The approach to this end is explained by Angelsen and Wunder, (2003) that, households may accumulate forest resources to escape poverty through intensification of extraction activities or specialization in some forest strategies.

2.5 Significance of firewood in rural livelihoods

Firewood is the main source of energy used for cooking and heating and also a major source of income for rural households (Bhatt & Sachan, 2004). Firewood is important to the effect that it provides cash income support to the rural poor during seasonal shortages from major livelihood sources as agriculture (Mamo *et al.*, 2007).

From their study, Mamo *et al.* (2007) found that 36% of households depend on firewood during seasonal food shortages for cash income. Many other studies (Adhikari, 2017; Belcher *et al.,* 2015; Yemiru *et al.,* 2010; Vedeld *et al.,*2007, Mamo *et al.,* 2007), have found firewood to be the most important forest product contributing substantially to subsistence and cash needs of the rural poor and playing a significant role as a gap filler as well as response to shocks (Wunder *et al.,* 2014).

In the Chiradzulu district in Malawi, Kamanga *et al.* (2009) found that firewood contributed as much as 66.4%–77.9% to total reported forest income, from both cash and subsistence incomes. Besides, the use of firewood has been so widespread and virtually accepted as the universally most important forest product used in all villages and almost all households, making the predominant role by firewood quite startling (Belcher *et al.,* 2015). In a similar study, Kamanga *et al.* (2009) found that about 90% of Malawi's population depend on firewood and charcoal for heating. This was not different from Babulo *et al.* (2008b) who indicated in their study in Ethiopia, that, while many households were found without livestock, they wasn't a single household found without using firewood. Also, firewood represents an important subsistence product particularly to the poor which is locally and commercially traded for cash income (Belcher *et al.,* 2015).

2.6 Sources of firewood

The main sources of firewood include exclosures, private ownership (homestead or cropping land), and communal or open-access resource (Babulo *et al*., 2008a). Exclosures are public or community restricted sources where access is gained through permission (Babulo *et al.,* 2008b). This source suggests a commonly owned property that seeks to ensure sustainable management for the continuous supply of a forest product, particularly firewood. For example, in a study in Tigray, in the highlands of Ethiopia, Babulo *et al.* (2008a), found that villages located in the highlands and middle highland areas were relatively better endowed with exclosures and other communally owned natural environments. These villages had continuous access to forest products and this largely contributed to lessening their poverty burden.

Communally owned forest resources or common property resource, on the other hand, are open access resources with no restriction or control. These sources are suitable as insurance or safety nets for the poor and the vulnerable (Wunder *et al.,*

2014). This is to say they are freely accessible and can be collected at any time anywhere (Zidago & Wu, 2015). However, this source is subjected to overexploitation and consequent degradation (Zidago & Wu, 2015). Supporting this assertion, Babulo *et al.* (2008a) in a study in the Ethiopian highlands, found that, the densely populated upper highlands that depended on common natural resources were less endowed with forest environmental resources and hence generate less forest environmental income and that empirical evidence from the area showed a high burden of poverty.

Homestead or private lands are household owned and accessible upon agreement by the owner. Perhaps for a better description, Arnold and Persson (2003), in their study in India and Africa, indicated that they found unrestricted access to firewood from Common Property Resource (CPR) changing over to use only on household lands or private lands. With these sources of firewood or fuelwood, aside purchasing or barter, the only worse way to access this resource is to steal. It is thus characterized by the right to exclude other community members from use. Arnold and Persson (2003), clarified that this source of accessing firewood makes the landless worse off. However, products from private lands are found to contribute less in terms of generating cash income from the sale of such products (Adhikari, 2017).

To improve the well-being of the poor is to secure the right of access and ownership of natural capital as well as improvement in socio-economic infrastructure (Timko *et al*., 2010; Angelsen *et al*., 2014). This is because natural capital provides a variety of products and services to rural poor households while social infrastructure enables access to opportunities (Dalka, 2016; Yemiru *et al.*, 2010; Sunderlin *et al.*, 2005; Ellis, 1998). These include consumer goods, production inputs, and inputs into productive capital, assets, and a range of indirect values (Cavendish, 1998., cited in Babulo *et al*., 2008b). Dalka, (2016) cites roads and market centers as other important social infrastructure that enables access to opportunities for higher-income. Importantly, the forest provides subsistence and cash income for the rural poor including a safety net function in times of shocks (Wunder *et al.,* 2014).

2.7 Uses of firewood income

In his study in Zimbabwe, Cavendish (2000), reports that, income earned from firewood and other Non-Timber Forest Products (NTFPs) are used to meet basic economic transactions at the household level. Detailing the uses of income from NTFPs, Sunderlin *et al.* (2005) report that forest income was used to pay school fees,

purchase agricultural inputs, or to pay emergency medical bills. This conforms with Shackleton and Shackleton (2004) when they similarly mentioned payment of school fees, uniforms, and books as the uses of forest income in their study in South Africa. As Awono *et al.* (2010) corroborate the views above, the uses of firewood income were further expanded to include investment in home improvements, phones, televisions, and radios. They specified the proportions of such income in some key sectors, citing that education accounted for, 30%, food, 27% and family health 25% and that traders spent a relatively small percentage of their revenue on events such as marriages, funerals and baptisms, and household living expenses.

2.8 Contribution of firewood to the building of livelihood capitals

Economic security for life is importantly linked to income and asset ownership (Dalka, 2016). The choice of a particular strategy or strategies is dependent on the ownership of capital assets of the household (Yemiru *et al*., 2010). Empirical evidence suggests that asset ownership may lead to better economic, psychological, social, civic, political, and intergenerational outcomes (Sherraden, 1991 cited in Dalka, 2016).

Under the Sustainable Livelihood Framework, capital or assets refer to the five main livelihood capitals, namely, human, natural, physical, financial, and social capitals. Ownership of these capitals in different amounts and quality are considered criteria for assessing the well-being status of households or livelihood outcomes (Nawrotzki *et al*., 2012; Babulo *et al.*, 2008b; Chambers & Conway, 1991)

Firewood harvesting is an important rural livelihood strategy. It is known that rural households depend on diverse strategies to meet their subsistence, consumptive, and cash needs. These may include agriculture, fishing, forest resource collection, etc (Nawrotzki *et al.,* 2012). However, the choice of a particular strategy is directly related to the asset endowment of a household (Mamo *et al.,* 2007). The difference between asset endowments indicates the difference between the poor and the wealthy households. Asset endowed households have the opportunity to choose superior or high-income earning strategies than the poor.

Similarly, the venture or strategy in which household assets are invested determines the response to shocks or produces different income outcomes (Wunder *et al.,* 2014). Different asset mix will also yield different income levels that can be ranked in welfare terms. Thus, given the option to choose among high yielding and

low yielding strategies, (by revealed preference), if any household fails to choose a high yielding strategy or activity, it is because that household is constrained to making such a choice and not that it is the preferred choice (Babulo *et al*., 2008a). This means involvement in firewood harvesting and sale is largely due to asset poverty (Cavendish, 2000) than being a preferred choice.

2.8.1 Human capital

Human capital refers to the health, nutrition, education, capacity to work and adapt, level of knowledge and skills, etc. of a person in the pursuit of a livelihood strategy (Chambers *et al.,* 1991). This study will however, limit human capital as an asset, to education, skill development, and health. Many studies (e.g., Kamanga *et al*., 2009; Dalka, 2016; Adhikari, 2017) have reported that well-educated people have a wider spectrum of opportunities and are therefore less dependent on forest resources and hence earn lower forest income (Wunder *et al.,* 2014). Cavendish (2000) in Zimbabwe, Puentes-Rodriguez *et al.* (2017) in Burkina Faso, Mamo *et al*. (2007) in Ethiopia, Babulo *et al.* (2009) also in Ethiopia, etc., all found that majority of the rural dwellers who engaged in the extraction of forest resources particularly firewood as a source of livelihood are illiterates with few having primary education and diploma level education.

Elaborating on educational levels of forest-dependent households and how it constrains them in taking advantage of high yielding opportunities, Mamo *et al*. (2007) reported that as much as 58% of household heads in their study area were illiterates. None of the household heads had completed high school studies to qualify for engagement in paid public services or other formal employment. Similarly, Vedeld *et al*. (2007) found that literacy levels were low, and consequently, enrolment rates into secondary and post-secondary education were equally low. Furthermore, in their study, Baland *et al.* (2003), found that about 70% of household heads have no education, are poor, and heavily dependent on firewood. The study thus concludes that education is a key factor in reducing dependence on firewood and other Environmental Common Property Resources (ECPRs).

Shackleton and Shackleton. (2004a) however argued that, high dependence on the forest is not exclusively due to low education and skill, but the lack of employment opportunities. This was based on their study that found that more than half of their study population (NTFP traders) had some secondary education (more

than 7 years) with 18% having a school leaving certificate and one with a tertiary diploma, but remain dependent on the forest. Formal employment is associated with better education which has the advantage of job security and better remuneration. Such opportunities raise the income levels of the poor and hence their ability to afford other assets (Kamanga *et al.*, 2009). Significantly, this can help contribute to improved social wellbeing thereby lifting the poor out of poverty. Thus Angelsen *et al*. (2014) establish that there is a negative correlation between higher education and forest extraction.

The health state of people is an important determinant of human capital. This, however, is based on the ability of a household to provide the appropriate nutrition and ability to access health care (Awono *et al.,* 2010). Often however, this is constrained by low earnings from dependence on the firewood trade (Awono *et al.*, 2010). The lack of resources to purchase supplementary food coupled with the periodic shortage of food in the year (Mamo *et al.,* 2007) occasionally results in food insecurity, starvation, malnourishment, and child mortality in poor households (Kamanga *et al.,* 2009). Biran *et al*.(2004) report that accessing fuelwood comes along with risks of maims, snake bites, rape, and high loss of calories especially when fuelwood is accessed under degraded forest conditions which will involve long distance travels to collect firewood.

2.8.2 Financial capital

Financial capital has been defined to include savings in the bank and the ability to lend money to other households (Yemiru *et al*., 2010). The rural poor depend more on forest and environmental resources for a relatively large share of cash income with firewood being the most important forest product and source of income (Mamo *et al*., 2007). However, given that firewood is a low-value forest product coupled with the fact that the poor do not have the means to extract and transport large amounts through the usually inaccessible terrain, cash income for poor households from this source tend to be low (Belcher *et al*., 2015; Babulo *et al.*, 2008b). Consequently, firewood dependent households tend to have low or minimal financial savings with intermediary banks (Yemiru *et al.,* 2010; Cavendish 2000; Barham *et al.,* 1999)

Dependence on forest environmental resources for the generation of cash income varies among income groups (Rayamajhi *et al.,* 2012). Poorest households are

more dependent on forest resources but earn the lowest income as compared to the less poor (Yemiru *et al.*, 2010). In terms of earnings for instance, Mamo *et al.* (2007) found that the annual forest income for the wealthiest group amounted to $191, a figure roughly twice that of the poorest group, ($95). In Swaziland, Manyatsi and Hlophe (2010) found that monthly firewood income contribution was between $67 to $133. However, this was described as significant on the basis that the country had 69% of its population below the poverty line of $2 per day. While absolute cash income figures might appear low, statistically they are significant to the rural poor at the brink of survival (Angelsen *et al*., 2014)

As an important component of financial capital, Rayamajhi *et al.* (2012) found that there is a negative relation between remittance, savings, and forest dependence. Where households receive high remittances or have high savings they tend to depend less on the forest. From their study sample, Rayamajhi *et al.* (2012) found that 23% of households received remittances while savings were available to 85% of households making them depend less on firewood. Consistent with many studies, Cavendish (2000) and Barham *et al.* (1999) indicated that the forest-poor have low savings with their intermediary banks. Highlighting the importance of household savings, they expatiated that, it supported the purchase of agricultural implements and also protected the farmer from disposing their farm produce at low prices during periods of glut, (Wunder *et al*., 2014).

Forest incomes are too low to help the poor out of poverty (Vedeld *et al*., 2007). Rather they are sufficient to meet consumptive needs rather than asset accumulation (Kamanga *et al*., 2009; Babulo *et al.*, 2008b). In a study in Malawi, Kamanga *et al.* (2009) found that some poorest households (13) depending on forest resources earn as low as $0.14 as daily average income per capita which compares with Rayamajhi *et al.* (2012) who also found that forest income contributes only about 2 -8% cash income of poorest households. Timko *et al*. (2010) found that households gather on average, as much as 6,164 kilograms of fuel wood per year, valued at US$39.

2.8.3 Physical capital

Physical capital entails the basic infrastructure (e.g. transport, shelter, water, energy, and communications, etc) and the production equipment as means of enabling the pursuit of various livelihood strategies (Nawrotzki *et al.,* 2012). Measured as

wealth, physical capital has been variously listed to include, livestock, land size, housing, plantations, tools, machinery, clothing, amount of adult labour, ownership of house in a nearby town, etc., (Marie *et al.*, 2017; Angelsen *et al.*, 2014a; Yemiru *et al.*, 2010; Mamo *et al*., 2007)

Besides serving as a means of production, ownership of physical capital, importantly also defines the wealth status or well-being of a household (Yemiru *et al.*, 2010; Babulo *et al.*, 2008a). Endowment in physical capitals facilitates forest extraction and transport (Adhikari *et al.*, 2017; Cavendish, 2000) and thus making a significant contribution to raising household income including other household assets. For example, Yemiru *et al.* (2010) report that ownership of donkeys and carts or tricycles enables transport of large quantities of firewood from the forest to the market in a less laborious way. Where large quantities are traded under competitive market prices, firewood income will be higher, but the asset-poor are disadvantaged due to low quantities that can be harvested and transported (usually through head porterage) (Belcher *et al.*, 2015)

Ownership of physical capital is not only a means of wealth status and means of production but also a store of value that can be used as collateral to access credit (Barham *et al.*, 1999). The firewood-dependent poor cannot earn enough to enable the acquisition of such assets hence remains asset poor and unable to access credit (Dalka, 2016., Babulo *et al.*, 2008b). Meanwhile access to, control over, and ownership of assets particularly land and livestock including, homes and equipment, and other resources enable people to create stable and productive lives (Dalka, 2016).

Often welfare differences in rural households are partly explained by differences in amounts of physical capital assets, an important factor that establishes the status of who is the rural rich and the rural poor (Yemiru *et al.*, 2010; Babulo *et al.*, 2008a). The ownership of physical assets or access to them reduces forest dependence (Mamo *et al*., 2007., Sunderlin *et al.*, 2005). However, Angelsen *et al. (*2014a) from their global study sites, found different relational patterns where asset endowed households are still more dependent on the forest. For instance, in their Latin American sites where forests were rich in high-value products, they found a positive correlation between productive assets and forest and environmental incomes. This was due to the accessibility to and quality of such forest sites. In the African sites, however, there was a negative correlation between non-farm incomes and forest and environmental incomes.

2.8.4 Natural capital

Natural capital refers to some non-cultivated naturally occurring resources that are sometimes identified and dominated for use.(Nawrotzki *et al*., 2012; Vedeld *et al*., 2007) Some of these reaources can be owned by dint of settlement, purchased or based on interaction. Such resources include, land, forest, livestock, knowledge of cultural environment, rivers, mountains (i.e. Geography of the area) etc. The study will limit natural capital to land, forest, livestock and knowledge of cultural environment including plants and animal species.

Access to, control over, and ownership of natural capital including land, livestock, forest, and other resources enable people to create stable and productive lives (Dalka, 2016). These assets can generate products or services that can be consumed or sold to generate income and improve well-being Carter and Barrett (2006 cited in Dalka, 2016).

land is perhaps the most important household asset for households that depend on agriculture for their livelihoods. Access to land is a basic requirement for farming and control over land is synonymous with wealth, status and power in rural areas (Dalka, 2016). It has a significant and positive impact on household income in both male and female headed households, indicating that the larger the cultivated land size, the higher is the household income Dalka (2016). Ownership of land or easy access to it, provides a basis for livelihood security, investment in agriculture or the capability to diversify into other high yielding livelihood strategies (Babulo *et al*., 2008a; Kamanga *et al*., 2009). Ownership of tenurial rights or security over land constitutes an important asset (Timko *et al*., 2010) that can be used as collateral to access financial credit for investment.

Forests on the other hand also constitute natural assets depended upon by rural households and provide benefits that serve a multiple of functions including as a major source of income, means of coping with predictable and unpredictable gaps in income (Wunder *et al.*, 2014; Yemiru *et al*., 2010) or as a means of wealth accumulation to escape from poverty (Yemiru *et al*., 2010; Kamanga *et al*., 2009). The degree of benefits depend on an interplay of factors like the nature and security of access to the resource and the capabilities of households in terms of skill, labour, and other capital resources (Yemiru *et al*., 2010). From a sustainable livelihood perspective, Warner, (2000 cited in amanga *et al*. 2009) report that forests are natural

assets that contribute to household cash income, food security, reduced vulnerability, and improved well being through non-material benefits.

According to Arnold and Persson (2003) formal and informal privatisation of land and wood resources previously available for use by fuel wood gatherers as common property is largely reducing rural households to what they can produce on their own land, or purchase or steal from other private lands. Such tenurial changes may encourage those with land to sustainable management forest resources (Arnold & Persson, 2003) but leave the landless and those with very little land worse off. Vedeld *et al*. (2010) buttress that, privatisation of communal lands, or protection of a forest for conservation purposes, could deny local people traditional usufruct rights to access important forest resource critical to their livelihoods.

Ownership of livestock by rural households serves as accumulation of wealth and social prestige as well as generate income through sale of animal and sale of its product Dalka (2016). As expected, possession of livestock has a positive impact on households' income and asset accumulation for both male and female headed households. That is because households with more number of livestock obtain more animal products such as milk. Besides, a household with large livestock holding can obtain more cash income from the sale of live animals (Dalka, 2016).

While livestock (especially cattle and sheep) play this important role in household income, Kamanga *et al*. (2008) in a study of 'forest incomes and rural livelihoods in Chiradzulu District in Malawi', found the main livestock in the district to be poultry, mostly chicken, followed by small ruminants particularly goat. Livestock was scarce and economically not very important. Most households do not keep large ruminants. Goats and pigs provided the bulk of livestock income. The average number of goats per households was only 1. In a similar study on 'households strategies and rural livelihood diversification in Sub Saharan Africa', Elis (1998) also found that poor households either have no livestock or have very few.

The rural poor is often a wanderer in their natural environment exploring for forest resources such as firewood, honey etc for both cash and subsitence use by the household. From these adventures, they develop adequate knowledge on the geography, as well as of the flora and fauna of the area. This entails the nature of the land scape (where forest, hills, low lands, marshy lands etc are) as well as the plants and animals of the area. This knowledge though economically poorly renumerative just as the firewood they depend on (Arnold and person, 2003), it is however very

important in its capability to serve rural forest depended households to successfully navigate the environment in search for a living and to be able to cope with shcoks and stresses when they occur Arnold (1994, 200 cited in Timko *et al.*, 2010)

Often the rural poor mostly women, are generally said to be poorer when it comes to ownership of most natural capital assets within the rural landscape, partly due to discriminatory cultural practices and partly because they depend more on low value forest products as firewood (Dalka, 2016; Yemiru *et al.*,2010), meanwhile access to natural resources play an important equalizing role in income.

2.8.5 Social capital

Social capital includes social resources, such as networks, group memberships, and trust relationships, upon which individuals and households draw upon in pursuit of livelihoods (Nawrotzki *et al.,* 2012). The concept of social capital as a livelihood asset has been defined by Portes (1998:6) as 'the ability of actors to secure benefits by membership in social networks or other social structures". The social capital network enables network members to access opportunities that they could not have acting alone. Members can leverage the resources of others within a network (Mcdougall & Banjade., 2015). Examples of social structures include neighbourhood, relationship of trust and mutual support, formal and informal groups, common rules and sanctions, common values, leadership, etc.

Collective group action to support the rural poor indicates solidarity among members. Based on this, Kwon *et al*. (2002) defined social capital as the goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action. Furthermore, as a means of collective action for a common good, social capital, has been defined as, the "web of cooperative relationships between citizens that facilitates the resolution of collective action or problems (Brehm & Rahn, 1997., cited in Mcdougall and Banjade., 2015).

As a sociological concept, social capital has been widely applied in different disciplines and contexts and is now transcending the boundary of being an individual asset to one for communities and beyond (Portes, 1998). Unlike physical capital which is tangible and observable, and sometimes called economic capital in people's bank accounts (Portes, 1998), human capital, which is found in the skills and knowledge acquired by people, social capital inheres in the structure of human relations; and to have social capital, therefore, is to be related to people (Coleman,

2009; Portes, 1998). This analogy simply seeks to establish the relational benefits that the firewood harvesting and trading households may be exposed to by being within the firewood harvesting and trading industry.

2.8.5.1 Sources of social capital

The sources of social capital have been identified differently but with closely related meanings. Portes (1998) identified the following sources of social capital : Norms and sanctions, the norm of reciprocity, bounded solidarity, and enforceable trust. Norms and sanctions refer to urging compliance to group rules with acceptable sanctions in default or violation. The norm of reciprocity, also known as obligations and expectations deals with, offer, or gift made with an expectation for payment. As a key feature of principle, the means and time of payment must necessarily remain undefined else such an exchange becomes an economic exchange (Portes, 1998).

This suggests that, as one receives a gift from a member, the giver may expect to receive something back. However, the form and nature of this "payment" and when it will be honoured must necessarily remain undefined. Ostensibly, on the other hand, the receiver stomachs it as an obligation to give something in return though no formal request will be made. This is necessary to sustain relational support or benefit.

Bounded solidarity, on the other hand, relates to the commitment to a common fate or identifying and demonstrating loyalty to a group one belongs to. This is usually what allows some group members to free ride on the resources of others within the group. Finally, enforceable trust relates to the offer of support to a member based on group approval or group guarantee (Coleman, 2009; Portes, 1998; Putnam, 1993). Under the various sources of accessing the benefits of social capital, the norm of reciprocity, also referred to as expectations and obligations is the commonest form of social capital but to a large extent, this tends to disadvantage the rural poor because it requires a deliberate investment of economic and cultural resources (Portes, 1998). The poor however has little to offer as gifts and as such benefit little from membership networks that sought to pool risks (Wunder *et al.,* 2014).

2.8.5.2 Benefits of social capital

As a benefit emanating from social relations, social capital becomes a strategic asset that can help improve the livelihood of the rural poor (Mcdougall & Banjade, 2015), dependent on low-value forest resources like firewood. To benefit from social

capital requires that people are organized into more or less formal institutions (Portes, 1998). Puentes-Rodriguez *et al.* (2017) in a study of the firewood value chain in Burkina Faso, identified that firewood traders are organized into groupings or associations along the firewood value chain.

These groupings entail firewood harvesters and collectors (located in the rural settings) and firewood transporters and marketers (also in the urban settings) and official forest management committees. These organized groups create the required structures for the utilization of social capital in the firewood trade. For instance interaction between firewood harvesters, transporters, urban traders, regulators and possibly users (Ceruti *et al*., 2015) could expose less privileged or endowed members to access certain benefits that they could not afford on their own (Gittel *et al*., 1998). According to Nawrotzki *et al*. (2012) in rural areas, associations function as a traditional form of insurance systems in the absence of formal institutions where the focus is on supporting pay funerals expenses and also provide insurance against harvest failure, illness, fire, destruction of one's house, etc.

Network members (e.g urban traders and transporters) sometimes provide rural people with benefits such as short-term loans to work with, support rural children secure school admissions, jobs in the urban centres, information on prices of their products, and generally pool risks (Belcher *et al.*, 2015; Coleman, 2009), etc. Reciprocally, they receive gifts in the forms of farm produce, live animals, local medicines, etc. However, Wunder *et al*. (2014) posit that, less endowed households have low social capital as they have nothing or very little to give as gifts. On this basis, they face restricted access to village level social and economic networks that can provide collectively based safety nets as a support to help them leave forest dependence, as the likely default livelihood strategy.

While the concept of social capital has been variously conceived, in general, the basic idea remained focused on social relations and their associated benefits. These definitions seek to depict, by extension, the expected benefit poor firewood households could derive from network relationships to improve their well-being. These include common institutions that serve to pool risks to prevent the poor from falling into deeper poverty or enhanced coping with shocks such as crop failures and illness (Wunder *et al.,* 2014).

2.8.5.3 The negative side of social capital

Portes (1998) and Putnam (1993) suggest that social capital sometimes is exaggerated in use, to make it appear as a treatment for all problems. This has been made to appear so because the negatives of the term are often not highlighted. In this direction, Portes (1998) points out that, social capital may restrict access to opportunities or exclude others who may have the capability of accessing some opportunities. It also acts to restrict individual freedom by insisting on group compliance and hence inhibiting initiative (Putnam, 1993). Keefer (2016) posits that, social capital groups can split up into feuding parties working against the larger good of the public for private gain. Thus, while social capital is an important resource that can be leveraged upon to improve the livelihood of the rural poor, it is however, important to ensure that social capital is focused on a group or public interest than on selfish individual interest if it has to be beneficial (Keefer, 2016).

2.9 Factors motivating reliance on firewood as a source of livelihood

Reliance on firewood harvesting and trading as a major source of livelihood is expressed as the share of forest products' contribution to total household income (Angelsen *et al.,* 2014; Timko *et al.,* 2010; Cavendish, 2000). All households dependent on low-value forest products as firewood remain poor, have limited assets, and are unable to meet all their aspirations. Most live on a day-to-day subsistence basis and continue to be vulnerable (Shackleton & Shackleton, 2004). For lack of livelihood option, the rural poor are compelled sometimes to overexploit but yet continue to depend on the resource (Vedeld *et al.*, 2007).

Several studies (Adhikari, 2017; Yemiru *et al.*, 2010; Kamanga *et al.*, 2009; Babulo *et al.*, 2008b; Mamo *et al*., 2007; Cavendish, 2000) suggest various factors that drive reliance on firewood. The common factors include the gender of the household, market access, household size, landlessness, lack of or poor education, lack of alternative high income livelihood options, lack of or inadequate financial capital, marital status, location/ remoteness, and asset poverty. The degree of reliance is also influenced by socioeconomic and other contextual factors under which a household lives. Some of these factors are discussed below:

Gender of household: firewood harvesting and trading appear to be an exclusive duty for females (Biran *et al.*, 2004). However, in a study in Zimbabwe and Burkina Faso by Cavendish (2000) and Puentes-Rodriguez *et al.* (2017) respectively,

they found that there is an overlap between forest-based activities of men and women, where both are duly involved depending on the cultural role definition for gender, nature of the activity, the pattern of family specialization within the household economy and location. Puentes-Rodriguez *et al.* (2017) found males as harvesters and collectors of firewood while women were engaged in transportation, trading, and marketing.

In a comparative study between Malawi and Tanzania, on firewood and families, Biran *et al*. (2004) found that firewood collection is a responsibility for females which is often learned from childhood. They stress that the burden of firewood collection is on women and that the task is an important consumer of time and energy. In Malawi for example, men and boys were never observed collecting firewood for domestic use as it is the duty of women and girls.

Landlessness: This constitutes a major factor for forest dependence. According to the World Bank (2003, cited in Sunderlin *et al.*, 2005), most of the people suffering from extreme poverty live on ‘‘fragile" lands, including arid zones, poor soils, and poor forest ecosystems. Lack of access to land limits the opportunity of the poor to diversify livelihood strategy into crop production (Barham *et al.*, 1999). This is so because diversification is a key feature for the poor to sustain and also accumulate resources to step out of poverty (Kamanga *et al.*, 2009; Babulo *et al.*, 2008b).

Usually, the forest-dependent poor is weak in securing the right of access and ownership of land. Often where they secure access, the land sizes are so small (0.41ha/household) and sometimes found on marginal lands and hence unproductive for any productive livelihood (Babulo *et al*., 2008a). The most vulnerable, who tend to be heavily dependent on firewood or forest resources are mostly women. The worse of this category are widows without male children and unmarried women (Cavendish, 2000; Adhikari, 2017).

The constraints faced by the poor to access land for crop production make the safety net function of the forest particularly critical for the landless as the forest becomes the only option for survival (Wunder *et al.*, 2014). Women, particularly widows, and the unmarried are the most affected or limited in accessing land for agricultural purposes (Cavendish, 2000; Adhikari, 2017).

Lack of, or Poor, educational background: lack or poor education is an important driver for firewood reliance. The lack of it limits the individual from taking

advantage of non-farm job opportunities as a way to earn higher incomes to improve wellbeing (Dalka, 2016; Mamo *et al.*, 2007). This poor education or the lack of it is what restrains poor households to remain more dependent on low-value forest products as firewood as a source of livelihood (Yemiru *et al*., 2010). The added factor for high dependence on low-value forest products is the low capital requirement for entry into harvesting and trading of firewood (Wunder *et al.*, 2014) and consistent with this, many studies, such as Cerutti *et al.* (2015), Mamo *et al.* (2007) Cavendish, (2000) found more than 50% of their study population who depended on firewood or forest products as a source of livelihood were illiterates. Education is thus said to be negatively and significantly related to forest income (Adhikari, 2017).

Lack of support for high-earning alternative strategies: This has been a major reason explaining why most households rely on firewood (Rayamajhi *et al.*, 2012., Kamanga *et al*., 2009., Mamo *et al.*, 2007). The rural environment is poorly served with social infrastructure and other amenities that could help create access to alternatives sources of income (Dalka, 2016; Yemiru *et al.*, 2010; Sunderlin *et al.*, 2005; Ellis, 1998). Often rural areas are poorly linked with access roads and this tends to prevent the rural poor from earning wage income and undertaking some small enterprises or market activities to earn higher income (Belcher *et al*., 2015).

It is found from many studies that diversifying into non-farm strategies is the surest way of helping the poor to step out of poverty (Rayamajhi *et al.*, 2012; Kamanga *et al*., 2009; Babulo *et al*., 2008b). Entry into such ventures by the poor is constrained by a couple of factors including financial and business acumen (Wunder *et al.*, 2014; Kamanga *et al.*, 2009).

According to Cavendish (2000), the inability of firewood depended households to raise the needed capital to invest in high income-generating activities is what constrains them to remain dependent on low-value forest resources. Wunder *et al.* (2014) explained that a certain minimum capital is required for poor households to access high-value forest products such as timber as alternative strategies. In a study in Ethiopia, Babulo *et al.* (2008b) found out that access to credit by the rural poor was difficult due to the absence of financial institutions. The lack of collateral by the firewood-depended poor further deepened their difficulty to access credit hence continuous reliance on low-value forest products.

Closeness to the forest: According to Belcher *et al*. (2015), remoteness from market centres or major access routes increases forest dependence. Settings far away

from market centres do not have the opportunity to access other income-earning opportunities as well as earn competitive market prices for their products (Sunderlin *et al*., 2005). This provides lower cash incomes but high subsistence value of the forest to the poor (Rayamajhi *et al.*, 2012). Sunderlin *et al*. (2005) report that, the chronic poor (that is, those who have no other option but to continue to gather NTFPs to survive) Arnold and Perez, (2001) who depends largely on forest products tend to live disproportionately in remote rural areas where they tend to have limited access to off/non- farm opportunities.

Timko *et al.* (2010) report that the heavy dependence on forest incomes by Cameroon's population is provided for by nearness to forest resources. Remoteness is characterized by little to no progressive socioeconomic and changes (Sunderlin *et al.*, 2005) including poor infrastructure such as roads, health, and educational facilities. Belcher *et al*. (2015) and Wunder *et al*. (2014), thus conclude that, distant location correlates positively with forest access but correlates negatively with market access

2.10 Institutional processes mediating firewood access

The role of institutions in mediating access to forest resources play a vital role in the utilization of these resources (Cerutti *et al.*, 2015). Unrestricted access allows for greater extraction of forest resources to meet household needs especially by the poor but has the tendency to cause overexploitation of the resource base (Babulo *et al*., 2008a). when forest resources are not regulated, the consequent effect is overexploitation leading to resource depletion. The possible outcome of this is increased vulnerability of the very poor (Mamo *et al*., 2007). On the other hand, strict restriction of access to forest resources especially by the poor would be detrimental to the survival of the poor (Angelsen *et al*., 2014a; Vedeld *et al.*, 2007).

As a course to averting rapid forest depletion, regulation of firewood harvesting and other forest resources may be important for sustainable use. Such a course of action is for the welfare of the very poor (Belcher *et al.*, 2015., Mamo *et al.*, 2007). As an open-access resource, firewood is generally harvested freely from the environment (Agyeman & Lurumuah, 2012). However, in some areas, access to firewood and other NTFPs may be controlled by some existing access and use rules. These may range from local, spiritual prohibition to national laws (Kamanga *et al.*, 2009).

The application of these rules in the management of this Common Property Resource (CPR) should not necessarily be based only on the existence of CPR, but also the ecological health and social context such as levels of poverty, quality of forest, available infrastructure, etc. (Hanna & Munasinghe, 1995 cited in Adhikari, 2017). For instance, in communities where exclosures exist to ensure sustainable access to forest resources, some traditional or spiritual rules may be applied to control firewood harvesting. while this can effectively help in the regulation of access, it does not suggest that such rules may not be violated by individuals (Babulo *et al*., 2008b). However, the rural people sometimes are compelled to degrade or overexploit and yet continued to depend on the resource basically to meet household needs or supplement subsistence income. This is simply due to a lack of livelihood options (Marie *et al.*, 2017; Wunder *et al*., 2014; Vedeld *et al.*, 2007; Sunderlin *et al.*, 2005).

The importance of forest resources and the need to regulate exploitation has been recognized in the revised Ghana Forestry and Wildlife Policy of 2012. Rural households are highly dependent on forest resources for their livelihood, but the nature of their dependence on these resources is of the form and perception of an open public good hence extracted free of charge without any restriction. For a sustainable supply of forest resources, the policy has considered the development of a national regulatory framework for the commercial extraction of defined NTFPs at local levels. It estimates that biomass in the form of firewood and charcoal dominates total energy consumed in the country, averaging 67% in 2008.

Also in the wake of sustainable forest resource management, governments have championed the course of regulating access to forest resource extraction through conservation projects which often limit access to NTFPs by the rural poor (*Mamo et al*., 2007; Sunderlin *et al.*, 2005). Puentes-Rodriguez *et al.* (2017) indicate that such restrictions make the poor more disadvantaged. In the control of such resources by the government, access is sometimes gained through bribery (especially if the resource is government-controlled) which the poor have no means to provide to gain access.

Cavendish (2000) however, indicated that environmental resources are largely communally owned under traditional rulers which tend to allow open access. This is also found by Degrande (2015 cited in Puentes *et al*., 2017) in the study of firewood value chain in Burkina Faso, where it was reported that management of natural resources in the study area (Cassou) was carried out by some existing structures: (i) the land chief (ii) the Village Development Committees, and (iii) the Forest

Management Groups together with (iv) the local forest services. These structures enact rules to check excessive exploitation and use rights of firewood.

Similarly in their study in Swaziland, Timko *et al.* (2010) detailed the legal forest management provisions of the country that controlled the use of open and protected forests for the extraction of firewood and the use of other forest resources. They cited a forest preservation Act, in Swaziland, (Act 1907) that prohibits the cutting down, damage, removal, selling, or purchase of indigenous or government timber without permission from the Minister responsible. However, the provision does not prevent persons living on Swazi Nation Land from cutting brushwood or taking decayed or dead wood on such areas for use as fuel.

As a result of the law exempting firewood extraction in Swaziland, Timko *et al.* (2010) report that the amount of firewood extracted by individuals for sale was not regulated. This nature of access provided by public institutional arrangements to firewood harvesting led to many poor households to depend on it for income. The amounts extracted however vary depending on the asset holding of households (Barham *et al*., 1999., Mamo *et al.,* 2007; Mamo *et al.,* 2007). In a study in Swazi land, Manyatsi *et al.,* (2010) found that firewood contributed between $67 to $133 per month to the livelihood of the traders.

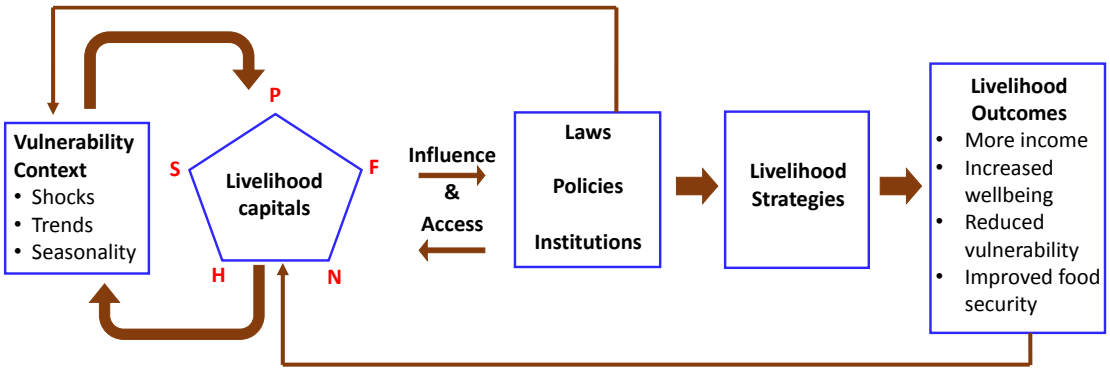
In 2001, the Swazi Nation enacted the Flora Protection Act (Act 2001), that prohibits any person from picking, plucking, gathering and cutting protected flora without legal permission. However, exceptions from this Act provide for Swazi nationals to collect and process plants out of the Flora reserves for personal and domestic use but not for sale. Indeed, the various enactments have also spelled out punishments for defiance such as a fine of $330 or imprisonment for two years.

Timko *et al*. (2010) further explained that the management and access to forest resources entail the use and recognition of the enforceable rights of local people, particularly the rights of indigenous people as enshrined in the international law on the rights of indigenous people to use, own, manage and control their traditional lands and forests as enshrined in the International Labour Organisation (ILO) convention s169. Most local and indigenous people are wholly or partially dependent on forest resources for a greater part of their living (Mamo *et al.*, 2007). Based on this, any attempt to restrict access to forest resources by the poor will result in consequences that will considerably affect their survival *(*Belcher *et al.,* 2015; Angelsen *et al.*, 2014).

Under situations where access is interfaced by discrimination, corruption, and issues of inequity of access (Puentes-Rodriguez *et al*., 2017), dependence on the forest as a source of livelihood and or as a safety net, then turn to have more negative effects on the very poor, tending to worsen income and welfare inequality between the rich and the poor (Sunderlin *et al*., 2005). Therefore, control mechanisms that are highly restrictive and unfair in access coupled with a weak understanding of the role of the forest to the survival of the very poor in the rural area, could pose extreme suffering leading to distress migration (Mamo *et al.*, 2007).

2.11 Conceptual framework

The conceptual framework (Figure 2.1) assesses livelihood outcomes under rural **vulnerability context** (socioeconomic) (Chambers *et al*., 1991). It thus illustrates a rural livelihood context characterized by livelihood stresses and shocks which are usually beyond the control of rural poor. Living within the vulnerability context, the people strive to rely on their assets or capitals to achieve positive livelihood outcomes through coping, adapting, and diversifying livelihood strategies. The contextual trends affect livelihoods and all available assets. As a result, the achievement of (or failure to achieve) a livelihood outcome is dependent on household asset endowment and the mediating institutional processes (formal and informal rules) which allow the choice of the livelihood strategy. Consequently, the livelihood strategy pursued determines the livelihood outcome which may be positive or negative (Scoones,1998).



H—Human capital; N—Natural capital; F—Financial; capital; P—Physical capital; S—Social Capital

Figure 2.1: The sustainable livelihood framework

Livelihood capitals or assets consist of the tangible and intangible materials that people have in their possession. Ownership of or access to these resources greatly

influences livelihood outcomes. Households endowed with productive livelihood assets are said to be better-off than asset-poor households (Mamo *et al.*, 2007). According to the framework, livelihood assets consist of natural, human, financial, social, and physical capitals. Lack of these assets coupled with the absence of a safety net increases the vulnerability of such households (Kamanga *et al.*, 2009). One important measure to cope with vulnerability is the diversification of livelihood sources. However, the ability to diversify is much dependent on asset endowment and the level of risk associated with alternative livelihood options (Ellis, 1998).

Institutional and organizational processes: This simply goes beyond the laws, policies, customs, etc, and a description of variable relationships to relate to the structured rules and norms agreed upon by society as the regularised pattern of behavior or practice (Scoones, 1998). Embedded in these institutional norms are the power relations which are dynamic and allowing reshaping and negotiations for the common good of society over time (Giddens, 1979 cited in Scoones, 1998). Institutional processes are important in matters of sustainable livelihood as understanding institutions help in identifying restriction/barriers and opportunities to resources for sustainable livelihoods. They also help in redefining what constitutes sustainable livelihood, since the concept is rooted in a sociocultural context and also unraveling the complex processes involved in access to resources (Scoones, 1998).

Livelihood strategies: This entails a mix of activities implemented to achieve a livelihood outcome. These strategies differ according to environmental context and asset endowment as well as influencing institutions and structural processes. The ability to pursue different livelihood strategies is dependent on identifying available livelihood resources (capitals) that people have access to or control over (social, tangible, and intangible assets) and also recognizing the enabling and restricting institutional processes (Kamanga *et al.*, 2009; Scoones, 1998).

Livelihood outcomes: This describes the outputs of livelihood strategies such as more income, increased wellbeing, reduced vulnerability, improved food security, and many others.

This study thus adopts this framework and the sustainable livelihood definition by Chambers and Conway (1992) to explain how firewood-depended households construct a living in a deprived rural setting in the North East Gonja District in the Savanna Region.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter describes the approach used to conduct the study. It describes the chosen research design and offers justification for the choice. The study area, the population of the study, sample size and sampling techniques, the research instruments, data-gathering activities, data analysis, and ethical issues are presented.

3.2 Study area

The study was conducted in the North East Gonja District of the Savanna Region of Ghana. The District is situated in the Eastern corridor of the Savanna Region. It is bounded by Tamale Metro and Mion Districts (Northern Region) to the North, Nanumba North and South (Northern Region) to the East. East Gonja (Savanna Region) to the South, and Central Gonja to the west.

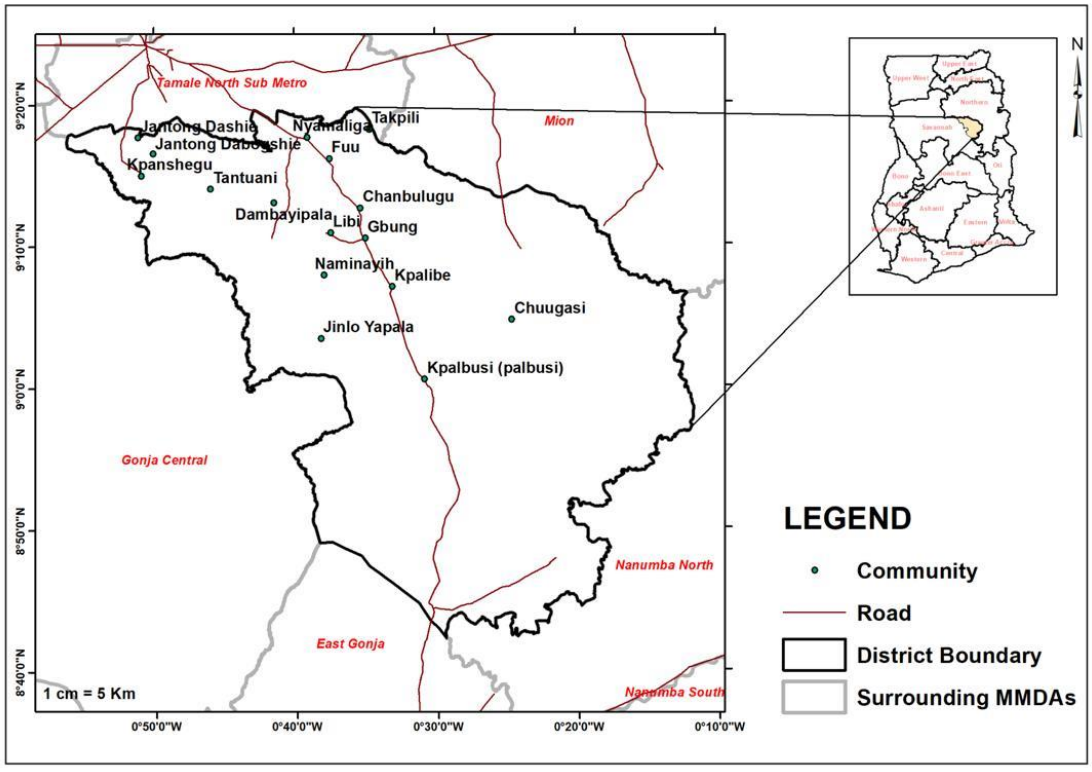


Figure 3.1: Map of the tudy area

According to the 2010 Ghana Population Census, the population of North East Gonja District in the year 2014 is, 23,312.00, (Ghana Statistical Service, 2014), and the total number of communities stands at 58.

The area is vast but thinly populated with many communities largely remote and constrained in critical amenities such as water and school infrastructure. The absence of these critical amenities contributes to poor development in the area.

The North East Gonja District has Guinea Savanna Woodland vegetation with a relatively dense tree cover that is atypical of the rest of the Northern Region. The area is within the Savanna ecological zone and thus experiences one rainy season in a year between May to October (GSS, 2014). The main occupation of the people of the District is agriculture and firewood harvesting as the main sources of cash and subsistence (GSS, 2014). Women are observed to be the dominant sex involved in firewood harvesting and other self-owned business activities

According to the Ghana Statistical Service (2014), this part of the then Northern Region has a relatively dense forest cover but intensive harvesting of the forest for firewood and charcoal threatens the vegetation cover. Firewood is loaded from the roadside and mostly from nearby or accessible bushes. Communities from which firewood is bought are dispersed throughout the district. Some are along the major road from Kpalbusi to Fuu while others are far away from the roadside.

3.3 Research design

The study adopted a sequential mixed methods research design. The mixed-methods approach is one wherein both quantitative and qualitative data are integrated at a couple of stages within the same study (Tavakoli, 2012). The choice of a mixed-method approach was deemed appropriate as it allowed the confirmation of quantitative data using qualitative data. This way, the researcher can present a more comprehensive picture of the situation as it pertains in the district. Using this approach also gave better meaning and value to the quantitative data.

Furthermore, Bhattacherjee (2012) reports that, regardless of the specific research design chosen, the researcher should strive to collect both quantitative and qualitative data using a combination of techniques since that may help generate unique insights into a complex social phenomenon that is not available from either type of data-gathering instruments.

Quantitative data was collected using a semi-structured household questionnaire. The type of quantitative data collected included household incomes, number of persons employed by income sources, number of children in the household, number of children in school, number of household members with NHIS cards, and number of

household with or learning artisanal skills such as masonry, carpentry, fitting, etc. This data was taken from respondents with the utmost care of getting the right information. As a result, the researcher approached such questions in a more systematic or stepwise manner. For example, in the case of firewood income, the study found from respondents the units in which firewood was sold, then what the price per unit is, and then the number of units that can be harvested and sold in a year.

Using mixed research design created the leverage to triangulate between methods and data collected. This served to strengthen the reliability of data by a simple comparison of data collected. Similarly, methods for data collection were triangulated in terms of suitability and ability to gather relevant data. Triangulation allowed relevant data to be collected to help present a more complete picture of complex societal phenomenon (Burgess, 2006; Walliman, 2006) or help improve understanding and the relevance of information about the social reality of quantitative data (Alston, *et al* 2003). For example, establishing the reliability of price and unit of selling firewood as well as the relative importance of firewood income in total household income using data gathered from the field.

3.4 Population: Target and accessible population

The population of the study describes the framework of all households in the study area. This constitutes the embodiment of the target and accessible population from which the sample size is drawn. According to Alston *et al*. (2003), the target population of the study refers to all households that harvest and sell firewood in the area as a source of livelihood. The accessible population constituted the firewood harvesting communities and households that could be reached for enumeration from which the sample size was drawn. The targeted respondents to the household questionnaire were primarily spouse of the household head or any other household member above 18 years of age who is in the position to respond to items of the instrument.

In this study, the unit of observation was the household. The choice of a household as the unit of study and not an individual was conscious. The reason was that the study sought to assess the benefit of firewood harvesting and trading to household members and not only to the household head or respondent. Using individuals as the study unit would lead to an underestimation of the benefits of the activity of firewood harvesting and trading.

3.5 Sample and sampling techniques

The study assessed the contribution of firewood harvesting and trading to the livelihood of firewood harvesters in the North East Gonja District. Preliminary qualitative information confirm that almost all households in the kparba area are into firewood harvesting for sale. The 2010 Population and Housing Census document provided relevant information entailing the list of all communities in the area (58) and a corresponding total number of households to be (2,020) (Ghana Statistical Service, 2014). The list thus served as the sample frame for the study. Since it was not possible to consider the entire population in the study, the researcher employed sampling techniques to draw a section of the population that would be representative to be used for the study. Thus the researcher made use of both probability and non- probability sampling procedures in the process. Given the total number of communities and household provided by the Census data, and using the Krejcie and Morgan (1970) table method of determining sample size, the number of communities and households that represent the actual sample size was found as 44 and 322 respectively.

However due to financial and logistical constraints, (Bhattacherjee, 2012), including other factors such as accessibility, the researcher decided to engage with two groups of women into firewood harvesting and trading, one at Kpalbe and the other Kpabuse to help identify the prominent or notable communities into firewood harvesting and trading activities. Harmonizing their responses, a list of 16 communities was produced. These 16 communities were randomly picked from the list of 44 communities which were in tend also randomly picked from the 58 communities for the district. Total household for the 16 communities summed up to 200. The number of households to be enumerated per community were determined as a ratio of the household count of each community to the total household count of 16 communities and multiplied by the total sample size of 200. Expressed as:

$$\text{sample size per community} = \frac{\text{cc}}{\text{tc}} * 200$$

- Where cc = household count of a community

  tc = total household count of 16 communities.

Using the above expression, the proportionate sample size for each community was determined. To choose households for enumeration at each community, the researcher used cluster and systematic sampling techniques to reach specific

households to administer questionnaires. The researcher clustered or grouped each community in accordance with the households to be enumerated in that community. Clustering was done to ensure the representativeness of the views of each community. Conveniently any household was chosen as a start thereafter any other housed was selected (See appendix 3 photo 1).

3.6 Research instruments and data collection procedure

The main instruments used for data collection was a semi-structured questionnaire. However other qualitative instruments were used to collect additional data for the pupose of enriching data collected using the questionnaire. The instruments are focus group discussion and key informant interviews (see appendices 1a, 1b, and 1c). A semi-structured questionnaire was used to collect both quantitative and qualitative data. The instrument contained both close and open-ended questions. Quantitative data for example focused on households' incomes, numbers employed by income sources, numbers of household members, numbers of children in the household enrolled in school, average health care cost, numbers of household members with skill or undertaking skill training. Qualitative data for example included sources of income, factors motivating reliance, and governing rules that regulate access to firewood.

A semi-structured questionnaire was used based on a couple of advantages. Some of these include the flexibility of allowing misunderstandings to be clarified, enabling the researcher to ensure that the right person answers the questions in the right order (Alston *et al.*, 2003). According to Walliman (2006), semi-structured questionnaires allow a mix of close-ended and open-ended questions to be asked. This feature allows adequate information to be collected from a large number of people in a short period in a relatively cost-effective way; data can be collected by the researcher or by any other person with limited effect to its validity and reliability. Quantified data can be used to compare and contrast other research and may be used to measure change. A semi-structured questionnaire allows certain designated areas of inquiry to be explored and clarification sought with the respondent.

The study however acknowledges that qualitative researchers sometimes reject structured or semi-structured instruments, arguing that these structures reflect the values, assumptions, and social constructions of the researcher rather than the perspective of the people being researched (Alston *et al.*, 2003; Burgess, 2006).

Walliman (2006) shared that doubts are frequently being raised about the precision of responses to semi-structured questionnaires regarding whether the meanings intended by the researcher's questions are equivalent to those understood by the respondent. Furthermore, it is questioned whether the list of choices of answers provided is compatible with what the respondent wishes to reply.

To help take care of weaknesses associated with the use of only one data-gathering instrument, the study used focus group discussion and in-depth interviews to gather qualitative data to complement or enrich data gathered from the semi-structured questionnaire. Qualitative data is strong in depicting social reality, the reason for which qualitative researchers maintain that much of social life, can only be understood in the context in which it is experienced and can never be captured in artificially structured questionnaires, which impose a particular view of reality upon the people being researched (Alstons *et al*., 2003). Qualitative methods are far more flexible and allow the researcher to change and develop the methods employed in the course of data collection.

A series of ten focus group discussions and five in-depth interviews were held in Kpalbusi, Kpalbe, Gbung, Nyamalga, Fuu, Kpansheegu, Takpili, Libi, Jinlo and Tantuani and Kpalbusi, Kpalbe, Kpansheegu, Takpili and Fuu respectively. The researcher could not organize focus group discussions in all the 16 communities due to time and resource limitations, as a result decided to zone the area into five zones and conducted two focus group discussions in each purposively chosen. The researcher sought to gather this qualitative data to enrich data gathered using the questionnaire. The focus groups were made up of seven women groups and three men groups (See appendix 3 photo 2a and 2b). Group members ranged from seven to ten as suggested by Walliman (2006). At the beginning of each meeting, the researcher introduced himself and the objective of the meeting. After ensuring that discussants were relaxed and winning their cooperation the researcher asked the questions and responses or comments were documented.

During the focus group discussions, the researcher was supported by a research assistant who played the role of a recorder while the researcher asked the questions. These roles between the researcher and the assistant were intentionally defined to ensure that the intent of questions is well communicated to elicit the right information or responses. During the discussions, efforts were made to ensure that all

in attendance felt free to express their views and perspectives. Each group meeting lasted on the average one hour thirty minutes (1hr 30mins)

Focus group discussions have the advantage of generating more information from many households using less time as compared to administering individual or household-based instruments. It also allows for brainstorming in the group situation. It is however difficult to analyse and also requires some expertise to conduct. According to Ryan and Bernard, (2003), focus group discussions are noted for internal validity limitations for which they are generally not employed in descriptive research. However, the researcher used this technique in this study to buttress or add meaning to quantitative data collected or find deeper insight into findings from the quantitative part of the research.

In-depth interviews were used to gather leadership views on the contribution of firewood harvesting and trading to household well-being in the North East Gonja District. Key informants engaged included chiefs, assemblypersons, and women leaders.

3.7 Pilot testing

Before the commencement of the data gathering exercise, the instrument was tested in the Jafor community where firewood is a major preoccupation of the people, particularly women to determine the suitability of the chosen methods as well the comprehension of questions by respondents. It was also to ensure that the instrument is reliable, admissible, and relevant, and also that questions are understood as they are intended. The reliability coefficient for the instrument was calculated to be $r = 0.96$.

3.8 Data cleaning

The data collected from the field was first cross-checked for unanswered questions inconsistencies and other omissions. Editing of obvious errors was done to ensure that there were no observable mistakes in the responses. The cleaning process also checked for areas not completed by the respondents. During data collection, mobile phone contacts of households were written on each household questionnaire. This was done to ensure that, where gross lapses occurred in responses whose resolution required returning to households, those respondents could easily be reached or contacted. The researcher participated actively and directly in the entire process of

the questionnaire administration but solely conducted in-depth interviews to ensure that relevant and accurate data was collected.

3.9 Data processing and analysis

After the data was cleaned, it was then coded and fed into a computer-based program- Statistical Package for Social Science Solutions (SPSS version 20) for analysis. The questionnaire was made up of (42) items of differing levels of measurement. The majority of the items (34) were ordinal and categorical, while (8) were numeric. Generally, the data was analyzed using descriptive statistics. Specifically, the (8) numeric items were analyzed using means and standard deviations while the majority of the items indicated above-used frequencies and percentages. Qualitative data, on the other hand, were organized into key thematic headings. Information from the discussion was used to buttress information generated from the quantitative data.

Objective one was analysed using averages, means and percentages. It is presented in a table showinhg the main sources of income, mean monthly income, relative percentage contributions of various income sources to household total income and the average number of household members employed by each source.

Objective two was analysised using bullets, means and percentages seeking to show the levels of firewood performance in building the five livelihood capitals. Human capital development was illustrated using the proxies of basic school enrolment, access to health care (valid NHIS card) and skill development at household level. The analysis used means, standard deviations and percentages. Financial capital was also presented in tables represented by lending and savings. The analysis used percentages of respondents who were able to lend or save part of their income earned from firewood harvesting and trading to depict their financial standing. Physical capital was also analysed using percenatges and presented in a table to show percentages of respondents and the types of physical assets they own through firewood harvesting and trading. Social capital and natural capital were presented using statements of percentages. Objective three and four were presented using bullet points and life stories.

3.10 Enumerators

The data was collected under the direct supervision of the student researcher with support from three trained research assistants. Two of the three research team members were from the study area and hence were conversant with the local terrain and language (Dagbani). Though the inhabitants are Gonjas, the dominant spoken language in the area is Dagbani. This is simply explained by their geographical closeness and long-standing interaction with Dagomba communities. For the other two team members including the researcher, who were not from the study area, assistance was sought from natives who speak both Dagbani and Gonja to support the administration of the instrument.

3.11 Ethical issues

Prior to visiting the field the content of the instruments for collecting data were vetted and accepted by the superviser of the study. As part of the community entry process for data collection, the researcher obtained a letter of introduction from the Kwame Nkrumah University of Science and Technology-Kumasi (Department of Silviculture and Forest Management, Faculty of Renewable Natural Resources) addressed to the Chief Executive of the North East Gonja District with copies to the Member of Parliament of the Constituency. This served to formally introduce the researcher and the purpose of the study. A copy of the letter was presented to the District Assembly. At the community level, the researcher and the assistants used two days to visit the major chiefs within the sampled communities to introduce the team and acquaint themselves with the area and some firewood dealers and other community leaders such as the assemblypersons. The content of the instrument was also explained section by section to the understanding of community elders and households for them to express their concerns if there were any. This also was done to satisfy the principle of Prior informed onscent.

During the administration of the questionnaire, the researcher and his team identified themselves at each household to avoid impersonation. The purpose of the study and the structure of the questionnaire was made known to the respondents. It was explained to respondents that, participation in the study was not obligatory, but based on the willingness of respondents. Respondents were assured of confidentiality. During the fieldwork, all forms of personal identification such as names of respondents were avoided. The researcher took time to ensure there was prior

informed consent of community members before the actual gathering of data commenced. See appendix 3 photos 3a and 3b on observance of ethical issues.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results of the study. The results are presented using tables and graphs. The presentation of results is preceded by the demographic characteristics of the respondents. The main findings are presented under the following headings: sources of rural household income and employment, the contribution of firewood harvesting and trading to building of livelihood capitals, factors motivating reliance on firewood harvesting and trading as livelihood activities, and institutional arrangement mediating access to firewood.

Respondents were predominantly female and almost all were without formal education.The main sources of income identified included crop farming, livestock rearing, firewood harvesting and trading and self-owned petty businesses such as selling of petro fuel and bicycle spare parts. Other income sources include wages from casual labour and remittances. Factors motivating reliance on firewood included low educational status, lack of financial capital and alternative sources of livelihood among others. Firewood access is regulated by traditional authorities.

4.2 Demographic characteristics of respondents

The demographic characteristics of the respondents are presented in Table 4.1. Majority of the respondents (82%) were females and most of them (8%) were married. Almost all respondents (91%) did not have formal education. Household sizes in the study area were generally large with a mean size of 8 (Table 4.2). Maximum and maximum household sizes for sample were found to be 12 and 6 respectively.

4.3 Sources of household income

4.3.1 Sources of household income and economic activities

The major sources of income and employment depended upon by households in the study area are crop farming, livestock rearing, self-owned trade and firewood harvesting. The others include wage labour and remittances. Table 4.3 presents the mean total household income and percentage contributions from the various sources. It shows Self-owned trade as the highest income source with a monthly mean income of Ghc150.00. This represents 25.65% of total monthly mean household income.

Table 4.1: Demographic characteristics of respondents

	No. of respondents	Percentage of respondents
Gender of respondents		
Male	36	18.0
Female	164	82.0
Total	**200**	**100**
Marital status of the respondents		
Married	164	82.1
Single/never married	7	3.3
Divorced	1	0.5
Widowed	26	13.0
Separated	2	1.1
Total	**200**	**100**
The educational level of respondents		
No formal education	181	90.90
Primary	8	4.00
JHS	9	4.50
Secondary/technical/vocational	2	1.00
Total	**200**	**100**

Table 4.2: Household size of respondents (N=200)

	Maximum	Minimum	Mean	Std. Deviation
Household size for sample	12	6	8.25	4.1
Number of Males in HH	6	2	4.04	2.3
Number of females in HH	6	2	4.19	2.7

There is more than one person in a household

It is followed by livestock rearig,136.83 (23.39%), crop farming 116.59 (19.93%) firewood harvesting, 90.27 (15.43%) and remittances, 55.1 (9.42%). Wages from casual labor were the lowest mean monthly incomes, 36.00 (6.16%).

From the Table 4.3, firewood is the economic activity most depended upon for cash income by households followed by crop farming. The income source least depended upon by households is wage labor. In terms of employment it was found that, the highest eemployer is agriculture, employing an average of 3 persons in a household while firewood, self- owned trade employ an average of 2. Wage labour and remittance are the list employers of 1 person each.

Table 4.3: Sources of income of sampled households

Income source	**Number of respondents**	**Mean monthly income (Ghc)**	**Relative (%) income contribution**	**Average number of household members employed**
Crop farming	184	116.59	19.94	3
Livestock	30	136.83	23.40	1
Firewood	196	90.27	15.44	2
Self-owned business	97	150.00	25.65	2
Remittances	15	55.1	9.42	1
Wages- casual labor	8	36.00	6.16	1

There were multiple responses

4.4 Sources of firewood resource

From a list of six different sources of firewood, open communal land was found to be the main source from which firewood is collected (see Table 4.4). Harvesting from open communal land is an everyday activity by almost all households.There is no household that collected firewood from restricted areas (i.e. shrine sites). This could be an indication of the effectiveness of traditional rules in protecting forests. Own-farm harvesting is less frequent, being more of a weekly affair while collecting firewood from a relative's farm is on monthly bases.

Table 4.4. Sources of firewood resource and frequency of harvest

Source	No. of respondents	Frequency of harvest		
		Daily	**Weekly**	**Monthly**
Communal land	200	193 (96.5%)	3 (1.5%)	4 (2%)
Family land	6	0.0%	3 (50.0%)	3 (50.0%)
Own farm	155	37 (23.9%)	113 (72.9%)	5 (3.2%)
Neighbor's farm	6	0.0%	3 (50.0%)	3 (50.0%)
Relative's farm	61	0.0%	19 (31.1%)	42 (68.9%)
Restricted area	0	-	-	-

Data contains multiple responses

4.5 Members of the household involved in firewood harvesting

The study sought to find out the people at the household level who are mainly engaged in the harvesting of firewood. The findings suggest that women are the predominant actors in the harvesting of firewood (Table 4.5). This is shown by 90% of respondents indicating that harvesting and trading in firewood are done by women.This suggests that women are the main actors in the firewood trade. While men are involved in firewood harvesting and trading, they represent a small proportion of those involved, that is 9%. Despite the small proportion of men involvement, the activity is not exclusively a women's affair.

Table 4.5. Household members who harvest firewood

Harvesters of firewood	Number of respondents	Percentage
Women	180	90%
Men	18	9%
Children	2	1%
Total	**200**	**100.0**

4.6 Means of transporting firewood

The main means of transporting firewood for sale or to a sales point in the bush is by head porterage. This is observed in Table 4.6 below where 95% of respondents affirmed transport by head porterage.

Table 4.6: Primary means of transporting firewood to point of sale

Means of transport	Number of households	Percent
Head porterage	190	95%
Motorized carts/tricycle	6	3%
Tractor	4	2%
Total	**200**	**100**

4.7 Market seasons of firewood

Firewood trade in the study area has seasons during which prices fluctuate. The majority of respondents (90%) indicated that firewood prices are at a peak during the rainy seasons whilst the prices are on the floor during the dry seasons. The main factor adduced for this fluctuation is the variation of supply of the product between the seasons. Respondents indicated that it is difficult accessing firewood and transporting it during the rainy season compared to the dry season when there is ease of access hence an abundance in supply. This tends to drive down the prices in the dry season which move up again during the wet season due to low supply.

4.8 Depletion of firewood resource

The activities of commercial firewood harvesting in the district show an obvious threate to the forest environment in the area. This was evident, as some parts of the district are already showing signs of shrub vegetation amd women clearly struggle a lot to access firewood even for their own domestic use. A woman was sited during data gathering stage virtually collecting shrubs to be used as firewood at home and also the piles of firewood gathered in the same community are also observed to be tiny in sizes (See appendix 3 photo 10). The areas clearly affected are the Jantong Dashie and Jantong Dabogshie sides of the district which are closer to Tamale (Northward) and as such had experienced heavy harvesting of firewood involving both locals and external harvesters. Qualitative sources have it that, many years ago, the area was heavily forested but lost the forest cover to unsustainable commercial harvesting of firewood and othe degrading activities. Appendix 3 (photos 4a, 4b and 4c) makes a comparism of forest cover between the areas closer to Tamale- Jantong (now esperiencing shortage of firewood) and areas far away from Tamale (southward) such as Kpalbuse (still having some good forest cover but also now experiencing uncontrollable exploitation by both locals and external harvesters without learning any lessons fron the Jantong area)

Exploring the possible causes of forest cover depletion (hence firewood), over 71% of respondents attributed it to commercial scale harvesting of firewood Geist and Lambin (2002 cited in Arnold & Persson, 2003) while 21% mentioned agriculture and 7.5% said population growth. Respondents largely do not believe population growth is an important factor in the firewood problem. This perhaps explains why only 7.5% of respondents suggest population growth to be a cause of depletion of firewood resource. (see figure 4.1). Qualitative sources further mention large scale cattle grazing, farming particularly commercial and bush fires as some other factors responsible for deforestation. .

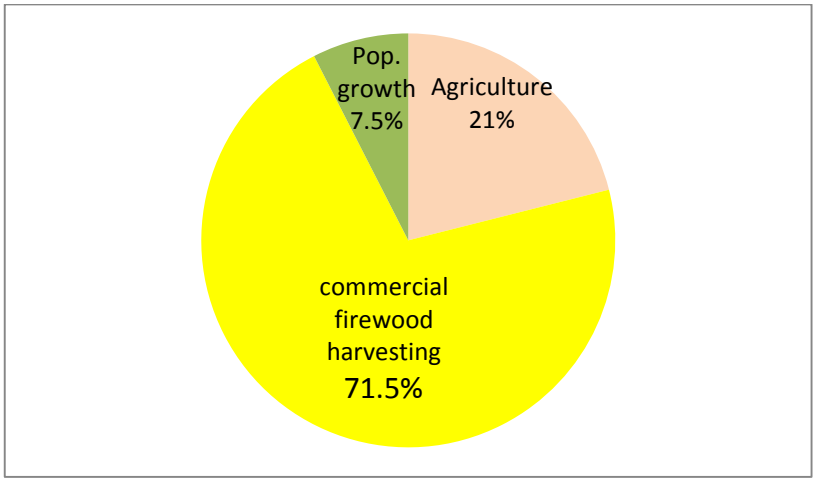


Figure 4.1: Possible causes of depletion of firewood resource

4.9 Alternative sources of livelihood

Considering the fast depletion of the firewood resource, it became necessary to probe what would be an alternative livelihood source. Respondents indicated that, besides their traditional sources of livelihood as farming, shea nut picking, and petty trading, they have no idea of any better livelihood alternatives. In an open-ended question on the alternative sources of livelihood, the respondents shared the following sentiments:

> *"...maybe me and my family will just die when the firewood resource runs out... I can't think of what else as our food crops are generally not for sale..." female at Kpalusi (24th February2019)*
>
> *"...me, I will just go back to pu all our hopes on farming basically to feed ourselves may be Allah will show mercy for us to produce more surpluses to be able to sell more to generate more income. What other choice do I have..." male at Kpalbe*
>
> *"If the firewood runs out, the government must come in. We are not the only people who will suffer...the people in Tamale who buy our firewood will also suffer...what will they use to cook their food?" Female at Kpalbusi*
>
> *"...I will find something to support my family. Maybe I will start trading if I get some small money. I don't know exactly what I will do, but God will show the way..." (female at Kpanshegu 28th February, 2019)*

Given the threat of depletion of the firewood resource, respondents were asked if they will support any afforestation project in the area. All the respondents indicated their

readiness to support interventions that will sustain the resource base which is pivotal to their survival.

4.10 Contribution of firewood harvesting and trading to the building of livelihood capitals

Generally firewood harvesting and trading did not improve all five livelihood capitals of households especially physical, financial and social capitals. However, respondents raised the major role played by firewood harvesting and trading in the education of household children and building of natural capital. Majority of the respondents have no savings of firewood income (62.8%); they are poor in physical assets, and over 90% did not benefit from social capital. The study results however show that there is high improvement in the areas of basic school enrolment, health care access and skill development,not excluding a niche on the growth secondary technical /vocational education. While respondents do not own lands, forests including plantations and large ruminants, over 85% showed sound knowledge in both plant and animal species and the geography of the area.

4.10.1 Financial capital

The contribution of firewood harvesting and trading to household financial capital was analyzed using savings and lending as proxies for financial capital. Majority of the harvesters (64.5%) were not able to do savings with the income they earn from firewood (Table 4.7). Similarly, 75% of respondents also indicated they do not earn enough to be able to lend to others. The number that reported making savings from firewood income (35.5%) do not save with formal financial institutions. They save with Village Savings and Loans Schemes (VSLS). This is an informal institution initiated by NGOs to encourage the culture of saving at the local level to enable local people to access credit. Much of the income earned from firewood is spent on food (46.7%), school fee, and other charges (24.2%), and health (20.8%) (Table 4.7).

4.10.2 Human capital

Human capital is the most critical asset in livelihood. The study sought to find out how firewood income has contributed to the development of members of the households in terms of their health needs, knowledge, and skill development. Thus,

questions were framed to cover these key areas and the information obtained from respondents are presented in Table 4.8 in the next page.

Table 4.7: Contribution of firewood to building financial capital

	No. of respondents	Percentage
Saves part of firewood income		
Yes	71	35.5%
No	129	64.5%
Total	**200**	**100**
Method of saving		
Bank	2	1%
VSLS	52	26%
Room/savings box	14	7%
Trusted friend	3	1.5
Total	**71**	**100**
Use of firewood income		
Pay school fees/supplies	29	14.5%
Health/medication	25	12.5%
Clothing	6	3%
Real estate/property	4	2%
Food/ingredients	136	68%
Total	**200**	**100**
Lend out firewood income		
Yes	54	25%
No	146	75%
Total	**200**	**100**

4.10.2.1 Formal education

The variables considered under formal education are numbers of school-going age children in the household who are enrolled, the highest level of educational pursuits of children in the household, and perception of respondents in terms of the

relative importance of firewood harvesting and trading to the education of household members. As established earlier in Table 4.1, most adults in households in the North East Gonja District have little to no formal education. Nevertheless, it was found that most children of school-going age in the district were enrolled in school. Table 4.8 shows that in 194 of the households surveyed, there was an average of 5 school-going age children in those homes.

Remarkably, majority of respondents indicated that most children of school going age in households were enrolled in school. The same Table 4.8 showed that in 176 households, of the 194 who responded, an average of 4 children were actually enrolled in school and were thus receiving formal education. It is well noted that, as of the time of this study, basic education in Ghana was essentially fee-free in public schools alongside other programs such as the FCUBE, capitation grant, etc. All of which aim at improving access.

However, the effectiveness of these policies varies across different environments and creates funding gaps to be filled. Aside these gaps, there are other necessary costs which do not come under policy cover but needed to be funded to complement efforts to achieve the education policy objective. This legitimate cost that needs to be funded is where the role of firewood harvesting and trading play a key role in the education of children at the household level. At the basic level and beyond, some of these costs include footwear, uniforms, supplementary feeding money, school bags, pencils, erasers, etc. It can be suggested that failure to finance these components could affect enrollment. This study is cautious not to attribute the successes of government policies on enrollment at the basic education level to the contribution of firewood harvesting and trading and as such seeks to carefully approximate the role of firewood.

Table 4.8: School enrolment of children in households of North East Gonja District

	Number HH	Mean	Std. Deviation
Number of school-going age children in the household	194	4.56	3.936
Number of school-age children in school	176	3.62	3.102

The foregoing discussion implies that for all basic school (primary and JHS) pupils and, at least, for SHS enrolled students who went to school after September 2018, there was significantly reduced cost implications to parents. However, there still exists an informal cost of education which is legitimate upon parents with wards in SHS. Some of these cost elements include the provision of trunks and boxes, footwear, toiletries, and hygiene supplies, mattresses, mosquito nets, supplementary food provisions, and cash for upkeep and travel cost. It follows, then that at the time of this survey the greater costs of education (fees) at levels higher than Senior High School was a matter for consideration among only a few households. In this survey, most respondents indicated that they had no outstanding financial obligations concerning the education of children in school.

4.10.2.2 Highest level of education of members in household

Majority of the respondents (124 out of 176) who responded to this item indicated that most of the children were in basic school (primary school) level. Table 4.9 shows the various levels of education of members of household. Among the various levels, most households, 76 out of 176 (43.2%) responded that the highest level of education of children in household was primary school. The second-highest level of children's education in the household at the time of the study was Senior High School (SHS) or Vocational/Technical School. Field observations however, showed that there were no senior high school facilities in any of the surveyed communities or those nearby; there were mostly primary school facilities in many communities and a few JHS facilities (see appendix 2).

All primary schools and JHS in the district are public schools. The implication is that while most communities in the district shared JHS facilities, children who qualified for SHS would need to attend school outside the district most probably in a boarding school. This would have significant cost implications for households. For a largely illiterate adult population, the researcher found that in as many as 9 households, there were children in training colleges, universitis, or polytechnics. It was observed that even though most parents in households may lack formal education, they do not wish to see their children deprived of that opportunity again. This may indicate that the decision-makers in the households understand the importance of formal education to improving the livelihood prospects of the younger generation.

Tale 4.9: The highest level of education of household

Highest school level of any children	Number of households	Percentage
Kindergarten	9	5.1
Primary	76	43.2
JHS	39	22.2
secondary/technical/vocational	43	24.4
Teacher/ nursing training college	7	4.0
University/polytechnic	2	1.1
Total	**176**	**100.0**

Not all households have school-going age children

4.10.2.3 Importance of firewood income in financing education

Acknowledging that other sources of financing education may exist, the researcher sought to assess the relative importance of firewood harvesting and trading in financing household education or human capital development in general. The results are shown in Table 4.10 below.

The general perceptions of respondents, both from quantitative and qualitative sources, suggest that the most important source of funding for the ancillary cost of education is firewood income. Responses as shown in Table 4.10 suggest that, 88.1% of respondents indicate that firewood income is important in funding education. Also, among the various sources of household income and economic activities, 72.2% of respondents confirm that firewood income is a prime source of funding education compared to other income sources. At least households are also able to rely on livestock for sale as the next important option when need for financing education arises.

To further illustrate how important firewood income is in funding education in the North East Gonja District, it will be noted that the number of households depending primarily on firewood income to pay school bills is 137 which is about two and a half times the total number of households depending on the three other sources (49). Moreover, 36.5% and 54.5% rated the importance of firewood income in paying education related bills as very high and high respectively (Table 4.10). Financing these ancillary costs of education serves to motivate the child to go to school (access) and remain in school (retention).

Table 4.10: Importance of firewood income in financing education

	No. of respondents	Percentage of respondents
Most important source of funding education in the household		
Firewood harvesting & trade	137	68.5
Crop sale	28	14
Livestock	33	16.5
Remittance	2	1.0
Total	**200**	**100**
Payment of all School Bills Using Firewood Income		
Yes	175	87.5
No	25	12.5
Total	**200**	**100**
Extent of the contribution of firewood harvesting and trading to education financing at the household level		
Very high	73	36.5%
High	109	54.5%
Low	16	8.0%
Very low	2	1.0%
Total	**200**	**100**

4.10.2.4 Skill development and healthcare access

Skill and health are important components of human capital. Study results indicate that it was only in 49 of the 200 households which had a household member involved in skills training (Table 4.11). The types of skills reported during group discussion sessions included auto works, electrical works, masonry, tailoring, and carpentry. About 87.8% of respondents indicated that firewood income was used in paying for apprenticeship costs and the share of firewood income in this cost was high (95.3%) (Table 4.12). It appears however that, skills training and apprenticeships may not be popular options to livelihood in the North East Gonja District as is to formal schooling, though it is important for youth employment and income generation.

The overwhelming majority of respondents (91%) reported that firewood income is the main source of health care financing. Results in Table 4.11 also showed that on average, five (5) members of respondents' households have valid NHIS cards. Besides holding valid NHIS card for free health care access, respondents' households had incurred a mean health care cost of Ghc181.6 in the past one year. Enquiring on the level of importance of firewood income in financing health care cost, 72% of respondents reported that 100% of health care cost at household level incurred outside the NHIS card coverage was financed from firewood income (Table 4.12). Only 2.3%

of respondents stated that firewood income does not contribute to the payment of health care costs in their households. On Healthcare financing, firewood income is either used to secure an NHIS card which provides free health care access or used to pay for health costs not covered by the NHIS.

The relevance of the NHIS card in this study is its provision of easy access to quality health care services without paying out of pocket (National Health Insurance Authority, 2019). The study noted that the productivity of labor is dependent upon its health state. Given this, about 90% of respondents indicate that premium payment to subscribe to NHIS is provided for by firewood income and that the inadequacy of firewood income could result in non-renewal of expired cards. The consequence of this will mean difficulty in accessing health care in times of ill health.

Table 4.11: The role of firewood harvesting and trading in household health and skill acquisition

Variable	Number of persons with access to / Av.cost	Min	Max	Mean	Std. Deviation
Adults in households under skills training	49	1	2	1.22	4.22
Members of household with valid NHIS cards	486	2	12	5.43	4.163
Average total healthcare cost over the last one-year period (GHC)	87	120	800	181.6	181.8

This table contains filter items. It counts number of actual persons with valid NHIS card, and those with skills in households

Table 4.12: Extent of firewood income contribution to skill development and health care access

	No. of respondents	Percentage of respondents
Contribution to skill development		
Yes	43	87.8
No	6	12.2
Total	**49**	**100**
Perception of importance of firewood income contribution to skill cost		
Low contribution to apprenticeship	2	4.7
High contribution to apprenticeship	47	95.3
Total	49	100
The above two items are filter questions		
Perception of the role of firewood income to household health care needs		
Firewood contribute to health cost	183	91.5
Firewood does not contribute	17	8.5
Total	**200**	**100**
Approximating the degree of firewood income contribution to health care		
100% payment of health cost	131	65.5
50% payment of health cost	51	25.5
25% payment- of health cost	16	8.0
0% payment- of health cost	2	1.0
Total	**200**	**100**

4.10.3 Physical Assets

Generally, income earned by households is spent across a range of needs including the acquisition of physical assets. The number and type of assets acquired depends on the income of the household. Inquiries from households revealed that some common physical properties that are owned by most households include bicycles, motorcycles, farm tools, radio, television sets, and occasionally a house. Table 4.13 lists these assets and shows that the commonly owned asset by households dependent on firewood are farm tools. This is represented by a majority of households, 152(76%) out of 200 who responded that farm tools were the common assets procured through firewood harvesting and trading.

Valuable assets such as motorcycles, bicycles, land, and houses, appear to be beyond the income of households dependent on firewood. Only 1 household (0.5%) indicated procuring motorcycles largely through firewood harvesting and trading. Entertainment and information-based assets such as radio, mobile phones, and Tv sets were also owned by a few households through firewood harvesting and trading. Information from quantitative and qualitative sources as well as direct observation suggests that it is the low value of firewood that explains why the firewood dependent households remain asset poor (appendix 3 photos 5a and 5b).

Table 4.13: Physical Assets Acquired from Firewood Income

Physical asset	No. Of households	Percentage of households responses
Farm tools (Hoes, axes, etc)	152	76
Bicycle	6	3
Livestock	8	4
Motorcycle	1	0.5
Mobile phone	15	7.5
Television set	11	5.5
Radio	22	11
House	4	2.0

Data contain multiple responses

4.10.4 Natural capital

All households have access to land though they do not have tenurial rights over them. Over 92% of respondents demonstrated sound knowledge of the cultural environment of the area (i.e. landscape, and of flora and fauna). Only few households (not more than 7) reported having small ruminants (i.e. cattle, sheep, goat) and not more than 3 households reported having cattle. The dominant livestock owned by majority of households is poultry. In the area, private ownership of land is not a common practice (at least during the time of this study), however there is ease of access to land by both men and women. However there is element of gender biase in access to land between

men and women where generally women have smaller land sizes compared to men. No household indicated owning forest or plantation.

4.10.5 Social Capital

The concept of social capital as a livelihood asset connotes benefits emanating from the participation in a network of relationships or associational life that allows individuals to claim or access resources possessed by their associates (Portes, 1998). Kwon *et al*. (2002) identify trade relation as an important source of social capital. The researcher thus sought to find out the extent to which firewood harvesters have benefitted from their firewood trade relationships. In the light of these, the survey results found that the overwhelming majority (92.1%) of the harvesters were not organized into firewood harvesting ad trading-based membership groups. Only 16 households out of 200 (i.e. 7.9%) respondents reported that they belong to firewood related associations (Table 4.14).

Over 83% of respondents reported not benefitting from their trade relations, yet almost all (97.5%) of them sell firewood to Tamale based customers. Only 16.9% reported having received some benefit from external trade relations (Table 4.14). The most important type of benefit derived by this minority group was 'interest-free loans' followed by food items. Results from focus group discussions indicate that, these loans were advances to buy farm inputs and implements to help prepare crop fields. Then later, firewood is harvested to pay the loan. Social capital benefits are based on a number of factors. Study results found that the two important reasons that warranted benefit from trade relations were 'selling firewood to dealers on credit' (10 households out of 33), and generousity (10 households out of 33) (Table 4.14). An important factor as stressed in the literature was reciprocity, which is giving and receiving. Eight out of 33 households indicated they gave out gifts earlier before receiving benefits though the gift was not intended for any exchange. Lastly, 5 households also said they rendered free labor to buyers to benefit from trade relations.

According to Portes (1998) and Kneefer (1998) social capital is not all about positive experiences but the concept is also characterized by negative experiences embedded within a network relationship. Consequently, two out of fifteen households said they suffered a loss of income, one suffered physical abuse, four said they suffered insults while five said they did not suffer anything negative from group membership.

Table 4.14. Contribution of firewood harvesting and trading to the building of social capital

	No. of respondents	Percentage of respondents
Membership in firewood-related groups		
Yes	16	7.9
No	184	92.1
Total	**200**	**100**
Sell firewood to urban dealers		
Yes	195	97.5
No	5	2.5
Total	**200**	**100**
Benefit from external trade relations		
Yes	33	16.5
No	167	83.5
Total	**200**	**100**
Type of benefit from external trade relations		
Interest-free loan	29	87.9
Food items	3	9.1
Cash gifts	1	3.0
Total	**33**	**100**
Reasons for receiving benefits		
Sold firewood on credit	10	30.3
Rendered free labor	5	15.2
Kindness	10	30.3
Gave out a gift	8	24.2
Total	**33**	**100**

4.11 Factors motivating reliance on firewood harvesting and trading

The findings of the study reveal that, most households are heavily dependent on firewood for daily household management and other critical needs. Three major factors among others were identified as responsible for households' heavy reliance on firewood. These factors as reported by household respondents include: lack of or

limited high income alternative livelihood sources as compared to firewood harvesting and trading and crop farming (100% of respondents), inadequate financial capital (99.5%), and low level of education (94.5%). The least factor driving reliance on firewood as found in the study is 'status of not being married' (0.5%) (Table 4.15).

In focus group discussions and in-depth interviews, respondents indicated that the study area has a limited number of formal organizations and other economic establishments capable of creating diverse alternative sources of livelihood for the people. They alluded to the fact that their educational constraint is a key factor in limiting their access to job opportunities. Respondents highlighted that the area has no financial institutions to enable them access loans, but were quick to add that, if such institutions existed, they do not have the collateral required to access the loans. Others indicated that their activities are low earning activities and so to work and pay for a bank loan with its associated high-interest rate would be difficult.

Table 4.15: Factors driving reliance on firewood by households

Factor motivating reliance	**Number of respondents**	**Percentage of respondents**
Inadequate financial capital	199	99.5
Low level of education	190	94.6
Lack of or inadequate access to land for farming	7	3.5
Lack of or limited alternative sources of livelihood	200	100.0
Widowhood	8	4.0
Lack of male children	3	**1.5**

Data Contains Multiple Responses

Based on the factors motivating reliance, firewood harvesting at a commercial scale may continue for long irrespective of its environmental effects in the study area. Assessing the thoughts of households on the environmental effects of commercial firewood harvesting, respondents were asked whether they will continue to depend on firewood harvesting if reliance factors were solved. The vast majority (98.4%) of

respondents indicated that they will not depend on firewood again as a source of livelihood. A small number indicated that they could still fall back into firewood harvesting even if they are provided with livelihood alternatives.

4.12 Institutional arrangement mediating access to firewood harvesting and trading

Firewood is a renewable natural resource that is heavily relied upon by the people of the North East Gonja District as a source of livelihood. This phenomenon is very common in most parts of the developing world. For concerns of over-exploitation or unsustainable harvesting, the study investigated whether or not this resource is regulated in the study area. The following findings were made from key informant interviews and focus group discussions:

- Chiefs are the institutional authorities and custodians of all natural resources in the area. They exercise control over the harvesting of firewood and other natural resources such as sheanut but do not have a hand in the regulation of the trade. However, the role of traditional authorities in regulating firewood harvesting and trading (as a dominant economic activity in the area) remains unorganised with a lot of lapses though some rules and taboos do exist to play some importantnt regulatory roles as follows;
- Harvesting of economic trees such as shea nut and dawadawa trees as firewood is not allowed. Voilation of this prohibition attracts a summon to the chief's palace for a non specific fine.
- Harvesting of firewood or any forest degrading activity is not allowed at sacred sites and along water bodies
- External harvesters require permission from traditional authorities upon the payment of a fee before entry into the area for harvesting. Focus group meetings reveal that there is no formal procedure for permitting external harvesters; how much is paid is not known and there is no organised system of accountability for fees collected. Discussants shared their displeasure over the influx of external harvesters and expressed frustration about the absence of an appropriate platform to express their concerns. On the other hand, the local firewood harvesters do not also have a common front to enable them engage effectively.

- Immoral acts of courtship and associated matters of intercourse in the bush or in the open are highly prohibited and severely punished.
- It is a taboo for anyone to go to the farm, firewood harvesting or fishing on Mondays and Fridays. Investigating the rational behind these taboo days, both in-depth interviews and focus group discussion sources reveal that it has both traditional and religious connotations. It was explained that the traditions and culture of Gonjas is closely related to the Islamic culture. So, while Friday is one of the days for traditional palace meetings as is for Monday, the Friday prohibition is largely to enable households to attend the Friday congregational prayers known as 'Jummah'. These days are set aside by chiefs and elders as days to discuss development and other matters of security affecting the people.

4.12.1 Challenges to functionality of institutions

The functionality of the traditional authority as a regulatory body was found to be limited by a number of factors as presented below;

- In the local environment, for almost all households headed by men, the responsibility of providing for ingredients for food preparation has been hived fully to women including other needs such as clothing. This places an enormous socio-economic burden on women on a daily basis. Consequently, the most depended upon source of income to meet this daily expenditure is firewood. This responsibility put women in a continuous cycle of harvesting firewood every day. As a result, the traditional authority has virtually become incapable of controlling the volumes and times of firewood harvesting as they are privy to it.
- The traditional authority is not empowered in terms of logistics and information on the threat of resource depletion and its associated consequences. This is partly because many believe the resource will never get depleted. However most of the women are very much aware of the fast depleting nature of the firewood resource and its possible consequences though they simply have no option than to continue to rely on it. It is no doubt that quantitative data confirmed that over 80% of respondents said they will support an afforestation project if introduced. As a result of this low capacity of chiefs, they are not able to monitor activities of external harvesters who often by-pass them and camp in bushes with

sophisticated harvesting machines to undertake excessive harvesting. Even where permission for entry is secured volumes harvested are not monitored and regulated. Chiefs however have a representative at the district assembly revenue check point where a fee of gh5.00 is charged along side the assembly fee for the chiefs. There however no any task force in place that moves round to monitor the harvesting and trading activities.

- It was also noted that, the palace platforms for discussions are gender biased in favour of men.

Findings from analysis of quantitative data confirm that 91.7% of respondents acknowledge that the traditional authority is the traditionally mandated institution responsible for regulating firewood harvesting and does actually regulate the resource as shown in table Table 4.16 below.

Table 4.16: Existence of regulations on firewood access

Response	Number of respondents	Percent of respondents
There are regulations on firewood access	128	64.0
There are no regulations on firewood access	52	26.0
Don't know/unsure if there are any regulations	20	10.0
Total	**200**	**100.0**

4.12.2 Firewood trade

Firewood trading and its associated pricing follow a seasonal trend. The dry season is the period during which access to firewood is easy and hence supply goes high and drives down price per load. The wet season presents the direct opposite of the dry season where access to firewood is difficult hence supply is low pushing up prices. The same load as shown in (appendix 3photo 5a), selling at Ghc420.00 during the dry season can sell between Ghc450.00- 550.00 during the wet season. Beside the natural seasonal price variations, the on and off sessions of major consumers such as second cycle educational institutions also influence price changes. Prices are high when schools are in session and low when they close. Other major consumers include bakeries and restaurants. As it is in most marketing value chains, the firewood

producers do not have direct access to these major consumers and therefore operate through intermediaries.

The market is not organised under any system, as such each seller looks for his or her own buyer and negotiates prices independently. Usually at the beginning of each season, the price at which the first seller sells, tends to become ruling market price of firewood for the season. This becomes possible through the grapevine. While firewood harvesters are not organised, they are able to slightly influence prices through telephone contacts with friends.

It is also reported that there are agents of the major consumers who keep or scout for contacts of harvesting communities. In that regard, when an individual harvests a truck load or a ‘’seat’’ (unit measure of a full truck, see appendix 3 photo 5b), he/she will place a call on the agent and the price is negotiated. During the process of marketing, harvesters revealed a worrying trend where agents intentionally perpetrate fraudulent transactions:

- Agents have on many occasions bought truck loads of firewood on credit and completely failed to pay, puting the days and months of labour of poor harvesters in vain. This is more pathetic in the particular case of women as portrayed in the following two testimonies:

  “I harvested a truck load of firewood during my pregnancy in preparation for my delivery. This was to assist me buy some basic items for the naming ceremony . In the process of the harvesting I was maimed as my axe missed its target and landed on my feet. My delivery was almost due when I sustained this injury. Before leaving for hospital I sold the firewood on credit to a Tamale-based buyer for payment to be made later. After the firewood was loaded off, that was the last time I saw the agent. Payment was never made. Finally, I delivered twins at the hospital but lost both within two months. I trust the absence of many basic things such as ingredients have contributed to that sad end’’. Mariama at Tantuani.28th February, 2019. See Appendix 3 photo 6.

  “I was pregnant and harvested about three ‘seats’ of firewood. I was suddenly taken ill and I was rushed to the Tamale Teaching Hospital. While at the hospital I asked for the firewood to be sold to enable me meet my medical

bills. A Tamale-based buyer bought with the promise to send the money to me at the hospital (Tamale Teaching Hospital). The firewood was conveyed and the buyer never surfaced at the hospital. Finally, I experienced still birth. Unable to pay me bills, I was detained at the hospital for almost one week. Having no option, I had to borrow from a VSLS group to clear the bill to get the chance of coming home . So as you meet me wondering on this dry land virtually with no trees, I am searching for firewood to sell to help me pay for the money I borrowed". Memuna at Damba- yili. 28th February, 2019. Appendix 3 photo 7.

- Agents may conclusively negotiate prices of firewood load but after loading the material, they turn to disagree on the price and virtually dictate their preferred price. They *b*ecome price takers.
- Agents may agree on negotiated price but make a false claim to the unsuspecting harvester that he/she does not have enough money on them, so top up payment will be made later. The agents subtly and dubiously fail to honour the agreement. These agents easily divert to other market places or different communities.
- Other agents intentionally over load the truck to the disadvantage of the harvester.
- After buying the firewood, most agents do not pay lump sum to enable poor harvesters derive maximum benefit from their labour. They rather pay in bits over a longer period of time. The money ends up only in petty expenditure.

4.12.3 Regulation of firewood trade

The District Assembly has been found as an important stakeholder in the regulation of the firewood trade but does little in terms of the harvesting of firewood. It has however established revenue check points where each truck load with firewood is charged Ghc10.00 Male focus group discussions revealed that, agents representing chiefs also charge Ghc5.00 for each truck load of firewood. The agents indicated that this rate for the chiefs is not regularly being honoured by transport agents and no punitive actions are taken against offenders except on a few occasions where the youth mass up to seek for justice especially when women are duped.

4.12.3 The reality of firewood harvesting and trading

All respondents hold the view that firewood harvesting is pursued as a livelihood strategy for lack of any better alternative livelihood strategy; else they are fully aware it cannot take them out of poverty. Some have expressed concern that sometimes all that they earn from the firewood is spent on their body health. That, the laborious nature of the work makes them age faster and weaker and often end life in abject poverty. They stressed that they are now conscious of the fact that quality education of their children is the approach for them to sustainably step out of poverty.

CHAPTER FIVE
DISCUSSION OF RESULTS

5.1 Introduction

This chapter discusses the findings of the study in relation to existing literature, with the view to establishing how the findings of this study compare with or diverge from similar studies. It will highlight major variables and assign possible reasons for such variations. The discussion will cover some key household characteristics and focus on main findings on the contribution of firewood harvesting and trading to household income and employment, building of livelihood capitals, factors motivating reliance on firewood trade and the institutions that regulate access to firewood.

5.2 Household characteristics

The study found that over 90% of the respondents in the study area do not have formal education compared to similar studies, this level of illiteracy is quite high. According to the Ghana Living Standards Survey Round 6, (Ghana Statistical Service, 2014) rural illiteracy in Ghana is about 58.3 % which indicates the very low levels of formal education in the study area. It is also far higher than the 58% found by Mamo *et al*. (2007) in their study in the Dendi district in Ethiopia and the 70% found by Baland *et al.,* (2003) in rural Nepal. The high illiteracy level suggests limited or lack of capacity by households to gain access to paid jobs and other public employment opportunities and hence tend to be heavily dependent on the forest for their livelihoods.

The majority of the respondents were female. The reason was, women were found to be dominant in the harvesting of firewood than their male counterparts in the households. Consistent with this finding,Yemiru *et al*. (2010) found that women are more dependent on low-value forest products such as firewood. Given that firewood is a low value forest product, it follows that women are more likely to be poorer than their male counterparts. Puentes-Rodriguez *et al.,* (2017) report that men harvest firewood as a source of income while women harvest firewood for cooking and domestic uses often without any economic profit. Contrary to findings byPuentes-Rodriguez *et al.,* (2017) who estimate women involvement in firewood to be harvesting largely for cooking and domestic uses, women from this study area were found to be largely engaged in firewood harvesting and trading largely for profit making or as a source of income. This finding is similar to findings in many studies

(Bwalya, 2011; Mamo *et al*., 2007; Sunderline *et al*., 2005; Arnold & Persson, 2003) which showed women's involvemet in firewood harvesting and trading as a major source of income.

Average household size in the study area was found to be eight (8) members. This means the number of dependents per household is large per the United Nation's standards, which defines any household size larger than five as large (United Nations Population Division, 2017). This finding compares favourably with the 7.7 household size for the Northern Region according to the 2010 Population and Housing Census (Ghana Statistical Service, 2010) and also consistent with MacGregor *et al.* (2007) who found a household size of 7.5 for the North-Central Regions of Namibia. It is however almost twice the household size for rural Savanna of Ghana, which is 5.5 as established by the Ghana Living Standard Survey Round 6 (Ghana Statistical Service, 2014).

A large household size generally appears a burden, given the number of mouths to feed, the number of forest resources to be extracted including other related costs such as health care and education. Contrary to this view point, Mamo *et al*. (2007) and Sunderlin *et al*. (2005) espoused that, a large household size motivates diversification into high income-earning opportunities and thereby limiting dependence on firewood. Similarly, Biran *et al*. (2004) found that, firewood consumption is not linear to household size. That is, irrespective of the household size, there is a certain minimum amount of firewood required to prepare or cook food for an average household size. Thus the quantity of firewood required to cook food for a two member household is adequate to cook for 4 or 5 people, tending to make cooking for a large population more efficient than a small population size.

5.3 Sources of rural household income

Findings from the study show that the major sources of income and employment for rural households in the North East Gonja District are: firewood harvesting and trading, crop farming, livestock rearing, self-owned petty business, casual wage labour and remittances. Many studies (Angelsen *et*., 2014; Yemiru *et al*., 2010; Kamanga *et al.*, 2009; Babulo *et al*., 2008a; Cavendish, 2000; Mamo *et al.*, 2007) have generally identified these sources as the main sources of income for the forest dependent poor households. These sources of rural household income as identified in the study appear to be universal for many rural households. However,

wages and remittances are less depended upon and as such they make little contribution to household income in the study area. This is in agreement with Babulo *et al*. (2008b) who in a study in Ethiopia found wages and remittances contributing less than 1% of household income. On the contrary Shackleton (2004) in South Africa found remittance as a major source of income to households. This could suggest that the North East Gonja district does not have skillful and educationally qualified people living outside the district who may be engaged in high income earning jobs hence remittances home are therefore quite low (Babulo *et al*., 2008a).

Firewood harvesting and trading has been found to be an economic activity largely depended upon by both the poor and the relatively rich households. This relates to the fact that,while forest dependence is noted more or less as a default strategy for the poor, it was observed that female spouses of better off households in the study area, are still into firewood harvesting to support basic household needs. For instance seamstresses, spouses of fuel dealers, edible oil processers, bicycle selling and fitting shop owners etc were found still engaged in firewood harvesting and trading. This is well buttressed by Adhikari (2017) when he posited that, while the poor may attempt to minimize risk by using forest resources to mitigate shortfalls in consumption levels, the rich or the less poor may be interested in enhancing their earnings by selling these resources, particularly when there are good market opportunities. The finding further corroborates conclusions by Mamo *et al.* (2007) who found that, the forest is not merely a safety net, to be utilized in times of predictable or unpredictable downturns but an essential, perennial livelihood source for the poor and "wealthy" households alike.

In order of mean monthly income for households, firewood ranks fourth after self-owned trade, livestock rearing and crop farming, with a contribution of about 15.43% of total household income compared to crop farming (19.93%), livestock rearing (23.39%) and self-owned business (25.65%). With a mean monthly firewood income of Ghc90.27, it means firewood depended households earn an average daily income of about Ghc3.0 per day which is less than the $1.9 per day poverty line (United Nations, 2015).This low mean income is found consistent with findings by MacGregor *et al*. (2007) in Namibia who found rural households' dependence on firewood earnings to be less than $1per day. This finding is much similar to findings by Kamanga *et al*. (2009) in Malawi where some poorest 13 forest households generate a daily per capita income of less than $0.14 per day.

It is noted that this level of income is quite low for improved living conditions in comparison with the Ghc8.85 minimum daily household expenditure for rural Ghana as established in the Ghana Living Standard Survey Round 6, (Ghana Statistical Service, 2014b). These low-income levels in the study area are indicative of extreme poverty conditions as shared by (Zelin, 2008). Accordingly, the global standard for extreme poverty is set at USD 1.08, equivalent to Ghc5.58468 per day (at a USD to Ghana Cedi exchange rate of 1:5.1710 as of April 11, 2019. (The Bank of Ghana, 2019)

It was also found that while self-owned trading activities and livestock rearing provide the highest monthly mean income, Ghc150.00 and Ghc136.83 repectively, they do not constitute the major strategies depended upon for livelihood by most households. Participation in these income sources appear to be the preserve of the better off households who can afford the initial capital required. This means that, while these sources give better returns, capable of helping the firewood dependant poor households to step out of poverty, they are beyond their reach due largely to the entry capital requirement barrier. This resonates with findings by Babulo *et al*. (2008b; Kamanga *et al*.,2007; Cavendish, 2000) that the firewood dependant poor is unable to diversify into high earning strategies due to the entry capital required.

Large livestock (cattle) for example were owned by very few households making it economically not important to most households at the time of this study. This is similar to findings by Kamanga *et al*. (2009) in their study in Malawi where firewood was found in almost every household but large livestock was found in none. On the contrary, Rayamajhi *et al.* (2012) found 73% of households from their study area owning large livestock alongside firewood harvesting. In corroboration with the study finding Mamo *et al.* (2007), indicate that, households who lack other livelihood options appear more dependent on forests. Some self- owned petty trading activities identified in the study area include tailoring, selling of bicycle and motor spare parts, carpentry, maisonry, sale of groceries, micro scale retail of fuel for motorbikes amog others.

While MacGregor *et al*. (2007) reported that it is households with formal employment that can earn the most income, not a single member of any household in the study area was found engaged in formal employment. This is also supported by the work of Mamo *et al*. (2007) who found majority of their respondents to be

illiterates and that none of the household heads had completed high school studies to qualify for engagement in paid public services or other formal employment jobs.

Crop farming has been found as the primary source of subsistence and occasional source of cash income. Most food produced is consumed and not sold. This finding is consistent with findings by Dalka (2016) and Mamo *et al*. (2009) which showed that agriculture is the primary source of subsistence for households in the Dendi District of Ethiopia. However there may arise emergency conditions under which food items may be sold. Dalka (2016) posits that, even when agriculture dominates as the primary source of income, fuelwood remains an important source of supplementary income, mostly because home consumption could not be met through farming alone.

Wage labor and remittances were not popular and important sources of income to most households in the study area. Contrary to the low dependence on wage labour in the study area, studies by Rayamajhi *et al.* (2012) in the Central Himalayas Forest, established that 64% households depended on the sale of labour as a source of icome. Of the 64%, half (34%) are unskilled and as such offered off-farm labour. The study results also relate to findings by MacGregor *et al.* (2007) who discovered that subsistence farming households earned less than $1/day in the North Central Regions of Namibia.

The reasons for these variations could be attriuted to differences in household and other contextual factors which have the ability to influence the availability of opportunities for wage income. It could also mean households hardly hire labor to undertake their jobs. Most works may be personally done y households or communal labor, thus creating limited opportunities for labor to earn wage income.

Similarly, remittances do not represent a major source of income given its mean monthly income contribution of Ghc55.10 and low dependence by households (only 8 households). This is consistent with findings by Rayamajhi *et al*. (2012) and Babulo *et al*. (2008b) who described casual wage income and remittance from their different study sites as contributing far less to total average household income. Contrary to this finding however, Shackleton and Shackleton (2004) and Cavendish (2000) found remittances as a major source of income for some households in South Africa and Zimbabwe respectively. Low dependence on these sources of income could suggest that migrants do not have the capacity to migrate to be capable of earning enough income to remit home. Once again, contextual variations are important in such comparisons.

5.4 Contribution of firewood to building livelihood capitals

The results show that except for human capital, firewood harvesting and trading is unable to support households to accumulate the livelihood capitals considered in this study, namely; financial, physical, and social capitals. Households were found to have poor levels of all the assets, particularly, physical, financial, and social capital. The limited capacity of households to accumulate livelihood assets suggests that they are unable to take advantage of high-income earning livelihood strategies, or such opportunities do not exist in the study area hence they are more likely to remain dependent on low-value forest resources such as firewood. This is consistent with many studies such as (Adhikari, 2017; Belcher., 2015; Yemiru *et al.*, 2010; Kamanga *et al*., 2009; Babulo *et al*., 2008a; Mamo *et al*., 2007; Sunderlin *et al.*, 2005) all allude to the fact that, poor households do not have the necessary asset base to enable them diversify into high-profit ventures. As a consequence they remain dependent on low-value forest products as firewood and therefore remain poor.

5.5 Human capital

The study found that firewood harvesting and trading has made important contributions to the development of human capital in the study area. Health care education, and skills development are key examples. It was established for instance that earnings from firewood have significantly funded anciliary costs of education, paid for apprenticeship cost, enabled subscription of most household members to access the NHIS and also catered for medical bills incurred in the event of expiration of the NHIS subscription or where health care costs are not covered by the NHIS benefit package (range of services covered by the policy).

The study notes that, on average, five members of the households under study have valid NHIS card and incurred a mean annual expenditure of Ghc181.22. Both the subscription to NHIS and settlement of cost of medical care were largely attributed to firewood income. Over 90% of respondents reported that firewood income was responsible for financing health care cost. This is however far higher than the 25% of firewood income spent on health as found by Awono *et al*. (2010) in Cameroun. Butressing the role played by firewood harvesting and trading in financing health care, Aboagye and Obuobi (2011) estimated the full Out-Patient Department (OPD) cost burden at a public district hospital to be $4.5 (Ghc25.74) and inpatient cost per day per inmate to be $6.05 (34.60).

The analogy in this estimation is that, with a mean annual health expenditure of Ghc181.22=$31.73, a household can afford to take care of seven of its household members once a year at OPD rates or an average of one person for at least four days at in-patient care rates. This thus makes firewood's role in health care important among rural households. This role of firewood harvesting and trading towards human capital development can well be compared to findings by Sunderlin *et al.* (2005) who noted that firewood income was used for payment of emergency medical costs in most developing countries where forest is a major source of livelihood.

The study results showed that despite the virtual lack of formal education among adult household members, enrolment of school-going age children of firewood dependent households was as high as 90% with the majsority found at the basic level, followed by secondary/ vocational-technical schools and a smaller number at the tertiary level. This finding is in tandem with SDG4 which seeks to ensure inclusive and equitable quality education and promote lifelong learning for all (United Nations Population Division, 2017) Further, to this, it resonates with UNDP's celebration of the 91% enrolment at basic schools and an increase in secondary school enrolment in developing countries since the year 2000 (United Nations Population Division, 2017).The UNDP had found this achievement significant towards achieving the Agenda 2030.

The study notes further that, enrolment and retention drive are much contributed to by the activity of firewood harvesting and trading irrespective of the many policies in Ghana that make basic and second cycle education free (e.g Free Compulsory Universal Basic Education, Complementary Basic Education, Free SHS, Capitation, etc.). This is because there exist important ancillary education costs such as school bags, pencils, and erasers of pupils, school boxes, footwear, uniforms, books, toiletries, hygiene supplies, mattresses, mosquito nets, supplementary food provisions, cash for upkeep and travel cost for students that are relevant to achieving enrolement and retention but which are not catered for by the indicated policies. This important funding gap is largely filled by firewood income. This corroborates findings by Puentes-Rodriguez *et al.* (2017) and Awono *et al*. (2010) that about 30% of firewood income was spent on the above categories of children's education expediture.These uses of firewood income is found consistent with similar uses decribed by Sunderline *et al*.(2005).

Skills training was not found popular among households. Potentially, households may not have fully appreciated the role of artisanal skills in reducing the problem of unemployment and hence poverty. This finding relates to the assertion by Rayamajhi *et al*. (2012), in their study in Central Himalayan Forest, that about half of the labour of household sold for income were unskilled. Furthermore, Wunder *et al.* (2014) and Kamanga *et al.* (2009) posit that most rural households have no access to non -farm income sources to escape poverty, not only because they do not have the required capital but also because they have no skills. Based on responses from respondents in this study, it can be concluded however that, of the very few household members (an average of 1 person out of the 46 households that have members undergoing skill training), firewood income plays a pivotal role in the payment of apprenticeship cost.

5.6 Financial capital

Using savings and lending as indicators of household wealth and financial capital as identified by a number of studies, (Marie *et al.*, 2017; Yemiru *et al.*, 2010; Mamo *et al*. (2007), the study found that households are poor in financial capital. The majority of respondents indicated that they had neither saved (62.8%) nor lent (75%) income earned from firewood. This could imply that most firewood-dependent households do not earn enough from their engagement to meet their basic needs and generate a surplus to enable savings or lending. This is similar to findings by Arnold and Persson (2003) and Cavendish (2000) that forest depended households have low savings with their formal or informal intermediaries.

Low prices and the high levels of competition due to ease of entry into the activity markets are basically some of the main reasons accounting for the low earnings and consequently low savings for firewood dependent households. Similar reasons have been espoused by Sunderline *et al*.(2005) who reported that the ease of entry into firewood trade and low prices are responsible for the poor fianancial holding of forest dependent households'. This thus keeps most of those engaged in firewood trade poor.

Yemiru *et al.* (2010) and Sunderlin *et al*. (2005) report that low earning is also partly because firewood is a low-value product. It stands to reason that once households have no savings, they have no financial security in times of emergencies. In-depth interview conversations revealed that, in times of health emergency for

example, firewood harvesters have always tried to rely on their firewood stockpiles to sell to raise income. Group discussions also confirmed that such urgent needs have often led them to fraudulent transactions by urban buyers.

Kamanga *et al.* (2009) and Sunderline *et al*. (2005) argue that the forest can be relied on to earn a higher income. However, the firewood dependent households in this study generally do not have what it takes to profit from such high-value products. For example, they do not own tricycles or donkey carts for transporting large quantities of firewood to the market for higher income. Apparently,the popular means of transport are by head porterage and sometimes on the shoulder (see appendix 3 photo 9). This finding resonates with conclusions by Belcher *et al.* (2015; Yemiru *et al.*, 2010; Manyatsi & Hlophe, 2010; Babulo *et al*., 2008b) that poor households have no donkeys or carts and as a result are only able to transport smaller quantities to market centres via head poterage for a lower return. Kamanga *et al*. (2009) stated that very poor households are almost destitute and not able to participate much in the collection of any resource including fuelwood from the forest to their advantange.
Shackleton and Shackleton. (2004) indicate that all households engaged in firewood trade remain poor, have limited assets and are unable to meet all their aspirations and most live on a day-to-day subsistence basis and continue to be vulnerable. The low value nature of firewood and hence low income, is evident in Appendix 3 photo 5a and 5b which shows the price per unit volume of firewood.

5.7. Physical capital

The results show that firewood dependent households are poor in physical assets holdings. This suggests that households have low incomes resulting from their inability to take advantage of better strategies or ventures to earn higher income to reduce vulnerability and improve well-being. Consistent with this finding, Kamanga *et al*. (2009) asserts that forest- poor households have the lowest income and are said to be near destitutes. Consequently, they are not able to go into the forest to gather firewood or take advantage of forest activities to their benefit.

Many other studies such as; (Belcher *et al*., 2015; Cerutti *et al.*, 2015; Vedeld *et al.*, 2009; Babulo *et al.*, 2008b; Mamo *et al*., 2007) have confirmed that forest-depended poor households are poor in productive assets. In this study households were found to own only simple and rudimentary physical assets such as hoes, cutlasses, axes, and basic feature simple mobile phones. This finding further agrees

with Wunder *et al*. (2014), who found that firewood income can only support the purchase of agricultural implements and also protect the farmer from disposing their farm produce at low prices during periods of glut.

The study found that less than 2% of respondents owned productive assets like houses and motorbikes whose market value are largely accounted for by income from firewood harvesting and trading. In consonance with this finding, Quiroz-Carranza and Orellana (2010, cited in Nawrotzki *et al*. 2012) report that few firewood dependent households own productive assets such as motorcycles, bicycles, mobile phones etc. Kamanga *et al*. (2009) and Babulo *et al*. (2008b) indicate that firewood dependent households are poor in assets since earnings from firewood are only sufficient to meet consumptive needs rather than asset accumulation. However, in the poverty of their physical assets, 71% of respondents indicated that the contribution of firewood income to the assets so acquired was high. Yemiru *et al*. (2010) report that it is practical to conclude that the firewood-dependent households are poor in physical assets considering that the type of assets they have are rudimentary and inefficient.

5.8 Natural capital

All respondents have access to land but do not have tenurial rights over such lands. While Dalka (2016) and many studies see access to land as an important asset for households, Timko *et al*. (2010) shares same but stress that tenurial rights overland is more important for its security, management and use and indeed to be qualified as collateral. This means that households can not use land as a means to access credit to be able to invest into high yielding livelihood strategies. Though access to land is not restricted, women are reported to generally have smaller land sizes compared to their male (Dalka, 2016; Yemiru *et al.*, 2010; Elis, 1998).

Over 90% of respondents show sound knowledge in the geography of the area and of the plants and animal species as well. This could imply that in times of shocks and stresses the household have a larger space within which it can explore for survival. Households do not own forest or plantation. This is consistent with findings by Yemiru *et al*. (2010). This however suggest that there is the possibility of over exploitation leading to resource depletion as expoused by Ceruti *et al*. (2015).

Most households reported owning fowls but few households own sheep and goats and yet very few own cattle. This is in line with findings by Kamanga *et al*. (2009) and Elis (1998). This suggest that incomes of most households will be affected

due to the type and number of livestock they own. Low household income negatively affect the ability of households to diversify livelihood strategies from poor to high income earning ones. This finding is consistent with findings by Kamanga *et al*. (2009) and Babulo *et al*. (2008b). This implies the chances of households to step out of poverty remains difficult and will require an intervention.

5.9 Social capital

Study findings on social capital show that households are poor or limited in social capital and hence remain more dependent on firewood harvesting and trading. Wunder *et al.* (2014) in their study, expected that households endowed with low social capital could have acsscess to village-level social and economic networks that can provide collectively based safety nets, thus leaving extraction from forests and wildlands as a more likely default option. This means households are not deriving benefit or relational support from other persons within their livelihood engagement network.This also implies that greater opportunity to improve their well-being is lost. Belcher *et al*. (2015) corroborate the fact that other village characteristics including social capital are expected to influence livelihood in both positive and negative ways.

In similar findings, Wunder *et al.* (2014); and Gittel *et al*. (1998) indicated that, belonging to a social network enables the individual to pool risk and benefit from resources of members, not of one's own. An assessment of the concept of social capital as a relational benefit claimed or accessed through participation in or belonging to group networks in this study, is an innovative measure as expressed by Wunder *et al.* (2014) in their global comparative study of Safety, Gap Filling, and Forests. They found the inclusion of social capital as an innovative variable in livelihood diversification. It is in this same thinking that the concept has been applied in this study.

Often, actors in organized groups benefit from others' resources on the basis of trust (trustworthiness) and obligations (motivation of a resource owner to respond to an actor or give out) (Castiglione *et al.,* 2007; Portes, 1998). With more than 95% of firewood harvesters trading with urban buyers, it is expected that, households would have been receiving some forms of benefits from urban buyers due to the trade relation which Kwon *et al*. (2002) mentioned as an important source of social capital. Benefits in the forms of employment opportunities, school admissions by firewood-dependent households, clothing, support for medical cost etc. Such relationships can

significantly help transform or support in improving the well-being of firewood-dependent households. This expectation is equally expressed by Portes (1998), that, networks of associations could lead to less privileged members especially from rural background gaining employment at urban centres or admission for their wards in town schools.

Results from the study communities suggest however that, 83% of respondents indicated not benefitting from social capital. This may be due the fact that, 92% of respondents indicated that they do not belong to any organized firewood-based membership group which is well expressed by most social capital authors as a necessary condition to benefit from social capital (Kwon *et al*., 2002; Portes, 1998). While selling to urban buyers is a source of social capital, not being in organised groups poses a limitation to earning any benefit from the organized relation as stressed by a number of studies (Kwon *et al*., 2002; Gittel *et al*., 1998; Portes, 1998).

Invariably, belonging to organised membership groups is a necessary condition to benefit from social capital. This is consistent with most narratives on social capital (Keefer 2016; Gittel *et al., 1998;* Angelsen *et al.*, 2014; Wunder *et al*., 2014; Kwon *et al*., 2002; Coleman 2009; Castiglione *et al.*, 2007; Portes 1998). While Portes (1998) stresses that people cannot benefit from social capital when they are not into organized relationship groups, he elaborated that benefitting from resources that others control is not because others exist, but that it has to be consciously and deliberately created through investment for purposes of benefit.

This conscious investment into relationship building was missing among firewood harvesters as espoused by some social capital writers (Kwon *et al*., 2002; Coleman, 2009; Castiglione *et al.*, 2007). Benefit from social capital was also poor perhaps based on what Wunder *et al.* (2014) and many other social capital proponents expressed as, 'the poor does not have anything to give and hence nothing to receive in return' (the principle of reciprocity). This is possibly so because the study found that those who benefitted from social capital either gave something earlier or sold firewood on credit or through generosity.

It was also found that firewood traders lose much of their income through fraudulent transactions from Tamale-based urban buyers (eg.full cargo loads bought on credit and not paid for). This type of transaction in firewood harvesting and trading is contradictory to the tenets of social capital which largely calls for risk pooling among network members. Focus group discussions revealed that urban buyers are in

a continuous habit of preying upon the rural poor by taking away large quantities of firewood without paying or underpaying.

Respondents shared the modes through which cheating by urban buyers occurs. These include, overloading of transport trucks with firewood, intentionally breaking price agreements after firewood has been fully loaded and failing to honour credit purchases of firewood loads. The sad aspect of this unfair trade as revealed by harvesters in a focus group discussion is that, during harvesting of firewood (which is easily stolen away by urban buyers), the harvesters suffer snake bites, and maims, from cutlass or axe wounds among others in harvesting during the last trimester of pregnancy. The discharge of such dishonest conduct and total neglect of the suffering of the harvesters, causing huge losses as members of a network (even if it is not well structured) undermine the importance of social capital as a relational benefit. This viewpoint is elucidated by Keefer (2016) who sees sympathy as another source of social capital.

5.10 Factors motivating reliance on firewood

The results point to three main factors motivating reliance on firewood in the study area. These include; a lack of high income earing alternative economic activities, low levels of education, and a lack of financial capital. Reliance on firewood or forest resources is buttressed by Bwalya (2011) who underscored in a study in Cote D'Ivoire, that limited employment opportunities in most developing countries make millions of poor people depend on firewood as a source of living. Similar dependence factors have been identified by several studies (Puentes-Rodriguez *et al.*, 2017; Babulo *et al.*, 2008b; Biran *et al.*, 2004; Cavendish, 2000). These suggest that households clearly understand what is responsible for their poverty situation but cannot change or improve it. This implies there is no option for households to turn to, but to continue to exploit the natural resource that is available and accessible. In line with this, Vedeld *et al*. (2007) noted that, poor households continue to degrade the forest resource base for lack of an option to high earning opportunities and continue to depend on it for a living.

The degree of reliance on firewood as a source of livelihood in the study area can be described as very high, to the extent that, any measure to strictly restrict access to firewood resources will result in unbearable consequences particularly the very poor who earn the largest share of household income from it or the forest in general .

Considering that the firewood resource virtually represents the hope for daily sustenance of households in the area, it can be surmised that any attempt to restrict access will meet fierce and life threatening resistance.

The consequences of strict restriction have been acknowledged and described strongly in different ways by many studies (Belcher *et al*., 2015; Angelsen *et al.,* 2014; Rayamajhi *et al*., 2012; Kamanga *et al.,* 2009; Babulo *et al.*, 2008b; Mamo *et al*., 2007; Angelsen & Wunder, 2003). These include but are not limited to considerably affecting the survival of the poor, potentially exposing people to extreme suffering and ultimately relegating rural people to levels of livelihood deprivation that entails, distress migration, conflict, health problems and even loss of lives.

Considering the above, Babulo *et al.* (2008b) suggest that for sustainable use and management of forest resources such as firewood, it is important to adopt measures that allow for the existing use and access rules that harmonize both economic and environmental aspects, such that local people will generate economic benefits without damaging the resource base. Hence, a participatory approach is key for sustainable management albeit its limitations as found by Adhikari (2017), Kamanga *et al*. (2009) and Shackleton (2004). That is participatory forest management tends to limit the welfare of the poor.

Firewood is a renewable natural resource that can regenerate, but obviously can be depleted through unsustainable use. In the study area, evidence on the ground (see Appendix 3 photo 4) suggests a threat to the resource base due to deforestation /forest degradation emanating from over exploitation and influx of large scale external harvesters as noted by Cerutti *et al. (*2015) (see Figure 4.1). As a result, consideration for alternative livelihood sources becomes eminent.

The scale and intensity of firewood harvesting in the area clearly poses a threat to the forest environment. On the basis of that, respondents were asked to suggest some possible livelihood alternatives should firewood become difficult to find. Based on the suggestions such as, going into petty trading if assistance is provided and others considering depletion of firewood as a matter of life and death suggests a critical situation if the firewood resource gets depleted. This is in tanderm with assertions by Sunderline *et al*. (2005) and Mamo *et al*. (2007), any intervention that restrict the poor's access to the forest will be a serious threat to the survival of the poor. This level of significance of firewood trade and income to households in the

study area also corroborates findings from several studies (Rayamajhi *et al*., 2012; Kamanga *et al*., 2009; Babulo *et al.*, 2008b; Mamo *et al*., 2007; Angelsen & Wunder, 2003), meaning it will be relevant to adopt measures that can ensure conservation of the forest environment in the area.

Contrary to findings by Cavendish (2000) and Kamanga *et al*. (2009) however, landlessness and widowhood are important factors for reliance on forest resources,but these factors were not found as important in this study.

5.11 Existing regulations on firewood access

The tudy results indicate that the traditional authorities are the main institution that regulates access to firewood. This implies that the area is not a government designated site. Traditional authority ownership and control over forest resources was found by Cavendish (2000), indicating that environmental resources are communally owned. Cavendish (2000), further stressed that most woodlands, rangelands, and water bodies are not owned privately but owned by the community through traditional authorities leadership. Babulo *et al*. (2008b) similarly notes the application of traditional and spiritual rules in the regulation firewood resources.

Contrary to these findings however, Manyatsi and Hlophe (2010) in a study in Swaziland, found that access to forest resources was regulated by government through an act of parliament, the Flora and Fauna Act (Act 2001). The Act however allows Swazi rural dwellers to harvest and process plants outside flora reserves for personal and domestic use but not for sale. Puentes-Rodriguez *et al*. (2017) in a study of firewood value chain in Bourkina Faso also found an integrated approach composing of youth, chiefs and government exercising control over firewood resource.

The role of the traditional authority in regulating and controlling harvesting and trading firewood resource is not much felt. This is because the governing rules are poorly enforced or not enforced at all.The basis for this is that there are regulations that, for example prohibit the harvesting of economic trees and the protection of sacred sites. These rules are functional and have practically protected sacred sites but are practically unable to monitor and control volumes of firewood harvested as noted by Adhikari (2017). Control over external harvesters was also found ineffective. In corroboration, Belcher *et al*. (2015) intimated that, culture and ethnicity are also expected to influence forest resource use decisions especially dealing with tribal people with long-standing traditions of forest-dwelling and forest use.

It was found that regulations are not enforced or are poorly enforced when it comes to harvesting and trading of firewood. This is because the rules are not punitive enough when violated. It was reported that, in some rare cases some chiefs connive with external commercial harvesters to enter the area for harvesting of firewood regardless of its degrading effect.

In the study area, Mondays and Fridays were reported as the 'taboo days' when harvesting of firewood or generally going to bush or farm is prohiited. Enforcement has however been ineffective. Adherence to this taboo, according to focus group discussions is optional and not for fear of being punished. It was reported that observance of these days may be because the individual chose for example, to observe the Friday prayers instead.

Firewood is therefore harvested freely from communal lands without any restriction. This finding is shared by many studies (Yeboah, 2017; Mamo *et al*., 2007; Sunderline *et al*., 2005) with the concensus that firewood is most beneficial to the poor when it is easily or freely accessible. This situation however, creates the opportunity for over exploitation and a potential for resource depletion. This could be due to the fact that the area is not a reserve or under any government control where punishment for breach is largely enforceable.

Study findings suggest that firewood harvesting and trading is regulated but there are many lapses in the regulatory mechanism. These entail lack of transparency on the part of the traditional authority regarding rates charged some external harvesters and their inability to monitor and regulate volumes of firewood harvested; the district assembly revenue staff at a revenue collection point. This finding is inconsistent with findings by Puentes-Rodriguez *et al*., (2017) whose study in Bourkina Faso found well organised structures along the firewood value chain where chiefs, youth and government were working in harmony to control the firewood trade.

The study found that trading of firewood was riddled with fraudulent transactions by agents, characterised by individual sale of products leading to substantial income losses on the part of firewood harvesters. This finding though contradictory, serves to confirm findings by Awono *et al*. (2010) who in a study in Cameroon found that women were very happy about the group sale of NTFPS regarding incomes that they earn.

From the foregoing discussions however, it appears there are limited, if any, restrictions or regulations in the study area that are effective in controling access to

and harvesting of firewood. One can state that there are functional rules and regulations for the protection of sacred sites and harvesting of economic trees but apparently the functionality of these rules in regulating firewood access and extraction leaves much to be desired. This is partly because local traditional authorities are not empowered to regulate access to firewood. Therefore, access to firewood in the North East Gonja District may be partially described as unfettered and hence subject to overexploitation and consequent degradation as espoused by Zidago and Wu (2015) and Cerutti *et al.* (2015).

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The main aim of this study was to generate evidence on the benefits that households of the North East Gonja District derive from firewood harvesting and trading. In other words, the study sought to answer the question of how firewood harvesting and trading have contributed to improving the well-being of the households in the Kparba area in the Nort East Gonja District.

- The main sources of livelihood identified in the study area are mainly crop farming, firewood harvesting, livestock rearing, and self-owned trade. The sources that are depended upon by almost all households are crop farming and firewood harvesting. A greater part of farm produce is used for subsistence but occasionally sold for money to meet some unexpected emergencies. Self-owned businesses and livestock are high yielding ventures with the potential to help poor households to step out of poverty, but the barrier of entry is the challenge of raising the required capital to enter into such enterprises. While livestock, especially cattle, was owned by very few households and therefore economically not important to them, almost all the households were engaged in the firewood business. Interestingly, no household head or respondent was found engaged in public service or salary earning jobs.
- Firewood is undoubtedly the most depended upon forest resource as a source of income for all households despite its comparatively lower mean income. Income from firewood is used to meet daily household expenditure especially for food and other important costs of health and education.
- The contribution of firewood harvesting and trading to the building of a mix of livelihood capitals was generally poor, especially in the particular case of financial, physical, and social capitals. Over 60% of households could not save with formal banks and over 70% could not lend firewood cash income due to low earnings from firewood. While households do not save with formal financial institutions, it is indicated that some of the harvesters are members of the Village Savings and Loans Association (VSLA).
- Households are manifestly poor in physical assets, basically owning farm implements such as hoes and cutlasses. They are similarly poor in social

capital as over 80% did not benefit from their firewood trade relation with urban buyers, even though almost all harvesters trade with buyers in Tamale. Working through organized groups or structures has been established as an important precondition for benefitting from others' resources.

- Firewood income has proven to play a key role in the development of human capital. On average, over 80% of respondents alluded to the role firewood income plays in funding education, health care access, and skill development of members of the household. While more than 90% of respondents and heads of households are illiterates, a similar number of 91% of young children are enrolled in school with the majority of them being at the basic level and then secondary level.
- It is overwhelmingly established that firewood income is the most important source of funding for household management and human development-related cost.
- Households are fairly endowed with natural capital as almost all households have access to land though they do not have tenurial rights. Also over 90% of household have sound knowledge of the geography and the flora and fauna of the area which is important in coping strategies of households in times of shocks and stresses. They are however poor in ownership of small to large ruminants such as sheep and cattle which have high income value.
- Though men are involved in firewood harvesting, it is dominated by women. Men may be engaged in firewood harvesting for money or specific purposes such as weddings but women are involved daily to sustain the household.
- Both men and women harvesters suffer ‘huge’ income losses through predatory or fraudulent transactions from urban buyers. Track loads of firewood are bought on credit for which payment is never made and the buyer is never found**.** This include breach of negotiated prices, cheating etc.
- The main factors identified as motivating reliance on firewood include lack of high earning alternative livelihood sources, lack of formal education, and lack of financial capital to diversify into high yielding livelihood strategies. Households have no capacity of improving their situation.
- It is established that the Traditional Authority is the institution that has the power of regulating firewood access where some rules and taboos are the

drivers. Firewood is harvested from open communal lands as everyday work. The regulation does not affect the quantity of firewood harvested. It however prohibits the harvesting of economic trees and in principle does not allow free entry by external harvesters. Generally, there are no deterring punishments for violation of rules.

- Firewood trade is regulated by both traditional authority and the district assembly through levies charged or loads of firewood transported. There are however many lapses in enforcement and the lack of transparency and accountability in revenue mobilisation.

6.2 Recommendations

Considering the role of and the degree of dependence on firewood in the North East Gonja District, it is important to pursue conservation programs that will ensure access to and the sustainability of the resource. In pursuing that however, it is important to note that, strict restriction of access to firewood resources may relegate rural households towards livelihood deprivation. Hence adopting a participatory and sustainable approach to firewood utilization and management will be a better way forward.

Secondly, continuous dependence on firewood may perpetuate the poverty situation of the people. It is important therefore to support the people through skill and entrepreneurial training alongside an integrated credit access to enhance their capacity to engage in high earning alternative livelihood strategies such as soap making and bee-keeping. Training them in group dynamics and moilising them to work in groups is equally of utmost importance.

Thirdly, social capital has the potential to improve the well-being of poor individuals or households. This is made easier by belonging to a network of members where a free opportunity is offered to leverage on resources of others within the network. Acting alone, the poor household or individual would not have access to such opportunities. Thus, it is important to support firewood harvesters and traders to operate in organized structures along the firewood value chain to enable them to tap into the wealth of benefits offered by social capital. Also, operating through an organized structure will help protect harvesters from predatory or fraudulent behaviors by urban buyers as well as not becoming price takers but capable of exploring for better markets for better price for their products.

Fouthly, for both short and long term reasons, the district assembly's investment into educational infrastructure development, enrolment and retention drive and efforts towards improvement in quality of education as a priority, is a critical need.

Fively, It would be important to consider an afforestation program in the area using fast growing species and other economic trees.

Six, people and their needs as the main driving force behind the depeletion of the firewood resource it would be relevant to carry a sensitization programe on the state of the environment and its livelihood implications for the people and the Assembly of the area

Seven, it would be relevant to support poor households to own some productive natural capital such as sheep, goats and cattle. Tenurial rights over land by poor people will be important if it is against the cultural practice of the area.

Considering the extent of reliance on firewood in the Kparba area in the North East Gonja District, the study makes the following recommendations for further research:

1. A follow-up study to help estimate the volumes of firewood exported from the study site and the differentials in incomes between the rural and the urban markets.
2. Re-assessment of the significance of firewood harvesting and trading in the building of human capital of households in the Kparba area as a sustainable index of well-being.
3. An assessment of the role and capacity of the Traditional Authorities in the sustainable management of the firewood resource.

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APPENDIX 1: DATA GATHERING INSTRUMENTS

A. Survey questionnaire

KPARBA FIREWOOD SURVEY INTERVIEW GUIDE

SURVEY: ASSESSING CONTRIBUTION OF FIREWOOD TO LIVELIHOODS IN EAST GONJA MUNICIPALITY.

Thank you for agreeing to take part in this important survey on assessing the contribution of firewood harvesting to the livelihood of the people of the North East Gonja District. The survey is part of research toward meeting the academic requirements for a post-graduate degree at the Kwame Nkrumah University of Science and Technology (KNUST). **Please be assured that your responses are for purely academic purposes. Also, be assured that your responses shall be kept in the strictest confidence and will not be traced back to you**. *You are encouraged to supply frank and accurate responses in order to enhance the quality of the research.*

SECTION A: HOUSEHOLD CHARACTERISTICS

1. Household characteristics

A. Is respondent head of the household?	**B**. If no, what is the relation with household head? (**See code 4)**	**C.** Gender of respondent	**D**. Age of respondent	**E**. Household size and gender distribution HH Size=		**F.** Marital status of respondent **(See code 5)**	**G**. Highest level of education of respondent (if respondent is not HHH **(See code 6)**	**H** Highest level of education of household head
Yes ( ) No ( )		M ( ) F ( )		M	F			

SECTION B: SOURCES OF LIVELIHOOD

2. What is/are the primary source(s) of livelihood for this household? (leave blank where not applicable)

A. Primary Livelihood sources for household	**B.** Which of these are or is a livelihood source for your household? (Tick all that apply)	**C.** What is the household's average monthly income from the livelihood source?	**D.** Rate your livelihood sources in order of importance. ***(higher number denotes greater importance from 1-9)***	**E.** Which of these sources use more of the family labour? **(Indicate number of family members engaged)**	F. For how long has this been a primary income source? (< 1 year; 1-5 years; 6-10 years; 10-15 years; over 15 years)
Farm					
Crop farming					
Livestock rearing					
Non-farm					
firewood					
Self-owned business					
Remittance					
Transfer payments					
Salary					
Off farm					
Wages					
other (Specify if any)					

3. What is your primary purpose for harvesting firewood?

   a. cash **b.** consumption **c.** cash and consumption **d**.other, specify…….

4. How important do you consider firewood income to household income?

   a. Not important **b**. somehow important **c**. important d. very important

5. What time of the day do you harvest firewood

   a. Morning **b**. Afternoon **c**. Evening **d**. All day **f**. Weekend

6. Sources of firewood

a. Where do you harvest your firewood from	tick	**b**. How often do you harvest from these sources **(1-daily 2-weekly, 3-monthly)**	**c.** What is the average quantity per the period **(indicate number of pans, bundle, "motor king")**
Open access/community			
Own farm			
Neighbours farm			
Relatives farm			
Restricted area			
Family land			

7. Indicate percentage of firewood which is sold for cash and which is consumed by the household (household consumption includes gifts to others, etc.)

% Consumed	% Marketed

8. Who harvest firewood for household?

a. wife/woman **b**. father /husband **c**. father and mother **d**. children and mother. **e.** entire household **f**. hired labour **g**.family relatives h. friends

9. Do you load or contribute to cargo load of firewood for sale in Tamale?

   a. Yes **b**. No

10. How much do you earn per unit of firewood load

11. How many times do you load per month or year?

12. In your view, has firewood become harder to find over the last 5 years?

    a. Yes **b**. No

13. If yes, what, in your view, accounts for this situation?
14. What is your primary means of transporting firewood from the source of harvest to the point of sale?

    a. head porterage **b**. motor king/tricycle **c**. tractor **d.** animal e.g. donkey
15. What will you depend on for livelihood when firewood becomes inaccessible or not available?
16. What are some of the direct affects you will suffer of when firewood get exhausted?
17. Would you be willing to support or be a part of resource management project or measures in the future to conserve the forest?

    a. Yes **b.** No
18. During which period of the year are the selling markets for firewood difficult/impossible? ***(Tick all that apply)***

    a. Early dry season **b.** late dry season **c**. Early raining season **d**. late raining season
19. During which period of the year does firewood attract the highest price? **(choose what or all that applies)**

    a.Early dry season **b**. late dry season **c.** Early raining season **d**. late raining season
20. During which period of the year does firewood sell for the lowest price? **(Tick all that apply**

    a. Early dry season **b**. late dry season **c**. Early raining season **d**. late raining season
21. What are the challenges to physically accessing the firewood market?

SECTION C: FIREWOOD CONTRIBUTION TO BUILDING LIVELIHOOD CAPITALS

Financial capital

22. Firewood income contribution to household financial capital

a. Have you ever saved part of your firewood income? (tick)	**b**. If yes, how much did you save? **(If no go to column D)**	**c.** Where do you save your money? **(See code 7)**	**d**. What do you use your firewood income for? (**see code 8)**	**e**. Have you ever loaned firewood money to others?	**f.** What is your Most important source of cash income? **(See code 9)**	**g.** Average monthly cash income from firewood
a. Yes **b**. No				**a.** Yes **b**. No		

Human capital

23. Contribution of Firewood income to household Education

a. Number of school going age children in HH			**b.** No. of children in school		**c.** What is the highest educational level of any children in school? **(See code 10)**		**d.** Have you paid all school fees/charges? How much total?	**e.** If no, how much do you owe?	**f.** What is the most important source of education funding in HH? **(See code 11)**	**g.** Have you been able to provide any supplementary readers or support to children learning?	**h**. Reasons not able to provide supplementary readers **(See code 12)**
M	F	None	M	F	M	F	Yes ( ) No ( )			Yes ( ) No( )	

How would you rate the contribution firewood income to the education cost of children? **(Tick one)**

a. very high **b**. high c. low **d**. very low

24. Firewood income contribution to health of household

a. How many adult members of household have valid NHIS cards?	**b**. If all or some do not have, what is/ are the reason(s)? **(See code 13)**	**c.** Does firewood income play a major role in access to health care? **(circle response)**	**d.** Have you incurred any health cost recently?	**e.** If yes, how would you rate firewood income to that cost **(Code 14)**
		Yes No		

25. Contribution of firewood income to household members' skill development or training

a.How many adults above 18 and below 60 years are in this household?	**b**.Are they skilled and earning income? or under any skill training? **(tick response)**	**c**. If yes how many of them are skilled or acquiring skill?	**d**.What is the type of skill? (**See code 15)**	**e**. Did firewood income contribute to cost of training? **(circle response)**	**f**.How would you rate the contribution firewood income to HH skill development? **(low, high, none) code16**
M= F=	Yes No	M= F=		Yes No	

Physical capital

26. Firewood contribution to household physical assets

Which of the following items do you or a member of the household possess at the HH level?	Tick	No. of assets	How would you rate firewood income contribution to acquired HH assets? (**low, high, or none**)	Comment
1. Bicycle				
2. motor bike				
3. own house				
4. television				
5. refrigerator				
6. Tape recorder/radio				
7. mobile phone				
8. hoe and/or cutlass				
9. specify if any				

Natural capital

27. Contribution of firewood to natural capital

Type of natural capital	Yes	No	Would you credit firewood income or trade for owning any of thess assets?	
			Yes	no
Land				
Animals (fowls, sheep, goat, cattle etc)				
Forest				
Knowledge plant and animal spp				
Knowledge of area geography				

Social capital

28. What support or benefits do you derive from firewood related networks? **(circle response, or fill in where applicable)**

a . Do you or a member of the HH belong to any local firewood related association?	**b.** If yes, what is the type of the association? (See code 17)	**c.** Have you ever received any benefit or support from the local group or a member?	**d.** If yes, what was the type of the benefit to the HH? (See code 18)	**e.** Do you sell your firewood to urban dealers?	**f.** if yes have you benefited from them in any way?	**g.** If yes, what was the form of the benefit (See code 18)
Yes No		Yes No		Yes No	Yes No	

29. What assured this benefit?

a. association membership **b**. sold firewood on credit to dealer **c**. rendered free labour **d**. demonstrated trust in relations. **e**. gave out a gift

30. Have you ever suffered any bad experience due to association membership?

a. Yes b. No

31. If yes what was it?

a. loss of income **b**. deprived of opportunity **c**. abuse **d**. Insult **e**. Did not suffer anything **f**. other(s), specify……..

SECTION D: FACTORS MOTIVATING RELIANCE ON FIREWOOD

32. What are the driving factors for your reliance on firewood harvesting?

a. Factors driving reliance on firewood trade	Tick all that apply	**c.** Rank factors according to importance. **(higher number denotes higher rank)**
Lack of/inadequate financial capital		
lack of/low formal education		
Lack of/inadequate access to land for farming		
Lack of/limited alternative livelihood sources		
Widowhood/ divorced		
Have no married sons		
Other(s), specify		

33. If none of the factors above apply, would you still harvest firewood? **a.** yes **b.** No

34. If yes to question 39 why? ……

SECTION E: INSTITUTIONS MEDIATING ACCESS TO FIREWOOD

35. Is access to firewood controlled/regulated/managed?

a. Yes **b**. No **c**. don't know

36. If Yes, by who?

a. Government **b.** Traditional Authority **c.** NGO **d.** Community People **e.** other(s), specify ……

37. How firewood is regulated

c. If by government, what do they do to enforced restrictions? (See code 19)	d. If traditional, what do they do to enforced restrictions? (See code 20)	e. If NGO, what do they do to enforced restrictions? (See code 21)	f. If by community People, what do they do to enforced restrictions? (See code 22)

38. Are there days you cannot go for firewood harvesting? Yes or no

39. If yes what explains that……..

40. What could be the reasons why restrictions are imposed on firewood harvesting?

41. If there are restrictions, how do the restrictions affect your firewood trade? ……..

42. Environmental challenges in the harvest of firewood

Which of the following Challenges of firewood harvesting do you face	Tick where applicable	Measures of confronting challenges
1. Snake bites		
2. Insect bites		
3. Injuries from sharp tools		
4. Rape		
5. Commuting long distances		
6. Other(s), please specify		

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B- Focus group discussion guide

1. Who are the key stakeholders in the firewood trade?
2. What are the actual benefits from the firewood trade?
3. What are the known strategies to ensure sustainability of the firewood resource?
4. What the existing rules regulating firewood
5. Are they any existing groups for decision making about the firewood resources as well as the trade?
6. Forms of conflicts and conflict resolution mechanisms

C - In-depth interview guide

1. In what ways does firewood trade benefit the household?
2. Does the trade prove to be capable improving well-being of households?
3. What make the people so depended on the firewood resource?
4. Is there any fear for depletion of firewood resource? And what are the possible causes?
5. What are the sustainability strategies if yes to question 3 above?
6. Are there any rules regulating access to firewood?

APPENDIX 2: COMMUNITY HEALTH AND EDUCATION FACILITIES

A- List of health facilities in the district- north east gonja

COMMUNITY	FACILITY TYPE	NO
Bunjai	Chps	1
Kpalbe	Health centre	1
Fuu	Health centre	1
Jantong Dabogshie	CHPS	1
Total		4

B- Educational facilities in the district

Community	**Primary Sch**	**JHS**	**Community**	**Primary sch**	**JHS**
Bunjai	1	1	Dakpemyili	1	-
Durba	1	-	Jantong Dashie	1	1
Latinkpa	1	-	Jantong Wulanyili	1	1
Kidengne	1	-	Jantong Dabogshie	1	-
Kanakulai	1	-	Kpanshegu	1	-
Wangase Turu	1	-	Kapkeni	1	-
Kpalbusi	1	1	Banvim	1	-
Zankum	1	-			
Kpalbe	1	1			
Fuu	1	2			
Gbun	1	1			
Libi	1	-			
Chambuligu	1	-			
Chandayili	1	-			
Kpinshilla	1	-			
Nyamalga	1	-			

APPENDIX 3: FIELD PICTURES

Photo 1: Administration of household questionnaire to household respondents

Photo 2a : Male focus group discussion at Kpalbe. 2b: women focus group discussion at Tapkili


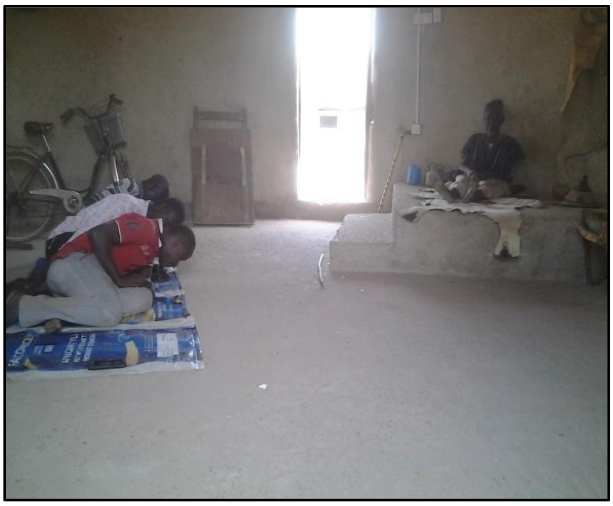

Photo 3: Traditional greeting at the Nyalmaga chief (left) and Janton Dabogshiewura's (right) palaces



Photo 4a. Good forest at Kpalbuse. 4b Degraded forest at Damayili. 4c. shrub vegetation at Jantong daoshie: Evidence of forest depletion. Residents at at Damayili and at Jantong Dashie indicate that their areas were equally forested some time ago.


Photo 5a: Truck load of firewood costing ghc420.00. Photo 5b: A ‘’seat’’ load of firewood (ghc60.00)


Photo 6: Woman pointing at her injured leg by an axe during firewood harvesting

Photo 7. A woman (Madam Memuna) wondering on forest depleted land for firewood to sell to settle a debt she incurred during her unsuccessful pregnancy.

Photo 8: Diversification: a seamstress and groundnut oil processor still into firewood harvesting

Photo 9: Carrying of firewood on shoulder.

Photo 10: situation firewood in the Jantong area of the North East Gonja District

It is important to note that photo 9 and 10 were taken within the same season in the month of February, 2019