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GENDER VULNERABILITY TO DROUGHT IN THE UPPER EAST REGION

OF GHANA: A COMPARATIVE STUDY OF BONGO

AND TALENSI DISTRICTS

MODESTA PUKUNYIEM

UNIVERSITY FOR DEVELOPMENT STUDIES



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GHANA: A COMPARATIVE STUDY OF BONGO

AND TALENSI DISTRICTS

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PHILOSOPHY DEGREE IN DEVELOPMENT STUDIES

UNIVERSITY FOR DEVELOPMENT STUDIES



OCTOBER, 2020

DECLARATION

Student

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

Candidate's signature

Date

.....

.....

Name: **MODESTA PUKUNYIEM**

Supervisor

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

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Name: **PROFESSOR DR. DAVID MILLAR**

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ABSTRACT

Climate change, manifested in the Upper East Region through prolonged droughts has adversely affected food security; availability, utilization and stability especially among smallholder farmers. Although it is obvious that climate change and drought has altered food production systems, very little however has been done particularly in making comparative analysis of the situation with regards to gender. Most intriguing is the fact that most studies so far have concentrated on identifying the level of vulnerability and adaptation but are silent on the issue of differences among groups (e.g. gender) in relation to droughts. What is missing in previous studies is the consideration of the role or significance of gender differences in the changing climate particularly in drought situations, since both genders are actively engaged in agriculture. Guided by the vulnerability theories, this study employed the descriptive research design to examine gender vulnerability to drought in the Upper East Region of Ghana. The findings reveal that both males and females are equally affected by drought related impacts but more men had access to land and other productive resources than women in both districts. The findings further reveal that, although both genders employed coping and adaptation strategies, more men used off-farm strategies (carpentry, masonry, trade and commerce, migration and government employment). These off-farm wage employment are less affected by climate change and drought making men more resilient to the impacts of drought and climate change. The findings further suggest that female farmers were engaged in less paid jobs such as petty trading and rendered farm related services to other people in exchange for food. Both males and females relied on wild fruits, vegetables and game as temporary coping mechanism during drought episodes and food shortages. Reducing gender vulnerability to drought will entail implementation of planned interventions that has the potential to decrease exposure and vulnerability to drought-related conditions. It is clear from this study that farmers' adaptive capacities are constrained. Hence, to increase resilience of vulnerable groups to drought related impacts, it is recommended that climate change adaptation pathways should pay close attention to gender and socio-economic differences of smallholder farmers.

Key words: Gender, vulnerability, drought, Bongo district, Talensi district, Upper East Region, Ghana.



DEDICATION

This thesis is dedicated to my father, Albert and my son, Karel Jayden

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"And now we thank you, our God, and praise your glorious name." (1 Chronicles 29:13). I thank the supreme power, Almighty God who has always guided me to live on the right path of life and work on this thesis. Without His grace and protection, this work would not have been a reality.

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LIST OF ABBREVIATIONS

ADVANCE	Agriculture Development and Value Chain Enhancement
AEA	Agriculture Extension Agent
CA	Community Action
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FBO	Farmer Based Organization
FGD	Focus Group Discussion
FM	Frequency Modulation
GDP	Gross Domestic Product
GIS	Geographic Information System
GSS	Ghana Statistical Service
HRD	Human Resource Development
IDMC	International Displacement Monitoring Centre
IK	Indigenous Knowledge
IPCC	International Panel on Climate Change
ISDR	International Strategy for Disaster Reduction
ISSER	Institute of Statistical, Social and Economic Research
LEAP	Livelihood Empowerment against Poverty
MoFA	Ministry of Food and Agriculture
MONRE	Ministry of Natural Resources and Environment
NADMO	National Disaster Management Organization
NGO	Non-Governmental Organization
PAR	Pressure and Release Model
SDG	Sustainable Development Goal
SHS	Senior High School
SPSS	Statistical Package for Social Scientists
TECH/VOC	Technical/ Vocational
TV	Television



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UN HABITAT	United Nations Human Settlements Program
UN	United Nation
UNDP	United Nations Development Programme
UNISDR	United Nations Office for Disaster Risk Reduction
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organization
WMO	World Meteorological Organization

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Climate change has dire consequences on food security, availability and also utilization as well as food system stability. Though smallholder farmers are expected to contribute to all food production and economic growth, they are however affected by drought related conditions resulting from climate change. Prolonged drought conditions not only lead to loss of livelihood but also increases smallholder farmers' vulnerability and marginalization of women in particular. In essence, peasant farmers are adversely affected by climate change. The climate change phenomenon may result in drought and thereby reduce agricultural output as well as their sources of livelihoods.

There are three main components of vulnerability. The first has to do with the level of exposure of a particular system to the impacts of drought. The second component of vulnerability deals with the sensitivity of the system to the impacts of drought while the third component has to do with the coping and adaptive capacity of the system or group of people to the impact of drought (IPCC, 2007). Farmers' exposure to the resultant effects of climate change and drought are noted to be more severe (Ayinde et al., 2010) particularly in geographical areas where funding to agricultural research has been significantly low, current proliferation of agricultural information and training are poorest, technological changes have been the slowest (Action Aid International, 2008) and where domestic economies rely significantly on rain-fed agriculture (Apata et al., 2008).

For instance, certain parts of Ghana particularly regions in the guinea savanna belt are witnessing decreased yields in crop cultivation as well as changes in livestock rearing.



This is noted to be a result of the severe weather and the changes in the recent climatic conditions. Rainfall in recent times has been very minimal in some regions of Ghana as well as other humid regions of West Africa (Adebayo et al., 2011). The severe effects of the changing climatic conditions on food production therefore require proper adaptive responses by the farm households in dealing with drought.

1.2 Background of the study

Globally, drought is noted as one of the most precarious natural disasters in recent times as it continues to cause destruction to lives and properties. It is generally believed to occur because of climate change and affects all dimensions of the human environment (Masih et al., 2014). Like most developing regions, Africa is one of the regions that is already suffering from the consequences of variability in global weather and climate events (Mishra and Singh, 2010). It is estimated by the United Nations (UN) that a substantial portion of the continent's inhabitants are exposed to drought related challenges in their geographical locations every year (UN, 2007; Mishra and Singh, 2010).

According to a definition by the World Meteorological Organization; drought is a prolonged absence of rainfall (WMO, 1986; Mishra & Singh, 2010). Corroborating that definition, the UN also explained drought as a natural occurrence that comes into being when rainfall has been significantly low resulting in hydrological inconsistencies and by extension impacting on natural resources. A definition by Mishra and Singh (2010) explains that drought is the absence of precipitation for a long period of years resulting in crop failure. Various definitions of drought have been given in literature. According to Mishra and Singh (2010), drought can be grouped into meteorological drought, hydrological drought, agricultural drought and socio-economic drought (Mishra & Singh, 2010).



Among the effects of climate change, drought is pervasive though some view it as an uncommon occurrence. The incidence of drought varies across regions in virtually all areas of the world regardless of the prevailing local climates. Though drought can exist for prolonged period, it is not a permanent phenomenon. It occurs when there is less rainfall or there is an increase in temperature for a long time leading to severe evatranspiration (Pearce et al., 2002).

Drought has rendered most people especially women and children in developing countries eventually poor since their source of livelihood which are tied to natural resources are severely affected by the fall outs from climate change. As noted, the most affected during drought periods is the farming sector due to decrease in productivity (McCusker et al., 2006), the agriculture sector agonizes the most in terms of the fall in productivity and unpredictable weather conditions that significantly affect food security (McCusker et al., 2006).

Ghana has experienced extreme drought and flood situations in the last 20 years which has resulted in the deterioration of socio-economic conditions of significant number of people in various parts of the country (USAID, 2012). In the Guinea Savannah area particularly, the five northern regions and parts of the Bono region have experienced decrease in rainfall in the past decade (Teye & Yaro, 2015; Aniah et al., 2016). This has contributed to a continued decline in agriculture productivity over the same period. The tendency for drought to occur is always high during the farming season making the timing of activities during that period to be very difficult for the peasant farmers who rely heavily on the rains in their farming activities (Nutsugah, 2013). Though, most farmers in Ghana acknowledge the changing patterns in climate and weather events, it is increasingly becoming difficult for them to autonomously adapt to these changes and thus render them vulnerable (Fosu-Mensah et al., 2012).



Vulnerability according to Adger and Kelly (1999) is the extent to which individuals or systems are unable to withstand the conditions resulting from drought on their sources of livelihoods as well as their health. Chambers (1989) considered vulnerability to be the exposure to consequences and stress with accompanying challenges in addressing them. By this, aspects of drought vulnerability include stress, shocks among others that people are exposed to externally; and an internal aspect, that is mostly helplessness, implying absence of accurate measures to cope with the demands and difficulties accompanying it. In relation to drought, most of the studies is focused on the causes, effects, coping mechanisms and adaptation to the subject to the detriment of comparative analysis of the subject with regardless to different social groups including gender (Masih et al., 2014; Awen-Naam, 2011; USAID, 2012). The records on drought in Ghana especially in the north are indeed good reasons why analysis of the situation is needed to help redirect a nation-wide attention towards drought reduction and adaptation to help raise the quality of lives in all drought affected areas in the country.

Coping strategies to droughts at the household level are the responsibilities of the farmers. According to the IPCC (2007), adapting to climate change is explained as a situation where the human systems are able to adjust to the anticipated change in the climatic conditions, their inputs or explore the intended benefits. Coping as well as adaptation enables farmers to increase their food security, income as well as improve their livelihood notwithstanding the changes in the climate and drought related conditions (Kandlinkar et al., 2000). Farmers responses and coping strategies in relation to the effects of drought on crop farming are based on the farmers own initiatives (Risbey et al., 1999).



Decision making by farmers is a daily activity where farmers constantly resort to both long term and short-term initiatives and interventions in managing the dangers associated with drought. Coping with drought conditions is based on the outcome of farmers own decisions resulting from climate change which is internal to the farmers household and also the farming systems externally as a whole (Smith et al., 2002). Farmers continuously face severe challenges including decrease in crop yield, food shortages and also outbreak of pests and diseases (Zoellick et al., 2009) which are mostly due to drought and changes in climatic conditions. According to WEDCO (2008), in adapting or coping with drought related conditions among households, a gender perspective is vital for effective policies.

Gender is defined as the roles and responsibilities assigned to men and women by the society. Gender is a social construct between men and women and the unseen power structures which regulate the relations between men and women (UNDP, 2010). According to Baker (2002), gender is not only limited to women and men but also on the relations existing between men, women and children in relation to their assigned roles, responsibilities as well as their contact with and power over resources in meeting demands of livelihood. In the context of this study, gender relates to the contributions of male and female smallholder farmers to decision making on drought conditions, crop and livestock production activities at the household level. Studies indicate that gender relation in agriculture is crucial for the reason that it determines household security, household well-being and several aspects of life (Apata et al., 2008).

According to empirical studies by (WEDCO, 2008), gender division of labor and power structures has the tendency in influencing household ability to respond to the effects of drought by implementing planned actions to address impacts of drought on



crop production. Contributing to the discourse, understanding how both genders are affected by drought differently is imperative in mitigating drought related challenges (Babugura et al., 2010). Similarly, USAID (2012) posits that such understanding in the gender differentiation will help in resolving the special needs of men and women in relation to drought. Participation of both genders in natural resource management is a pre-requisite in ensuring sustainable development. That notwithstanding, attempts to address the effects of drought on agriculture has not fully incorporated the differentiation in the adaptive capacity in recent times. This is due to the fact that gender and drought are cross-cutting issues (USAID, 2012).

Therefore, in coping or adapting to drought conditions, taking cognizance of gender in decision making will provide appropriate assistance for men and women farmers who are building adaptive and coping mechanisms. Lambrou and Laub (2007) added that understanding the gender perspectives to drought, including the extent of gender exposure to drought as well as their roles in drought resilience which has been neglected for some time now is eminent. Most studies conducted on drought including studies by Agwu (2009), Okhimamhe (2009), Haigh et al. (2010) and several others, have focused on gender vulnerability to drought or coping strategies or adaptation measures by farmers. It is therefore imperative that this study seeks to make a comparative analysis of drought and gender vulnerability in Bongo and Talensi districts. This will offer the opportunity to identify gender-based vulnerability and contributions to drought mitigations and decision making.

1.3 Problem Analysis

It is evident from literature that several studies have focused on vulnerability and adaptation to drought but very little is done particularly in making comparative analysis of the situation with regards to gender. Most intriguing is the fact that most



previous studies to a large extent has focused on identifying the level of vulnerability and adaptation but are silent on the issue of differences among groups (e.g. gender) in relation to droughts. In recent advancement in scientific knowledge and technology, it is possible to make scientific analysis of the climate. Additionally, scientist have come out with appropriate means of determining future inferences of the shifting weather conditions on agrarian activities in some geographical settings, particularly developing countries and have made certain conclusions which when taken can reduce or mitigate the effects of drought (Awen-Naam, 2011). However, what is missing out in the discussion is the consideration on the role or significance of gender differences in the changing climate, particularly in drought situations. For example, both genders in the study areas are actively engaged in agriculture (GSS, 2014). The impacts of the negative implications of drought on small-holder farmers are gendered particularly in Bongo and Talensi with some studies highlighting that women are particularly more vulnerability (Codjoe et al., 2011; Yaro et al., 2010).

My preliminary survey has shown that the incidence of climate change and by extension drought have had significant effects on food security, despite the implementation of some adjustments by farmers as well as interventions by some NGOs, drought mitigating factors have largely been unsuccessful. In the quest of finding solutions to the drought phenomenon, more studies on the gender differentials to drought are required (Arku, 2013, p. 420).

This study will therefore make comparative analysis to actually understand the level and variations in vulnerability among gender to help design the best methods for adaptation or mitigation. According to Adjei et al. (2012) the vulnerable in society are women, children, aged and the physically challenged among others, and by extension these groups of people are adversely affected by issues of natural occurrences such as



drought. From this analogy, the study shifts the discussion from the domain of vulnerability and adaptability to a detailed study of the situation among the two groups in order to enable policy makers better appreciate and understand the challenges different groups of the society are confronted with in relation to climate change extremes. The exclusive focus on adaptation only by previous studies has hindered discussions on drought mitigation. Thus, the role of gender in drought remain largely invisible in most climate change mitigation policies which further weakens the adaptive and coping capacity of vulnerable groups in climate change and drought prone areas (Masih et al., 2014; Awen-Naam, 2011; USAID, 2012).

Notwithstanding the availability of several empirical studies on drought in Ghana, there is little systematic research which focus on the influence of gender on issues of drought vulnerability. Situational analysis of the drought situation in the Bongo and Talensi Districts shows that the vulnerability of men and women to drought is not the same. Both sexes are affected differently depending on the agricultural activity they are engaged in, in addition to the preparedness and capacity of their respective households. Studies have shown that men hold large portions of agriculture lands than women. Resource constraints among women also increases their vulnerability to droughts thereby making them poorer than their male counterparts (Adjei et al., 2012). Evidently, there is a research gap on the level of vulnerability among women and men to drought.

With the target on women and men, the thesis seeks to contribute to appreciating the different level of drought vulnerability among both genders. The study will make available “differences in vulnerability in relation to exposure, sensitivity and capacity to adapt to drought between both genders in the Bongo and Talensi Districts.



1.4 Research Questions

1.4.1 Main Research Question

What differences exist in gendered vulnerability to drought in Bongo and Talensi Districts?

1.4.2 Specific Research Questions

1. How has gendered experience of drought been in the Bongo and Talensi districts?
2. What are the different sensitivity levels of droughts between men and women in the Bongo and Talensi districts?
3. What role do socio-economic factors play in determining the coping and adaptive capacity of both men and women to drought exposure in the Bongo and Talensi districts?
4. What coping and adaptation measures have been employed by both men and women in reducing their vulnerability to droughts in the Bongo and Talensi districts?

1.5 Research Objectives

1.5.1 Main Research Objective

To examine the differences in gendered vulnerability to droughts in Bongo and Talensi Districts.

1.5.2 Specific Research Objectives

1. To assess gender experiences of drought vulnerability in the Bongo and Talensi districts.
2. To assess the different sensitivity levels of drought between men and women in the Bongo and Talensi districts.



3. To examine the role of socio-economic factors in determining the coping and adaptive capacity of both men and women to drought in the Bongo and Talensi districts.

4. To explore coping and adaptation measures employed by both men and women in reducing their vulnerability to droughts in the Bongo and Talensi districts.

1.6 Significance of the study

The research seeks to make modest contribution to the implementation of environmentally friendly policies that seeks to integrate the wellbeing of women and other vulnerable groups in deprived communities in Ghana. This can be possible by identifying the adaptive and coping capacity of the vulnerable groups.

The findings of the study will also fill knowledge gaps regarding the level of exposure, sensitivity and adaptive capacity of women in particular to drought and climate and climate change impacts. The UE/R of Ghana is drought prone area and worst hit by climate change, and the most vulnerable groups and usually women. It is therefore necessary that studies of this kind are conducted to identify possible solutions that policy makers can use to design programs that will sustain the livelihoods of the poor and vulnerable. Individuals experience or exposure to drought as well as gender vulnerability to drought serves as the basis for this study. Similarly, the extent of individuals including their households in making short- and long-term changes to adapt to climate change (Berman et al. 2012) as well as how it incorporates gender vulnerability is placed at the center of the research analysis. This study is necessary as it brings to light how the comparative study of drought situations can help find strategic approaches in resolving drought related challenges in the areas under study. It will also help to ascertain and examine drought related challenges confronted by farmers in relation to drought vulnerability in Ghana since the issue of



climate change is increasingly becoming an environmental problem in Northern Ghana.

The study will also make a modest contribution to the Sustainable Development Goal 13 which seeks to take urgent actions to combat climate change and its impacts by outlining the diverse coping, adaptation and mitigation measures different social groups employ to withstand the impacts of climate change and related threats (droughts).

1.7 Scope of the study

The study seeks to assess gender vulnerability to droughts in the Talensi and Bongo districts in the Upper East region of Ghana. Issues relating to small-holder farmers adaptation and coping strategies to climate change and drought in the region and Ghana as whole is of interest to the researcher.

1.8 Organization of the study

The thesis is written in five chapters. The first chapter provides a background on gender vulnerability to the impacts of droughts and climate change in general. The chapter outlined the study's background, problem statement, research questions and objectives, as well as justification of the research. The second chapter reviewed literature on climate change, social vulnerability and other relevant literature on the topic. The theoretical and conceptual framework of the study was also discussed in the second chapter. Chapter three is devoted to the profile of the study area and the research methodology. Chapter four is devoted to the findings and discussions of the study while chapter five focuses on summary of major research findings, conclusions and recommendations.



CHAPTER TWO

THEORITICAL AND LITERATURE REVIEW

2.1 Introduction

The focus of this section is on the review of literature on issues of gender vulnerability to drought and climate change. The literature review begins by analyzing climate change issues, its causes as well as expected impacts on people's livelihoods, particularly in the rural areas in Northern Ghana. The review further scrutinizes the dominant theoretical formulations on the issues of gender, vulnerability, droughts and climate change. Similarly, issues of gender vulnerabilities in relation to drought and climate change are examined drawing on social vulnerability theory. Lastly, the section evaluates issues around coping and adaptation to changes in the climate.

2.2 Conceptualization of Climate Change and Drought

The prolonged change in the weather conditions specifically 30 years and beyond is defined as climate change (MONRE, 2008). Thus, the aggregation of weather conditions daily in a long time constitutes the climate in a specific geographical setting. The weather is explained as daily recordings of the atmosphere taking cognizance of the variations in the prevailing temperature and also precipitation (Ramamasy et al. 2007). According to O'Brien et al (2006), though climate change is a natural occurrence, human actions also compound its occurrence.

Climate change refers to the direct or indirect actions of humans resulting in a change in global weather conditions in a prolonged period. Climate change vulnerability refers to the uncertainties in the average weather conditions occurring annually as well as statistics of extreme weather conditions including storms and rise in temperature particularly during the hot seasons (ISDR, 2008). The little changes in the average weather conditions over a period and which can have great impact on



extremes including droughts or floods is referred to as climate extremes (Selvaraj et al., 2006).

Drought generally refers to the absence of precipitation in particular geographical settings over a long period. Ramamasy et al. (2007) explained that a temporal decrease in rainfall greatly less than the accepted level for a given period is termed drought. Also, the change and delay in the rainfall patterns, as well as the value of the rains particularly the level of precipitation is also described as drought. Technically, when precipitation decrease below 80% in a particular period, that period can be termed as a drought period.

In my humble opinion which is in agreement with the definition of drought by Shaw (2008), drought is defined as the increase in temperature and the absence of rain in a long while. In formulating policies for drought, it is necessary to thoroughly understand the concepts of droughts. Apart from policy makers, understanding of the drought concept is very paramount to enable farmers cope or devise adaptive mechanisms to drought. It is evident that extreme human actions on the environment can result in variations in weather and climate (Panu & Sharma, 2002). Some scholars point to the fall in normal precipitation and oceanic circulations as major causes of droughts (Panu & Sharma, 2002. Brooks et al. (2005) also posits that human actions through excessive exploitation of the natural environment and its resources are contributory factors to drought.

2.3 Patterns and Trends of Global Climate Change

Global climate has experienced changes over time. Human induced forces have been cited as the main drivers of climate change and global warming. Global warming is a human-induced phenomenon driven by an increase in carbon dioxide (CO₂)



emissions and other greenhouse gases (GHG) into the earth's atmosphere. The French scientist, Jean Baptist Joseph Fourier, first discovered global warming in 1824. An overwhelming body of scientific evidence supports global warming and climate change. Generally speaking, CO₂ and other GHGs in the atmosphere entrap part of the outgoing solar radiation, thereby raising the earth's temperature (Gyampoh, 2009). The world is currently facing a rapid warming cycle with CO₂ concentrations in the atmosphere with increasing evidence from ice cores that show that current atmospheric concentrations exceed the natural range of the last six hundred and fifty thousand (650,000) years (Friedrich Ebert Stiftung, 2012).

The issue that the climate is changing is therefore no longer subject to debate as several studies conducted by researchers all over the world confirm it. Earth has had tropical climates and ice ages many times in its 4.5 billion years (Met Office, 2015) but most of it is no more in existence today. According to Hansen *et al.*, (2006) global surface temperature increased in the past century by more than 0.5⁰C and (Hansen, Ruedy, Sato & Lo (2006) puts the warming over the past 100 years at 0.8° C or 1.44° F. The issue of warm temperature resulting from changing climate is confirmed by National Academy of Sciences, which notes that the last few decades of the 20th century were the warmest in the past 400 years (National Research Council, 2006). Met Office (2015) also note that, Scientific research shows the average temperature of the planet's surface - has risen by 0.89 °C from 1901 to 2012.

According to Hansen, Ruedy, Sato & Lo (2006)), 2005 was the warmest year since the late 1800s, and 1998, 2002, 2003 and 2004 followed as the next four warmest years. What can be seen from this is the fact that five warmest years over the last century occurred in the last twenty years. Hensen et al, (2006) argues that, the 2005 atmospheric warming figures was very notable because until then, the 1998 warming



was said to have been enhanced by the strongest El Nino of the century which added 2°C warmth to global temperatures (Hansen et al., 2006) and some researchers had used that to counter the claims of global warming.

Gyampoh (2009) opines that, over the past 30 years, the Earth warmed by 0.6° C or 1.08° F and 0.8°C in the last century. This is supported by Hansen et al. (2006) who concludes that there has been slow global warming, though with large fluctuations, over the past century until 1975 and subsequently the temperature has increased by 0.2°C per decade since then. IPCC (2001) notes that, the increase in 2⁰C global temperatures is in response to increasing emissions GHGs but concludes that are in line with expectations (IPCC, 2001). In Africa where climate change has been obvious, atmospheric warming of 0.7°c over the 20th century has been observed which is a result of 0.05°C warming per decade through the 20th century as well as increased precipitation for East Africa (Hulme *et al.*, 2001; IPCC, 2001; IPCC, 2007).

Apart from the obvious rises in world temperatures, land surface precipitation has also increased over the same period in the mid-to high latitudes, but shows a decrease in the tropics and subtropics (IPCC, 1996). Also, since 1900, sea levels have risen by about 19 cm globally, on average (Met Office, 2015). This has been attributed to melting glaciers induced by high temperatures. This is confirmed by Met Office, (2015) which notes that, glaciers all over the world - in the Alps, Rockies, Andes, Himalayas, Africa and Alaska - are melting and the rate of shrinkage has increased in recent decades. Also, Arctic sea-ice has been declining since the late 1970s, reducing by about 4%, or 0.6 million square kilometres (an area about the size of Madagascar) per decade. At the same time Antarctic sea-ice has increased, but at a slower rate of about 1.5% per decade (Met Office, 2015).



In effect, overall areas of the world affected either by drought or excessive wetness have increased over the last few years. Considering the diverse manifestation of climate change around the world, Intergovernmental Panel on Climate Change (IPCC) indicate that if emissions of greenhouse gases continue to rise at their current pace, the world will be faced with a disastrous future in the form of sea-level rise, shifts in growing seasons, biodiversity loss, as well as increased frequency and intensity of extreme weather events such as heat waves, storms, floods and droughts (IPCC, 2001; IPCC, 2007).

2.4 Climate Change Incidence on Agriculture in Ghana

A greater proportion of Ghanaians, particularly the rural dwellers' livelihoods are tied to agriculture and as such engage in all kinds of agricultural activities including crop farming and animal rearing (ISSER, 2014). Despite the contributions of agriculture to the socio-economic development of rural dwellers and the nation at large, the sector is greatly challenged with increasing climate change conditions including drought and increase in temperature. Ghana, just like other Sub-Saharan African countries, greatly depends on the rains for agricultural activities. Hence a decrease in precipitation or a substantial delay in the rainfall pattern can impact negatively on livelihoods and agricultural activities of peasant farmers (Asante et al., 2017).

Concerning the recent phenomenon on climate change, scholars have noted that farmers across gender have either devised means or are devising alternative coping mechanisms to adapt to the negative effects of drought on their sources of livelihoods (Arku, 2013; Cudjoe & Owusu, 2011). The Upper East region is among the five Northern Regions located within the guinea savanna belt and produces foodstuffs in large quantities and transported to other parts of the country. Notwithstanding the substantial amount of contribution in terms of foodstuffs from this region, the five



northern regions are severely exposed to the climate change phenomenon which invariably would affect food security in general. Studies in the guinea savanna belt have revealed that, the belt has one rainy season which usually commences from May/June to September/October. That notwithstanding, the rainfall pattern of the region is highly erratic and unpredictable, and in recent times has a delay onset and short duration. All these circumstances present dire consequences on crop cultivation in the area (Owusu & Waylen, 2013).

Drawing lessons from the vulnerability concept, there exist significant variations on how climate change impact both gender (Yaro et al., 2010; Codjoe et al., 2011). Evidently, men and women have varied needs and as such respond to climate change challenges differently. Similarly, both genders adapt diverse coping mechanisms (World Bank, 2009; Yaro et al., 2010). Buttressing this assertion, studies conducted by some scholars in Ghana has revealed the magnitude of women susceptibility to environmental stress including climate change impacts (Codjoe et al., 2011; Arku, 2013). This paper agrees with the position of Arku (2013. P.420) that in-depth studies is needed to establish the different coping mechanisms adopted by farmers across different genders of the society.

2.5 The Concept of Sustainable Livelihoods

Several conceptual frameworks have been put forward to enhance the understanding of livelihood. However, the one that has received much attention in recent times is the concept of “sustainable livelihood” which is linked to livelihood security (Scoones, 1998; Mettle, 2010, Carney, 1998). Sustainable livelihood refers to a living, which is adequate for the satisfaction of basic needs and the ability to withstand anticipated shocks and stresses such as climate change. That is, the ability to cope and recover from stress and shocks, maintain or enhance capabilities and assets to provide



sustainable livelihood opportunities for the next generation and at the same time not undermining its resource base (Chambers and Conway, 1992). It also involves contributing to livelihoods safety nets and benefits at the local and global levels and in the short and long term (Mettle, 2010). The concept of sustainable livelihood is important in this study since climate change presents shocks to peoples livelihoods. The ability to cope in its midst thus emphasizes on the need for sustainable livelihood.

Chambers and Conway (1992) reiterate that, the concept of Sustainable Livelihood (SL) is an effort, which goes beyond the conventional definitions and approaches to poverty eradication. Soussan et al. (2000) also postulate that the previous approaches to poverty eradication and livelihood had been shallow and limited as it focused only on few manifestations of poverty, such as low income, or did not consider other vital aspects of poverty such as vulnerability and social exclusion. It is now important that more attention is paid to the various elements and processes which either restrain or enhance poor people's ability to make a living in an economically, socially ecologically sustainable way (Farrington et al., 1999; Ellis & Mdoe, 2003).

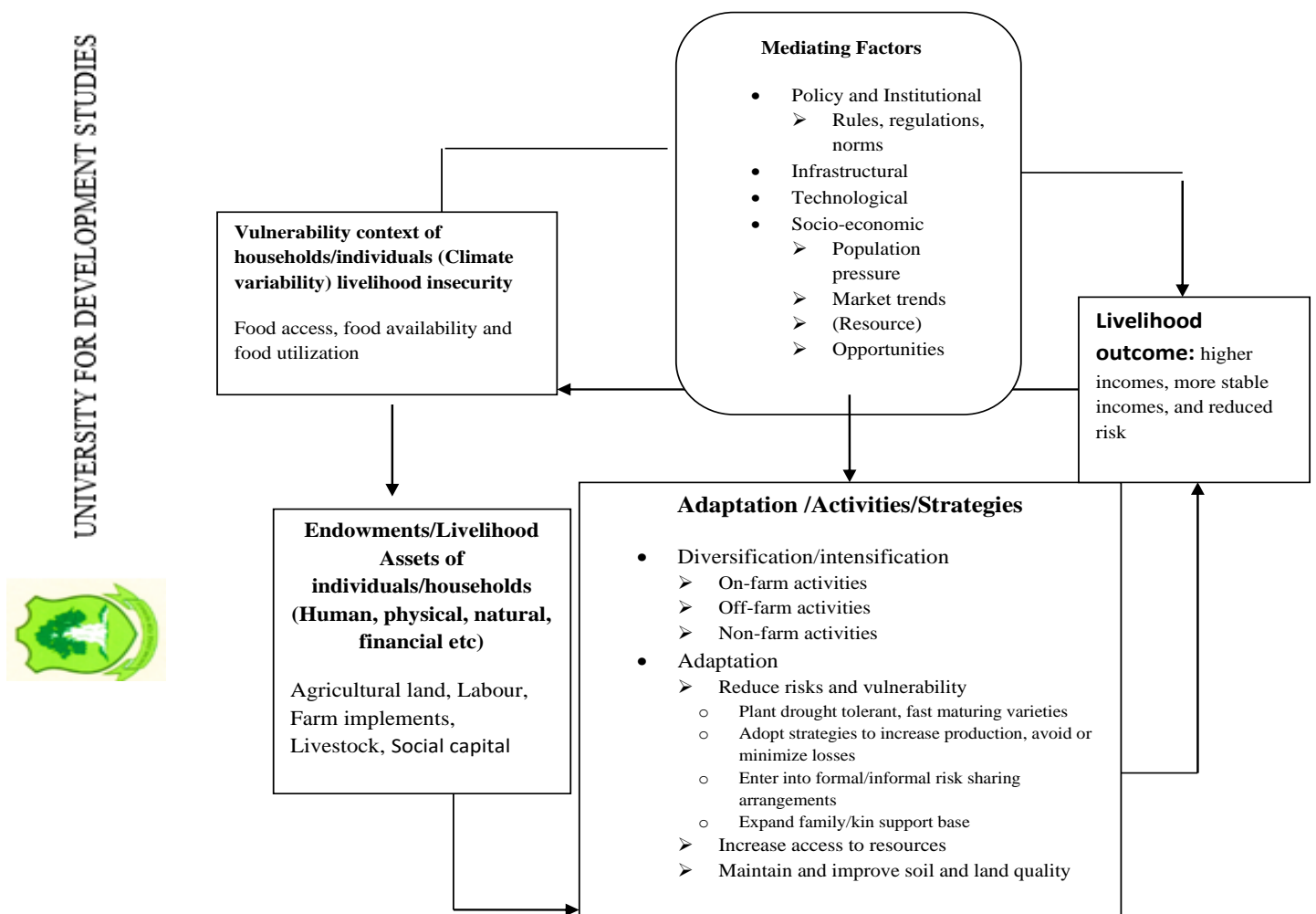
Sustainable livelihoods (SL) approach draws on an improved understanding of poverty, but also on other streams of analysis, relating for instance to households, gender, governance and farming systems, bringing together relevant concepts to allow poverty to be understood more holistically. Sustainable livelihoods are a systemic and adaptive approach that links issues of poverty reduction, sustainability and empowerment processes such as participation, gender empowerment, and good governance (Ellis & Mdoe, 2003). The attractiveness of SL lies in its applicability to different contexts, situations of uncertainty and in its capacity as a consultative and participatory process for the cross-fertilization of ideas and strategies between various



stakeholders (Chamber & Conway, 1992). Considering the nature of sustainable livelihood, different frameworks have been developed to explain the concept. Figure 2.1 shows sustainable livelihood framework as put forward by Scoones and Carney, (1999). Their framework is one of the commonest being used as forms the base from which many others have been derived.

Figure 2. 1: The Sustainable Livelihoods Framework

FIGURE 2.1: THE SUSTAINABLE LIVELIHOOD FRAMEWORK



Source: Adopted from Tessema, (2008) and modified.

The framework (Figure 2.1) indicates that sustainable livelihood involves the ability of households or communities to withstand shocks, trends and seasonality change. This however is dependent on household livelihood asserts (thus, natural, human,

financial, social and physical capital) and how they make use of them. Besides, livelihood vulnerability (thus shocks, trends and seasonal change) are influenced by government and private sector policies, institutions and processes. For households' livelihoods to be sustainable, effective structures must be put in place (effective livelihood strategies) towards producing sustainable livelihood outcomes (Carney, 1999). Three main sustainable livelihood strategies have been identified, which households pursue in the face of crisis (shocks, change in trends and seasonality). They are; livelihood diversification, agricultural intensification, and migration (Farrington et al., 1999; Ellis, 2000).

The concept of sustainable livelihood underpins livelihood security (Mettle, 2010). Care International has focused on household livelihood security and defines it as "a family's ability to maintain and improve its income, assets and social well-being from year to year relief to rehabilitation to development continuum" (De Haan & Zoomers, 2005).

This means that, sustainable livelihood is a prerequisite to achieving livelihood security. The two concepts as thus used interchangeable in many instances. However, what is of importance to this study is the two concepts. The study seeks to understand how climate change affects rural livelihoods and how people cope with it. The study thus focuses on how climate change affects both sustainability and security of rural livelihoods. The sustainable livelihood framework thus provides the guide to understanding the various components of people's livelihoods and how these are affected by climate change. The framework also provides the guide to understanding the coping strategies being adopted by households and communities alike. Having understood what constitute livelihood and circumstance it is deemed secured or



sustainable, the next section narrows the discussions to main forms of livelihoods being found in rural areas, which forms the bases of this study.

2.6 The Concept of Vulnerability

There are varied definitions and approaches to the study of vulnerability. Vulnerability is explained as the extent to which a system is prone to and as such cannot endure the impacts resulting from climate change and extremes events (IPCC, 2007). Consequently, the absence of financial and institutional assistance and natural resources availability which is a source of livelihood to rural dwellers usually influence one's vulnerability to risks linked to climate change (Denton et al., 2000). The term vulnerability is further defined by Moser and Ekstrom (2012, p.2) as "the degree to which systems are susceptible to loss, damage, suffering and death in the event of a natural disaster or hazards". From this definition, it suffices that systems can be represented as households, communities or organizations. Vulnerability is defined in other quarters as "the characteristics of a person or group and their situation influencing their capacity to anticipate, cope with, resist and recover from the impact of natural hazard" (Moser and Ekstrom, 2012, p.2)). Moser and Ekstrom (2012, p.2)) further suggest that a methodological study of the concept vulnerability in relation to climate change is also defined as "the risk involved in disasters must be connected with the vulnerability created for many people through their normal existence". Contributing to the discourse, Cutter et al (2003, p.7) argues for the need "to identify, delineate and understand those driving forces that increase or decrease vulnerability at all scales". Climate change vulnerability refers to "the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with adverse impacts of climate change (IPCC, 2005, p.21).



The United Nations Office for Disaster Risk Reduction (UNISDR) (2008) also defines vulnerability as the conditions shaped by physical, social, economic and environmental factors or processes, which accentuate susceptibility of a community to the impacts of hazards. The definition from the United Nations for Disaster Risk Reduction takes into account external environmental factors such as shocks, or stress as well as consider the magnitude and frequency of potential hazards unlike the definition from IPCC.

The lack of a common definition to the study of vulnerability in literature is very challenging. According to Cardona (2004), the lack of a comprehensive conceptual framework that aids a common multidisciplinary risk evaluation is an obstacle to the effectiveness of disaster risk management and adaptation to climate change. In the same vein, Dasgupta and Baschieri (2010) make the case that carrying out vulnerability assessments may be complex due to the multiple definitions of vulnerability and the scarcity of data to measure vulnerability. Further, the absence of terminological compatibility has been noted as one hindrance in vulnerability literature. For example, Fussel (2007) identifies that each of the conceptual frameworks for vulnerability suggest an important classification of factors that shape the vulnerability of a system to a specific hazard, he maintains that the terminologies are clearly incompatible with each other, and none of them are comprehensive enough to consistently integrate the other. According to Fussel (2007), the failure to differentiate between the spheres or scales and knowledge domain are two largely independent dimensions of vulnerability factors viewed as the source of this dilemma. Despite the numerous conceptualizations of vulnerability, two dimensions are widely acknowledged in literature.



2.7 Approaches to Vulnerability Study

Adger (2006) summarizes three major vulnerability drivers as resource availability, resource distribution and regulatory institutions. Similarly, other researchers (Sen 1997, Davies, 2010, Watts and Bohle, 1993) have also debated that entitlement and endowment, empowerment and political economy drive vulnerability. Despite the constraints in attempts at conceptualizing vulnerability, vulnerability is broadly categorized into a number of broad approaches rooted in the risk-hazard approach, the political economy approach (the pressure and release model), the social-ecology, the vulnerability and disaster risk assessment (holistic perspective), as well as adaptation to climate change (de Sherbinin et al, 2007; Fussel, 2007). For the purpose of this study, the political economy approach and the risk-hazard approach were considered.

2.7.1 Risk-Hazard Approach

This perspective also known as outcome vulnerability (O'Brien et al., 2007) is widely used by engineers and economists in the technical literature on disasters. This approach primarily focuses on physical systems, including built infrastructure and it tends to be descriptive rather than explanatory (Fussel, 2007). Traditionally, the risk-hazard approach assumed that hazards events are real and that the hazard is known and stationary (Hulme et al., 1999). This approach evidently distinguishes between two factors that shape the risk to a particular system that is the hazard and vulnerability. Hazard in this content refers to potentially destroying physical event, or human activity that is characterized by its location, frequency and probability, whereas vulnerability shows the relationship between the severity of hazard and the degree of damage caused (Fussel, 2007). In the opinion of Lankao and Qin (2011), the basic objective of this approach is normally to help address a fundamental research and policy question: taking into consideration policy response, what are likely



avoidable or unavoidable impacts of hazards, such as changes in temperature and concentration of pollutants on urban population, infrastructure and activities? Biophysical vulnerability is often used to characterize the vulnerability concept in the hazard-risk framework.

This approach to vulnerability has however been criticized by several scholars as being too hazard-centered. The approach becomes difficult to apply to study a category of people whose exposure to climate hazards largely depends on their behavior, which is determined by a myriad of social, economic, political, cultural and institutional factors. Eventually, the vulnerability of people under this approach has sometimes been conceptualized as exposure to hazard (Liverman and Merideth, 2002). Also, Lankao and Qin (2011) have argued that this approach considers only part of the significant attribute and dimensions involved. For example, the authors argued that the approach ignores the following critical issues: how and why specific urban centers or populations and sectors within the cities are differently affected; whether local stakeholders and populations are receptive to adaptive options and motivated to make the necessary changes; whether they possess the necessary skills, awareness and resources to be able to adapt and how their potential adaptive choices are constrained by the social, economic, political and environmental circumstances in which they live and operate. To address the weaknesses connected with this approach, the political economy has been used by many scholars to understand the inherent or contextual vulnerability.

2.7.2 Political Economy Approach

This approach, also called the Pressure and Release model (PAR) (O'Brien et al. 2007), contextual vulnerability (O'Brien et al. 2007) or inherent vulnerability (Lankao and Qin, 2010), is the most dominant approach in social science-related vulnerability



research, particularly in the poverty and development literature. According to O'Brien (2007, p.70), "this approach is particularly with the process and multidimensional view of climate-society interactions" (O'Brien et al. 2007, p.76) and posits that climate change can be perceived in different dimensions specifically political, institutional, economic as well as social structures. Also, the changes that interact differently in relation to contextual states linked to specific vulnerabilities to drought is of essence in the study. Response may inadvertently impact on the process as well as the contextual state and within this context. Changes in the climate significantly take place in the biophysical state in the face of climate change and as such affect the responses involving the change processes such as economic and political development. These change processes also impact the context relationship to climate change. Hence, decreasing vulnerability from the angle of political economy/social vulnerability perspective involves modifying the content where climate change happens in order to enable people to enhance their responses to the conditions relating to climate change. Thus, while hazard risk approach is concerned primarily with hazard and exposure, the political economy perspective concentrates on the social conditions and root causes of exposure in society (de Sherbinin et al., 2007).



2.7.3 Double Exposure Framework on Vulnerability

Stemming from the weakness of other vulnerability frameworks that dissociate vulnerability from climate change, the double exposure framework was developed, which falls under the contextual framework on vulnerability description (O'Brien and Leichenko, 2000). The double exposure framework deepens the understanding of how globalization and environmental change interact and affect each other as well as either serve as positive avenues or hindrances for people and their society at large. The integrative nature of the double exposure framework throws light on the non-

permanence and geographical connections, feedbacks and also the influences among the two global happenings which are usually neglected in other discussions (Leichenko & O'Brien, 2008). In furtherance to the discussion, Leichenko & O'Brien (2008) established three distinct levels or approaches of the double exposure framework. These are feedback, outcome and content double exposure. The context double exposure is of much prominence since it shows how new situations are linked to global environmental and heightened vulnerability to all types of shocks and stresses. From the discussion relating to context double exposure on people and the society, most people are vulnerable women, children and those with physical disabilities (IPCC, 2014; Leichenko & O'Brien, 2008).

2.7.4 The Entitlement Approach to Vulnerability Analysis

The entitlement approach was designed initially to investigate the causes of famine. To put it most succinctly, it says: famines are caused by entitlement failure. The theory was principally expounded by Sen in the early 1980s (Sen, 1981; 1984) and essentially displaces food production failure as the cause of famine by focusing on the effective demand for food, and the social and economic means of obtaining it. According to Adger (1996), entitlements are real and potential sources of welfare or income. They are 'the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces' (Sen 1984: p497).

Hence, the entitlements approach to vulnerability analysis explains why people have been vulnerable to potential sources of welfare (income) and famine, where there are no absolute shortages or no external factors apparently present. Entitlements are production-based, trade-based or transfer based. Hence, they are endowments entitlements and exchange entitlements. Individuals and households have



endowments, which include privately owned wealth, but also maybe calls on national social security or their neighbors and kin. They also have exchange entitlements from their labor or the output from labor (income), (Adger, 1996). Essentially, vulnerability occurs to entitlements when people have insufficient real income and wealth, and when there is a breakdown in other endowments which they have previously had. Sen's (1981) analysis of welfare or famine vulnerability was link to the effects of climate change and variability that essentially breakdown people welfare or livelihood in societies as a result of low technology or adaptive capacity.

2.8 The Concept of Gender

Gender refers to the social ascription conferred on men and women. Thus, how one society views and understand gender may vary from another society. By virtue of socialization, both men and women are assigned different gender roles and as such respond to climate change vulnerability differently (WHO, 2011). Alston (2013a) postulates gender as behavior imbibed through social and cultural ascriptions which influences the attitude of a person and defines who a male or female is. From the two definitions, it is evident that gender is a social construct and it is culturally specific.

Also, it is necessary to note that the term sex and gender are not the same and as such cannot be used interchangeably. Sex is biologically defined whiles gender on the other hand is premised on the social and cultural composition of a group of people. Similarly; there is clear distinction between women and gender. Gender isn't same as women.

According to Alston (2013a), gender must be perceived as the relationship that establishes males and females in a cultural perspective. Hence, any conceptualization that confuses gender with women is bound to underrate the historical, social, cultural and contextual variables that interact to shape power roles and influences the



relationships between men and women in any given society. Thus, Bennett (2005) is of the opinion that gender must be viewed as how power structures, relations and roles existing between males and females are understood by the wider society. Alston (2013a) also argues that gendered identities, roles and norms are not static but are constantly renegotiated across time and space. Contributing to the discourse, Esplen and Brody (2007, p.2) argue that “abstracting women from their social realities eclipses the relational nature of gendered power and the interdependency of women and men, and paints a distorted picture of women’s vulnerabilities, choices and possibilities”.

There is the likelihood by scholars and researchers in gender studies and drought to view women as a single unit who are exposed to extreme environmental factors and severe weather conditions (Demetriades & Esplen, 2008). According to Demetriades & Esplen (2008), conceptualizing women this way is problematic on several accounts, since it leads to a lack of understanding in the variations existing among males and females in addition to other disadvantages linked with status, sex as well as the ethnic background of persons. It is further argued that intersecting inequalities result in varying experiences relating to power among males and females. Another concern with this conceptualization is that it fails to recognize the context-specific effects of women’s vulnerability to climate change. For instance, Ghanaian women may be confronted with climate change challenges uniquely from other women in other parts of the world. Even within Ghana, women in urban areas are confronted differently with respect to climate change compared to women in rural areas. Further, within urban Ghana, women living in elite residential neighborhoods may face a different set of challenges compared to those living in vulnerable locations. These suggest that



context-specific factors need to be taken into considerations in vulnerability studies in order to strengthen adaptation capacity of individuals.

2.9 Gendered Vulnerability to Climate Change

One influential factor to the effects of climate change adaptability is gender. Climate change impacts will be differently distributed among regions, generations, ages, classes, income groups, occupations and gender (IPCC, 2007, p.786).

From IPCC's assertion, it is evident that the gender factor cannot be downplayed when considering effects of climate change. The gender dimension of climate change has similarly been recognized as a subject that requires urgent steps to address (WHO, 2011). Some researchers have further elaborated that identifying the different coping capacity of each gender is a step to address the challenges related to climate change with regards to preparedness and mitigation factors towards climate change effects (Enarson et al., 2007; Anderson et al., 2009); division of labor (Enarson and Fordham, 2011), and post-disaster reconstruction and recovery (Bradshaw, 2010). Aside the gender dimensions of climate changes, the international community adopted the SDG's in 2015 to ensure sustainable development by 2030. This agenda includes a number of commitments achieving gender equality. Specifically, SDG 13 is on taking urgent action to combat climate change and its impacts. The SGD 13 targets strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. Similarly, the goal targets promoting mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing states, including focusing on women, youth and local and marginalized communities.



Knowledge and awareness of the consequences of the risks and hazards associated with exposure to vulnerability of climate change is approached in engaging an adaptable approach to climate change in any given society (Adger, 2010). Vulnerability is explained as the extent to which a system is prone to and as such cannot endure the impacts resulting from climate change in addition to climate change extremes events (IPCC, 2007). Consequently, the absence of financial and institutional assistance and natural resources availability which is a source of livelihood to rural dwellers usually influence one's vulnerability to risks linked to climate change (Denton et al., 2000). Gender on the other hand is the social ascription conferred on men and women. Thus, how one society views and understand gender may vary from another society to another. By virtue of socialization, both men and women are assigned different gender roles and as such respond to climate change vulnerability differently.

As earlier discussed, the guinea savannah belt is exposed to extreme vulnerability issues emanating from climate change. Consequently, farmers within the guinea savannah belt are prone to climate change challenges including drought, flood, increased temperature as well as decrease in precipitation (Acquah & Onumah, 2011). Similarly, the change in the rainfall patterns resulting in delay in the planting season exposes farmers not only to climate change vulnerability but also the outbreak of pests and diseases has the possibility of resulting in crop failures (Yaro et al., 2010). Kemansur et al. (2011) are of the opinion that the variations in the planting seasons, drought, decreased precipitation and rise in temperature and flood exposes farmers to climate change vulnerability in Ghana. It is also established in literature that prolonged dryness and absence of rainfall and decreased flow of water into streams



and rivers have dire consequences on food production and farmers' livelihood (Wringley-Asante et al., 2019).

It is evident that there exist gender variations in Ghana and across other parts of Africa. Importantly, although most women derive their livelihood from natural resources and by extension on land and forest resources, they lack the right and control over land and forest resources (Human Resource Development Department, 2008). Culturally, men exercise control over forest resources, land and have access to credit facilities compared to women. The variations in access and control of natural resources particularly favors men and influences how men and women adapt to climate vulnerability. There exist structural differences in the roles ascribed to men and women by families through socialization and as such the outcome in the variations in gender roles and power relations significantly affect the adaptive capacity of women whose livelihoods are tied to natural resources unlike men (Wright & Chandani, 2014).

Stemming from the fact that there exist gender variations in the adaptive capacity in relation to climate change, there equally exist gender variations in the agronomic practices in relation to climate as pointed out by scholars in their studies on gender and change issues (Cudjo et al., 2011; Arku, 2013). Evidently, most women are exempted from decision making particularly in the patriarchal societies, hence decisions are taken on their behalf (World Bank, 2009). Although, women may be reluctant to adopt new technology to improve their agricultural activities and also lack the needed funds to support their livelihood, literature suggests that women have unique adaptive capacities that they use to abate the shocks and stresses relating to climate change locally (Egyir et al., 2014; Nhemachema & Hassan, 2007).



2.10 Definition, Causes and Some Potential Consequences of Climate Change on Developing Countries

One of the major challenges confronting the world in recent times relates to climate change and drought. On the part of the IPCC (2012, p.29), climate change is defined as “an alteration in the state of the climate that can be identified by changes in the mean, and to the vulnerability of its properties, that persists for a longer period, typically decades.”

Though climate change and climate change variability are a natural phenomenon, human activities through deforestation and excessive exploitation of natural resources are said to have led to rise in temperature and decrease in rainfall across the globe (IPCC, 2007). Increase in greenhouse gas in the atmosphere resulting from human activities particularly from the pre-industrial period has been noted, increasing by 70 percent between 1970 and 2004, most of what has been as a result of energy supply, transport and industry (IPCC, 2007).

Climate change extremes are made evident in the floods and rise in temperature experienced globally (IPCC, 2012). It is projected that the global mean temperature has risen between 0.3 and 0.6 since the 19th century. It is largely noted that vulnerability and exposure often vary between regions and among populations within regions (de Sherbinim et al., 2007). This further relates to the differing vulnerability of communities and services affected by climate change (Denton, 2002). Peduzzi et al. (2009) posits that though developed nations are exposed to hazards associated with climate change, largely, developing countries are noted to be facing the brunt effects resulting from climate change as well as have more people who are unable to cope with the situation (de Sherbinim et al., 2007).





Though Africa's contributions to greenhouse gas emissions is negligible by global standards (Cudjoe et al., 2012), it is observed as the continent whose people are unable to cope adequately with climate change due to their level of exposure (IPCC, 2007). Invariably, adaptation to rise in temperature, drought, crop failure, the ecosystem changes and human health impacts are great challenges the continent of Africa faces. Africa's populations vulnerability has been attributed to conflicts, food shortages, poverty and also over exploitation of natural resources to the detriment of the environment (IPCC, 2007). According to IPCC (2007), Africa's exposure to rising and frequent drought incidence will be severe by 2020. The IPCC report further suggests that by the end of same year, crop production which is dependent on rain will decrease to about 50 percent across some nations in Africa. Notable direct effects will include increased food insecurity and the exacerbation of malnutrition. The effects on the poor people, especially women living in marginalized communities, can be enormous. Also, the predicted rise in sea levels connected with climate change will significantly be a challenge to low-lying areas such as Accra. According to Denton (2002), West Africa, especially the Sahel region has been identified to be among the countries more vulnerable to drought and climate change, deforestation and desertification.

2.11 Social and Human Effects of Climate Change on The Livelihood of Rural Poor

Notably, increasing polarization and spatial segregation has become a dominant characteristic of growth of towns and cities which tend to generate varied degrees of vulnerability among city residents (Mitchell, 1999b). In the United States for instance, the factors known to consistently increase social vulnerability are density (urbanization), race, ethnicity, socio-economic standards taking cognizance of their habitats, cultural and ethnic backgrounds, age and also gender which span close to

half of the difference linked to vulnerability (Enarson, 2012). This difference is particularly severe in cities of the developing countries where decades of uncontrolled population growth has led to concentration of large sections of their populations in informal settlements, which are often found in dangerous locations (UN HABITAT, 2003).

Climate change impacts are likely to affect residents of marginalized communities often populated by the rural poor with the majority being women. The IPCC (2012, p.7a) points to decline in health conditions, uncertainty in livelihood resources as well as deprivation in meeting needs and services that are basic to human sustainability as concerns that aggravate rural people's vulnerability to drought and climate change. The gender variations across different cultures in Africa which usually give more opportunity to males further worsen the issue of vulnerability (Satterthwaite et al., 2007; Terry, 2009; Alston, 2015). According to WHO's report (2011), climate change is certain to affect the health conditions particularly through change extremes such as drought, floods as well as rise temperature and outbreak of pest and diseases which will then affect crop production dramatically.



2.12 Effects of Climate Change on Vulnerable People

Climate change has severe consequences on livelihoods sources and sustainability of natural resources. The ensuing literature review brings to light some of the effects of climate change on vulnerable people.

2.12.1 Air Pollution

Air pollution resulting from industries, transport and other sources are predicted to worsen the health and safety conditions of people. Additionally, rise in temperature as well as prolonged dryness as a result of climate change is likely to compromise public health and safety. According to a study by Ash et al. (2009), the degree of one's

exposure to air pollution may differ among individuals, ethnic backgrounds, social status, and race. That notwithstanding, it is evident that everyone is at risk of industrial waste that end up polluting the atmosphere and as such needs the necessary attention in addressing climate change.

It has been identified that effects of climate change as well as ground level ozone as a result of still air can further worsen the poor quality of air situations (Karl et al., 2009). It is further suggested by Karl et al. (2009) that ozone exposure would further affect lung functioning as well as worsen respiratory illness including asthma. This therefore makes children, open-air workers as well as athletes more at risk.

Though climate change cannot be directly linked to air pollution, it is noted that fallouts from climate change can worsen individuals suffering from severe respiratory illness linked to air pollution (Morello-Frosch, 2009). Consequently, air pollution can bring about more respiratory diseases which may affect vulnerable communities, more particularly those in the slums and poorly ventilated buildings and environment.

Invariably, people already with severe respiratory diseases and other medical conditions are susceptible to climate change effects on health (Gamble et al, 2008). Certainly, people with other biological and genetic conditions could experience increased sensitivity to heat and air pollution. It is further argued that the socio-economic status of individuals also has bearing on one's level of vulnerability to climate change particularly taking notice of exposure level to toxins, nutrition as well as availability of resources and quality health provision (Gamble et al, 2008). Contributing to the discussion, Few (2006) argued that the coping capacity of individuals to exposure to climate change with regards to health conditions and institutions is relative to the social variations of health risks in the perspective of



climate change. Additionally, bushfires, particularly burning down forest could affect rural people and their livelihood (Davidson et al, 2003).

2.12.2 Economy and Jobs

Climate change would certainly affect people's jobs significantly particularly those found in the agriculture and tourism sectors (Morello-Frosch et al., 2009:15). It is noted that with the recent incidence of climate change, the tourism sector is likely to suffer as people are not likely to travel more and also health conditions may worsen (Cordeva et al., 2006). Interestingly, people within the low-income brackets are vulnerable to access quality health care due to the fact that they are unable to register for health insurance schemes. Consequently, they are unable to recover swiftly from sickness linked to the impacts of climate change while some are unable to pay for their hospital bills.

According to Cordova et al. (2006), climate change can significantly affect cost of engaging in business and also affect employment opportunities. Particularly, communities and individuals that heavily depend on agriculture, tourism, fishing and forestry are likely to suffer severely due to the effects of climate change. Additionally, community's exposure and vulnerability to climate change is connected to neighboring landscapes in relation to agricultural and forestry activities as well as water availability.

The contribution of agriculture to the national economy is enormous. According to Liverman and Merideth (2002), many crops are susceptible to drought, outbreak of pests and diseases, increased temperature. Consequently, agricultural activities which are rain-fed are likely to suffer in the event that there is less rainfall or over a long period of time. The drought would affect crop yield and thereby increase prices of



agricultural commodities on the market. Among those to likely suffer are the poor in the rural areas who lack the capacity to access credit facility or any form of financial support and as such may not be able to afford increased energy cost, food and water cost. Additionally, they may not be able to afford health care and other necessities for human survival.

2.12.3 Rural Workforce Issues

Majority of rural communities are dependent on natural resources, are less educated as well as highly specialized skilled compared to other residents (Davidson et al., 2003). Interestingly, persons who have highly specialized skills are unable to transfer those skills to other sectors in the event of economic recession. Also, rural areas that are dependent on tourism in addition to natural resources may suffer in the event of low water levels in the lakes, high sea levels, decreased sports, fishing and also weak snow events (Wall, 2008).

Further, in the event of job and income losses, poor educational opportunities, decreased service delivery and also have limited resources to cope with climate change, rural communities are certainly at a great risk. Evidently, rural dwellers do not have the requisite skills of the human capital which may enable them switch to other employment opportunities outside their main occupations in the event of low crop yield (Wall & Marzall, 2006). Literature suggests that rural economies are at risk and vulnerable to impacts of climate change thereby making economies of rural communities and jobs, as well as resources weak (Wall & Marzall, 2006).

2.13 Gender Differentiated Impacts of Climate Change

Over the years, gender and climate change issues have been discussed primarily as an advocacy for gender perceptions in international politics, however such discussions lack verifiable data and evidence to buttress it (Arrora-Johnson, 2011). This therefore



suggest that considerable steps should be taken meticulously when analyzing differences among gender in relation to climate change in order to ensure that the right information are solicited and not just based on hearsay, assumptions, speculations or projections. Therefore, the ensuing discussion highlights on the impacts of climate change on gender and natural resources.

2.13.1 Gender Gaps Existing in Agriculture and Food Security

Literature suggests that women are actively engaged in agricultural activities and therefore contribute significantly to food security, however cultural norms and certain practices in some parts of the African societies particularly the patriarchal societies including the five northern regions of Ghana limit women's capacity to exercise control over resources necessary to enhance agricultural productivity. Male dominance in terms of power in decision making and control of natural resources is a delimitation to women's participation in climate change adaptation. There is therefore a discussion in literature and among scholars to mainstream gender into the approaches of vulnerability to climate changes as suggested by Smit (2006), Thompson et al. (2007) and Morton (2007).

Among the gender gaps identified during the literature review includes the issue of some cultural norms that are discriminatory and inimical to women. Also, women are voiceless to speak out in decision makings, lack knowledge on land rights as well as lack financial literacy. The presence of gender inequalities in human capital was identified as a gap in mainstreaming gender in agriculture and food security. Challinor et al. (2007) and Morton (2007) therefore posits that there is the need to take cognizance of the unique indigenous knowledge available to farmers particularly and use it as basis to address farmers' vulnerability to drought and other climate vulnerability issues.



2.14 Coping and Adaptation Strategies to Droughts

Generally, coping mechanisms are the actual responses to crisis on livelihood systems in the face of unwelcome situations, and are considered as short-term responses (Berkes & Jolly 2001). While coping and adaptation strategies of rural people have traditionally included crop diversification, mobility, livelihood diversification, and migration, singling out climate as a direct driver of changes is not so simple (Mertz et al., 2009). However, specific studies have gone further to explore some of the coping strategies adopted by rural people to minimize the effects of climate change, with most emphasizing on agro-related activities.

Related to agro-related coping strategies, Aniah, Kaunza-Nu-Dem & Ayembilla (2019) in the study of climate change and smallholder farmers in Bongo District note that, adaptation strategies most commonly used include tree planting, soil conservation, late planting and irrigation among others. In addition to these soil conservation schemes including stone/grass bunding, composting/organic manure application was also adopted. Farmers also planted different varieties of crops, planting early and harvesting water as ways of adapting to climate change (Aniah, Kaunza-Nu-Dem & Ayembilla, 2019). Aniah, Kaunza-Nu-Dem & Ayembilla (2019) also note that, in the time of climate change, people change composition of livelihood portfolios by relying more on non-agricultural sources of income, by adding more market-oriented agricultural activities such as cotton, onions, tomatoes and by changing their food production strategies to more drought-adapted varieties on the one hand and to less water-stressed fields on the other hand (where they produce vegetables and rice). Similar coping strategies can be observed with regard to animal husbandry as people begin to diversify animal or shift to more productive ones (Aniah, Kaunza-Nu-Dem & Ayembilla, 2019).



Generally observed from the discussions is that, adaptation methods most commonly cited in the literature include the use of new crop varieties and livestock species that are more suited to drier conditions, irrigation, crop diversification, mixed crop livestock farming systems, changes of planting dates, diversification from farm to nonfarm activities, increased use of water and soil conservation techniques, and trees planted for shade and shelter (Nhemachena and Hassen, 2007 in Aniah, Kaunza-Nu-Dem & Ayembilla, 2019). What is observed from these is that, though the strategies appear different among various groups, there are similarities which go to support the general livelihood coping strategies involving diversification, intensification and mobility (Lyimo & Kangalawe, 2010; Caway & Chambers, 1999).

In whatever form coping strategies appears, they have been adopted in many areas as a way of responding to the effects of climate change. According Paavola (2008), these responses have been crucial in ensuring the security of rural livelihoods. However, some of these responses deplete and degrade natural resources such as forest, soil and water resources, which will complicate living conditions of rural people in future (Paavola, 2008; Cooper et al., 2008; Leary, 2012). This implies that, some coping strategies adopted by rural people in the midst of climate change have long term negative effects on their lives.

2.15 Conclusion

The literature review has shown that there exist gender variations to climate change vulnerability and drought. Invariably, it notes that men and women are affected differently. Considering the significant inputs of smallholder farmers particularly women in farming activities and to food availability, literature suggests that optimum steps are taken to address women's vulnerability to the stress and shocks resulting from drought and other climate change challenges whiles taking cognizance of the



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traditional adaptive strategies and agronomic practices available to any given society to enhance food productivity as well as protect the natural environment.

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CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.1 Introduction

Chapter three of the thesis presents a profile of the study area, types of data collected, data collection methods, sampling methods as well as sample size.

3.2 Description of study area

Towards achieving the objectives set out for the thesis, the study focuses on the Bongo and Talensi districts, inhabitants of both districts are predominantly engaged in agriculture but are currently confronted with the consequences of drought and climate change in their daily activities.

3.2.1 Profile of the Bongo District

The Upper East has 15 administrative districts of which Bongo District is part and was created in 1998 through a Legislative instrument 1446 (LI 1446) to promote grassroots participation in local governance as well as promote effective development at the local level. The district has Bongo as its capital (GSS, 2010).

The district is situated between on the west by longitudes 0.45° W. and also north by latitudes 10.50° N to 11.09° with a land mass of about 459.5 square kilometers. The district shares boundaries with Burkina Faso at the north, Kassena-Nankana East district to the west, Bolgatanga Municipal at the south west and Nabdam District at the south east. The district is situated in the oncho-cerciasis-freed zone (GSS, 2010).

The Bongo district just like other parts of the Upper East Regions has same climate with an average temperature of 21°C monthly. The Bongo District has an uneven landscape and the slope rises higher at the western and northern parts specifically (GSS, 2010). For the mean monthly temperature, the highest temperature up to 40°C



is experienced in June with the lowest of about 12⁰C around December. Harmattan winds and haziness are specific features during the dry season. The district experiences an average of 70 days rainy season annually. However, the communities are flooded after few hours of rainfall as well as erosion of the soil during heavy rainfall. The minimum rainfall begins in June. The maximum rainfall is experienced from August to September; however, it reduces drastically in the middle of October at the time the dry season (GSS, 2010).

Special features in the district are the Savannah woodland which is composed usually of tress, grasses, herbs and other plants that are able to resist the impacts of drought. In recent times, perennial bushfires and extensive crop cultivation on the same piece of land for a long time without practicing any meaningful agronomic practices have resulted to bure lands. Only trees such as baobab, acacia, sheanut and dawadawa plants thrive in the savanna belt (GSS, 2010)

Among the geological composition in the Bongo District is Granite which is all over the district, Hornblade as well as a small amount of biotite as mineral compositions in the district. Thus, granite constitutes the major soil formation in the district (GSS, 2010).

3.2.2 Profile of Talensi District

Among the 15 administrative districts in the Upper East is the Talensi District and was created in 2012 to promote grassroots participation in local governance as well as promote effective development at the local level. The district has Tongo as its capital (GSS, 2013).

The district is situated between on the west by longitudes 31 and 10.5⁰W. and also north by latitudes 10⁰15 to 10.6⁰N with a land mass of about 838.4 square kilometers.



The district shares boundaries with Bolgatanga Municipality to the north, West and East Mamprusi at the south, at the west by Kassena-Nankana district to the east by the Bawku West and Nabdam districts (GSS, 2013).

The Talensi district just like other parts of the Upper East Region has same climate with an average temperature of 45⁰C monthly. The Talensi District has an uneven landscape and the slope rises at the western and northern parts specifically with a gradient of about 10-50 around the Tongo communities (GSS, 2013). For the mean monthly temperature, the highest temperature up to 45⁰C is experienced in March and April with the lowest of about 12⁰C in December. Harmattan winds and haziness are specific features during the dry season. The district experiences an average of 95mm which is between 88mm-110mm annually. However, the communities are flooded after few hours of rainfall as well as erosion of the soil during heavy rainfall. The minimum rainfall begins in May. The maximum rainfall is experienced from August to September; however, it reduces drastically in the middle of October at the time the dry season (GSS, 2013).



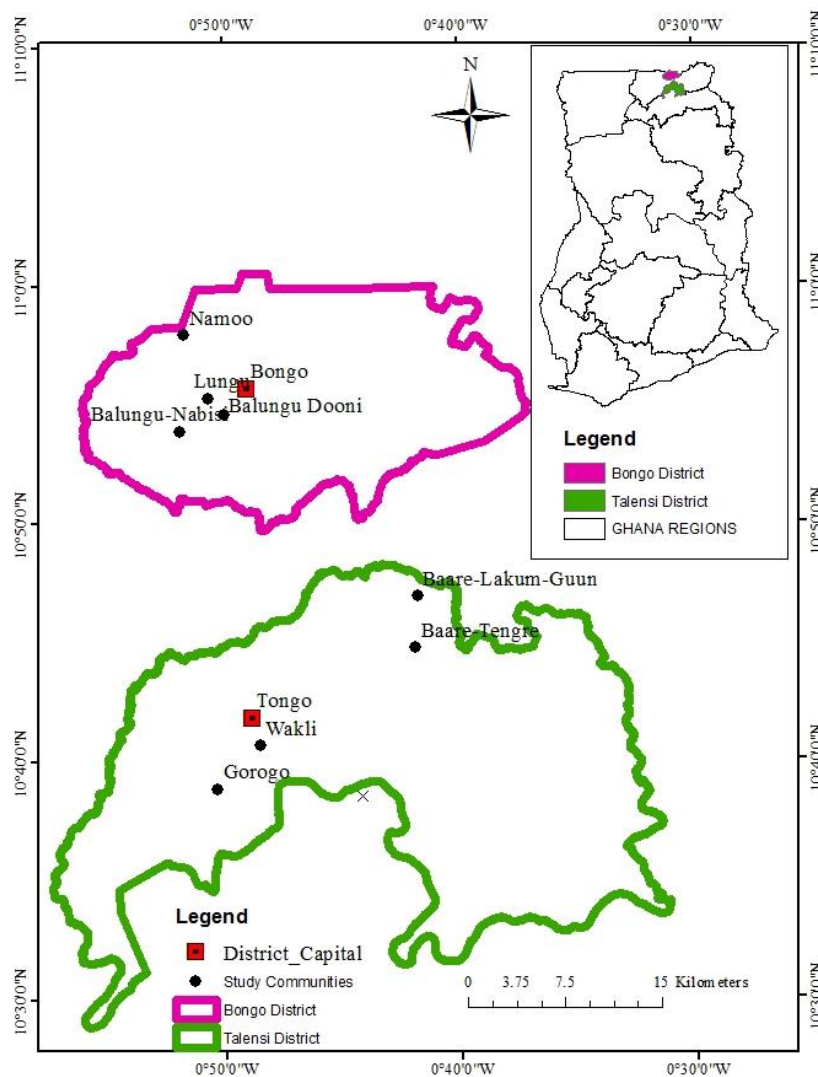
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Among the geological composition in the Talensi District is granite which all over the district. Thus, granite constitutes the major soil formation in the district (GSS, 2013).

The district has the White Volta and its tributaries as the major rivers.

Figure 3.1: Map of study area

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Source: Author's construct.



3.3 Research Methodology

The discussions of research methodology in this section includes research design, methods of data collection, sources of data, sampling techniques and sample size determination. The rest include data collection instruments and management of field data and analysis.

3.3.1 Research Design

A case study as a form of descriptive research design was used for the study. Case study according to Stake (1995) is a strategy of inquiry by which the researcher explores deeply of a program, events, activity and process of one or more individuals. For the purpose of this study, the case study was used as a strategy of enquiring and exploring gender vulnerability to drought in the Upper East region of Ghana.

3.3.2 Methods of Data Collection

Both qualitative and quantitative research strategies were used. The quantitative strategy used questionnaires; a strategy under the descriptive research strategy to ask questions pertaining to the characteristics of the population being studied. Also, the quantitative approach helped to reduce data collection from numbers for statistical computation in the form of frequencies, correlation and charts to assist analysis of the data collected (Anderson et al., 2009).

For the qualitative strategy, the study employed interviews for gathering useful in-depth information necessary for the study. The qualitative strategy was applied to solicit empirical support with regards to the research questions as well as in-depth interviews that leads to non-numerical data (Denzin & Lincoln, 2011). This approach also enabled the researcher use a mixture of data collection procedures to collect detailed information regarding drought and gender vulnerability in the Talensi and Bongo districts. For gathering reliable and valid data, the study employed two methodological approaches in which the qualitative approach was used to complement the quantitative approach. Data collected included farm-level and demographic information; respondents' experiences on drought, as well as impacts of drought on their livelihoods. Data on institutions relevant to helping farmers adapt to drought was also collected.



The tools for data collection used for the study were questionnaires for household survey, checklist for observation and focus group discussion and interview guide for in-depth interviews for selected communities from the two districts.

The selected method for primary data collection was done under the form of semi-structured and in-depth interviews by using a questionnaire. A structured questionnaire was used for the survey with questions crafted to cover all objectives stated for the study. The questionnaires used essentially helped provide first-hand and new information regarding the topic under study. Finally, they encouraged respondents to talk and go more deeply into the issue of concern.

As part of the interview section, focus group discussions was another method used to collect data from the field by using a checklist. Both genders were involved in the discussions and their opinions and experiences of drought vulnerability were unraveled as well as its impacts on agricultural activities in the communities. Two focus group discussions were conducted in each of the study districts. Eight (8) participants were purposively selected to take part in each of the discussions in the communities. One group was composed of males headed households and the other composed of female headed households in each community. The rationale was to examine the perception of drought by different sex groups based on which appropriate strategies could be developed and comparison made. These methods helped to understand drought from within the affected areas and the significance of gender difference in the different levels of drought vulnerability. The also employed participant observations using an observation guide to observe farmers on-farm coping and adaptation strategies they implement on their farms (Merriam, 1998).



3.4 Sources of Data

Data sources for this study included both primary and secondary sources. Primary data sources included interviews with smallholder farmers, key informants, government officials working in the areas, Non-Governmental Organizations, Assembly members and also Agricultural Extension Agents (AEAs).

In addition to the primary data, the study collected secondary data including a review of official documents on the subject, climate records (rainfall and temperature data for the past 3 decades) and statistics on the topic areas, including reports and working documents prepared by government agencies and civic institutions as well as other official publications. The secondary data analysis also involved archival research from books, journals, magazines, articles, internet materials and other related information.

3.5 Population

Population of the study refers to the objects that are of interest to the study and which the researcher wants to investigate (Turner, 2011). The target population of this study included all the smallholder farmers in the Bongo and Talensi district comprising of both men and women, government officials working in the two District Assemblies, Environmental Protection Agency (EPA), and representatives from district NADMO offices as well as officials of NGOs working in climate related areas.

3.6 Sampling Methods

Both probability and non-probability sampling methods were employed in this study. Probability sampling methods such as simple random sampling and non-probability sampling techniques such as critical case sampling, criterion sampling and purposive sampling methods were employed in this study. First, the selection of the study



districts commenced with a vulnerability assessment of the Upper East Region. The vulnerability assessment identified the Bongo district as the most vulnerability district in the Upper East Region to droughts and the Talensi district the most resilient to drought in the Upper East Region. The identification of the Bongo and Talensi districts as the most vulnerable and resilient districts to droughts in the Upper East Region is also confirmed by previous studies (Aniah et al., 2016; Antwi-Agyei, 2012). The Bongo and Talensi districts were therefore selected for comparative analysis.

Secondly, the study employed the criterion sampling technique to select the study communities. A criterion was developed and communities that met the predefined criteria were selected for the survey and qualitative interviews. Ten (10) communities were selected from the two districts, 5 from each community for this study. From the Talensi District the communities selected include Baare Tengre, Baare-Lakum-Guun, Tongo, Gorogo and Wakii. The communities selected from the Bongo Districts also included Balungu Dooni, Balungu Nabisi, Bongo, Lungu and Namoo.

Purposive sampling technique was used to select participants for the Focus Group Discussions and Key Informant interviews. During the administration of the household survey, individuals who demonstrated extensive knowledge and understanding on the subject matter were identified and later contact for face to face individual interview or invited to form a group for the focus group discussion. According to Barbie and Mouton (2007) purposive sampling is significant in exploratory studies since it offers the possibility of collecting reliable qualitative data.

Lastly, the simple random sampling method was employed for collecting data from households. The simple random sampling technique was used as a result of the homogeneity of farmers. Broadly, all the smallholder farmers face the same weather,



have common livelihood assets, market and soil conditions. They also have similar socio-economic characteristics. Hence this sampling approach provided the farmers equal chances of being part of the study. Simple random sampling (lottery method) was used to select the list of household heads and bearing the sample size in mind 80 household heads were randomly selected from the list. According to Patton (1990), the quality of the sample affects the quality of the research generalizations. Patton further explains that obtaining an unbiased sample is the main criterion when evaluating the adequacy of a sample. Patton identifies an unbiased sample as one in which every member of the population has equal opportunity of being selected in the sample.

3.6.1 Sample Size

From the ten sampled communities in the two districts, a sample size of 160 households was randomly selected using the lottery system; that is 80 households per each district bearing the population of these two districts. The sample size spread across the household heads who are smallholder farmers. They were selected and interviewed. Out of these, each community had men and women assuming equal proportions based on the population of each community.

Only adults of 30 years and above were marked for selection because it is understood that farmers under 30 years would not be able to identify their experience of drought in the region, since drought is a long-term event taking cognizance of variations in temperature, rainfall, winds and also other changes in the weather.

Also, six institutions were interviewed. These comprised government officials working in the two District Assemblies, Environmental Protection Agency (EPA), NADMO and community leaders specifically the chief of each community, Assembly



members of the selected communities and also Agricultural Extension Agents (AEAs) in each community.

3.7 Method of Data Analysis

Analyses of data were done with regards to the specific objectives stated at the beginning of the study. Statistical Package for Social Sciences (SPSS) was used for analyzing the data collected. SPSS is a data management and statistical analysis tool which has a very versatile data processing capability. SPSS software version 22 was most preferred because of its ability to model latent variables under both normal and non-normal conditions. By using the SPSS, data collected were coded and special steps were taken to categorize the findings into specific themes and summarized by way of descriptive analyses during the analysis. Observations and discussions resulting from the focus group were assessed by way of categorizing them in themes and inputting the information into computer for both qualitative analyses.



CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

This chapter presents the results and discussions of the study. The first sections deal with demographic features of respondents, followed by analysis of experiences of both men and women to droughts. Scrutiny of the sensitivity levels, coping and adaptation mechanisms of both men and women droughts in the selected districts are also presented. A comparative study of the situation is made between the Bongo and Talensi districts and between men and women. The study further examined the role different socio-economic and environmental resources play in reducing vulnerability and increasing adaptive capacities both genders in the Bongo and Talensi district.

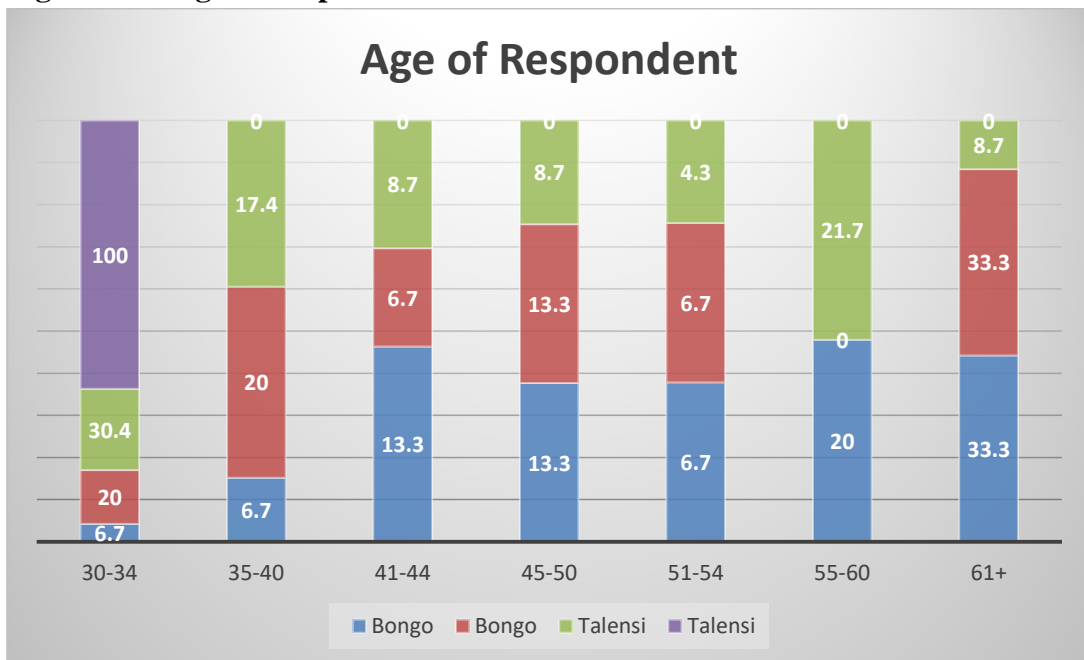
4.1 Demographic features of respondents

This section of the study discusses the demographic features of respondents. The demographic variables of interest to this study include sex of respondents, educational status, number of years in farming, marital status, sex of household head, household size and land ownership status among others. These variables have significant implications on smallholder farmers vulnerability to drought, adaptive capacity and their implementation of coping and adaptation mechanisms in both study districts. This observation has earlier been confirmed by (Arku, 2013; Djabletey et al., 2012).



4.2 Age of Respondent

Figure 4. 1: Age of Respondent



Source: Field survey, 2019.

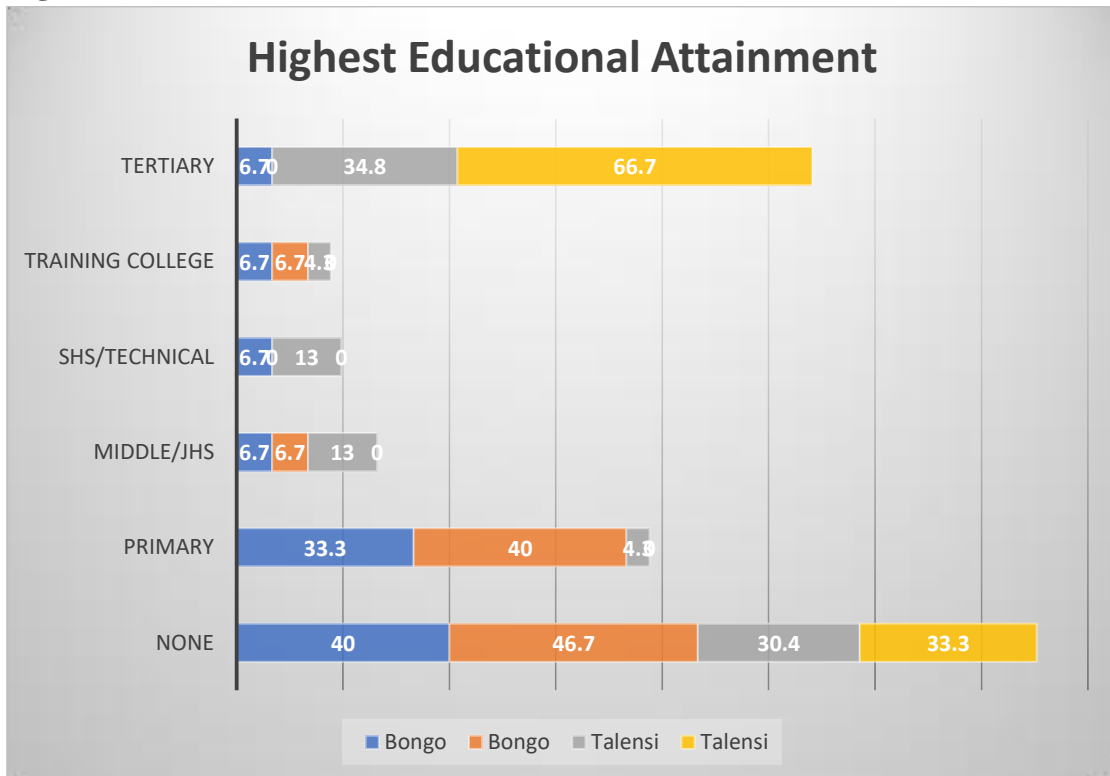
As shown in figure 4.1 it suffices to say that in Bongo, there are more people within the age bracket 61+ representing 33.3% and 33.3% of male and female respondents respectively, as compared to 8.7% and 0% for male and female respectively in the same age bracket in Talensi. The implication is that in terms of in-depth knowledge and experience of the drought situation, there are more people who have lived through the condition over the years in Bongo and can share their experiences compared to the average respondents in Talensi.

In this study, both genders attested that the rainfall patterns have changed tremendously resulting to drought on some occasions for at least the past 5 years. Before going deeper into the analysis of the situation, the study recognizes the role both males and females play in agriculture and as such was interested in the proportion of males that were households' heads and that of females.



4.2.1 Educational Level of respondents

Figure 4. 2: Level of Education



Source: Field survey, 2019.

With regards to understanding issues of drought resulting from climate change, one's educational level was paramount in knowing the different levels of exposure to drought, awareness, and effects on crops and health (well-being) as well as implementing suitable coping strategies. From figure 4.2, Bongo district had a significant number of people with no education. Over 40% and 46.7% of males and females in the Bongo district respectively had no formal education whereas 30.4% and 33.3% of males and females respectively had no formal education in the Talensi district. However, the number of respondents in the Bongo district who obtained primary level education were higher than those in the Talensi district. About 33% and 40% of males and females in the Bongo district had primary education while 4.3% and 0% of respondents in the Talensi district had attained primary education. Many

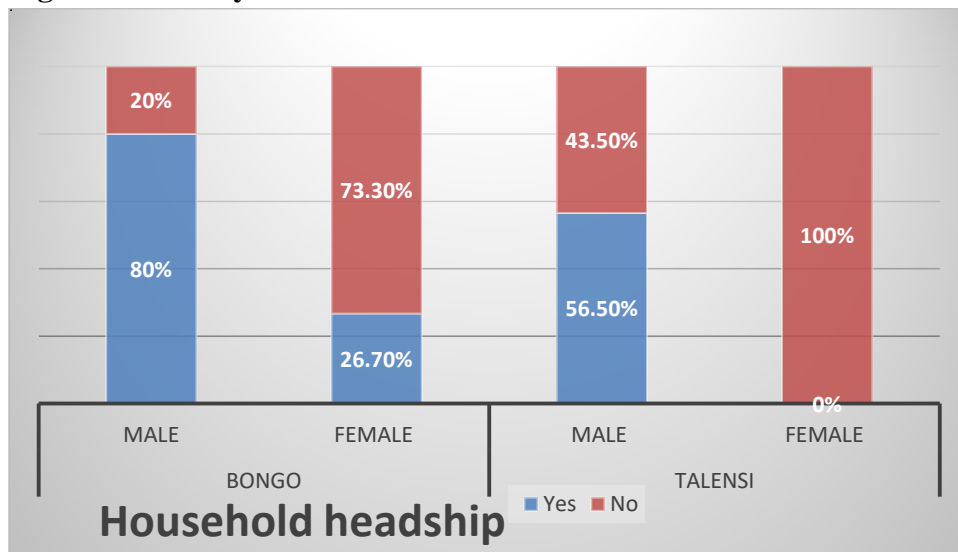
respondents who attained tertiary education were found in the Talensi district, where 34.6% and 66.7% of respondents attained tertiary level education compared to a mere 6.7% and 0% of respondents who attained tertiary education in the Talensi district of males and females respectively. Those with Middle/JHS education were 6.7% for males and 6.7% for females in Bongo compared to 13% males in Talensi with no woman crossing that level. Those respondents who had education to SHS/TECH/VOC level were 6.7% representing the males in Bongo and 13% for the males in Talensi. Nonetheless at the training college level 6.7% were represented for both males and females in the Bongo district compared with only 4.3% males educated to the college level in Talensi.

From the analysis it suffices to say that the literacy level in the Talensi district is higher compared to the literacy level for Bongo district. However, it was revealed during the study that the use of indigenous knowledge (IK) and past experiences was prevalent among farmers and served as guiding tools aside the significance of educational attainment in helping farmers implement appropriate coping strategies to drought. Similarly, those with higher educational backgrounds were more open to alternative livelihoods and as such could diversify the livelihood sources to withstand the shocks and stresses resulting from drought as well as adopt improved farming systems including intercropping, mulching and access to irrigation compared to those with minimal or no educational background who only depended on primitive or traditional means of farming and as such could not diversify their livelihood sources.



4.2.2 Household headship

Figure 4. 3: Are you the household head?



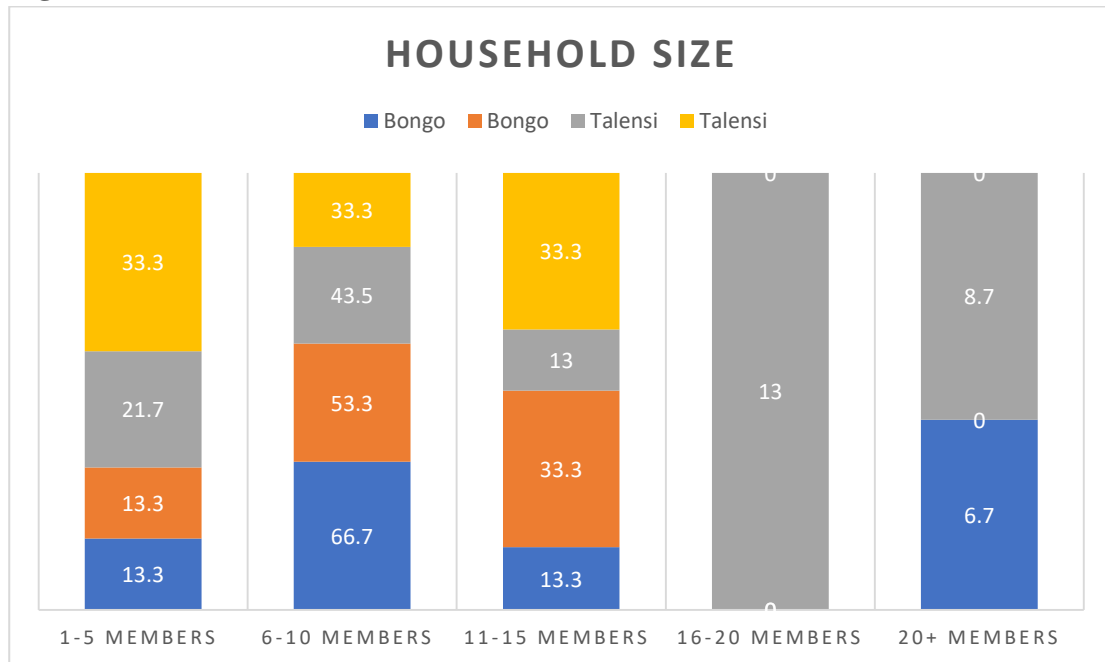
Source: Field survey, 2019.

As shown in Figure 4.3, it is evident from the analysis that 80% of the household heads in Bongo are males compared to 56.5% male household heads in Talensi. The higher percentage of male household heads in the study was not deliberate however a further probing revealed that due to the culture and the nature of inheritance resulting from the patriarchy system in the communities, there were more male headed households than females. This result is consistent with findings of Nkhata (2014) who also reported that more male headed households participate in agriculture as compared to female headed households.



4.2.3 Household Size

Figure 4. 4: Household size



Source: Field survey, 2019.

Household size is another important determining factor in household choice of coping and adaptation strategies in the face of drought and with respect to the number of mouths to feed at a time. Consequently, a detail scrutiny was conducted to analyze the sex of respondents against the household size. The analysis show that about 13.3% and 21.7% of males in the Bongo and Talensi district respectively had a household size between 1-5 members while 53.3% and 43.5% of females in Bongo and Talensi had household size of 1-5 members. Also, 66.7% and 43.5% of males in Bongo and Talensi district respectively had 6-10 household membership size.

As shown in figure 4.4, about 43.5% and 33.3% of females in Bongo and Talensi respectively also had household membership size of 6-10. Household membership size of 20+ recorded the lowest percentage of respondents. Only 6.7% males in Bongo and 8.7% males in Talensi had household size above 20. None of the female headed households had members above 20. This indicates that men usually have large



household size than women. Similarly, some of the household heads also had between 11-15 members representing 13.3% males and 33.3% females in Bongo compared with 13% and 33.3% females' household heads in Talensi. Household heads with members ranging from 16-20 were represented by 13% for males in Talensi. The implication of this analysis is that the higher the household size, the higher the number of mouths to feed in the house. Hence at any time there is any drought situation in the communities, it doesn't only affect the household heads, however, their dependents are also adversely affected depending on the intensity of the drought situation and the household size.

Literature suggests that the size of a household presents the burden that a household has in terms of food security and general welfare. The bigger the size of a household, the greater the need for income for a living and consequently, the higher the probability of vulnerability of such households to drought. This finding does not conclusively suggest that size of a household is a determining factor in the choice of coping and adaptation strategies to drought impacts.



4.2.4 Sex of Household Head and Type of Land Ownership

Table 4. 1: Sex of household head against type of land ownership

Sex of household head	Type of land ownership			Total
	Owned land (purchased/inherited)	Rented	Shared holding	
Male	72.1%	90.9%	50%	73.3%
Female	27.9%	9.1%	50%	26.7%
Total	100%	100%	100%	100%

Source: Field survey, 2019.

A cross-tabulation was then carried out to look at the sex of household heads against type of land ownership. Under type of land ownership, it was grouped into 3 categories namely land owned either through inheritance/purchasing, land rented and land accessed through shared holdings. The table 4.1 reveals that in relation to male headed households in both the Talensi and Bongo districts, 72.1% of the respondents either owned land through inheritance or purchasing compared to 90.9% of the respondents who had rented farmlands, while 50% of the males had access to farmlands through shared holdings. Subsequently, from all the 3 categories of ownership to land, 73.3% of male headed households had access to land. Similarly, analysis in the two districts taking into consideration the female headed households with regards to the 3 land ownership categories, 27.9% of the respondents had ownership to land either through inheritance or purchasing compared to 9.1% of the respondents who had rented farmland while another 26.7% of female household



heads owned land through shared holdings. Subsequently, from all the 3 categories of ownership to land, 26.7% of female household heads had access to land. The findings are indicative that more males (73.3%) had access to land for farming activities while less females (26.7%) has access to land for farming activities. These findings are supported by Yaro's (2010) study which earlier indicated that fewer women in many communities in the Northern part of Ghana has access to land for their livelihood activities.

4.2.5 Housing Type

Table 4. 2: Housing type

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Single room	6.7	0	8.7	0
Compound	93.3	100	52.2	66.7
Semi-detached	0	0	17.4	0
Detached	0	0	21.7	33.3

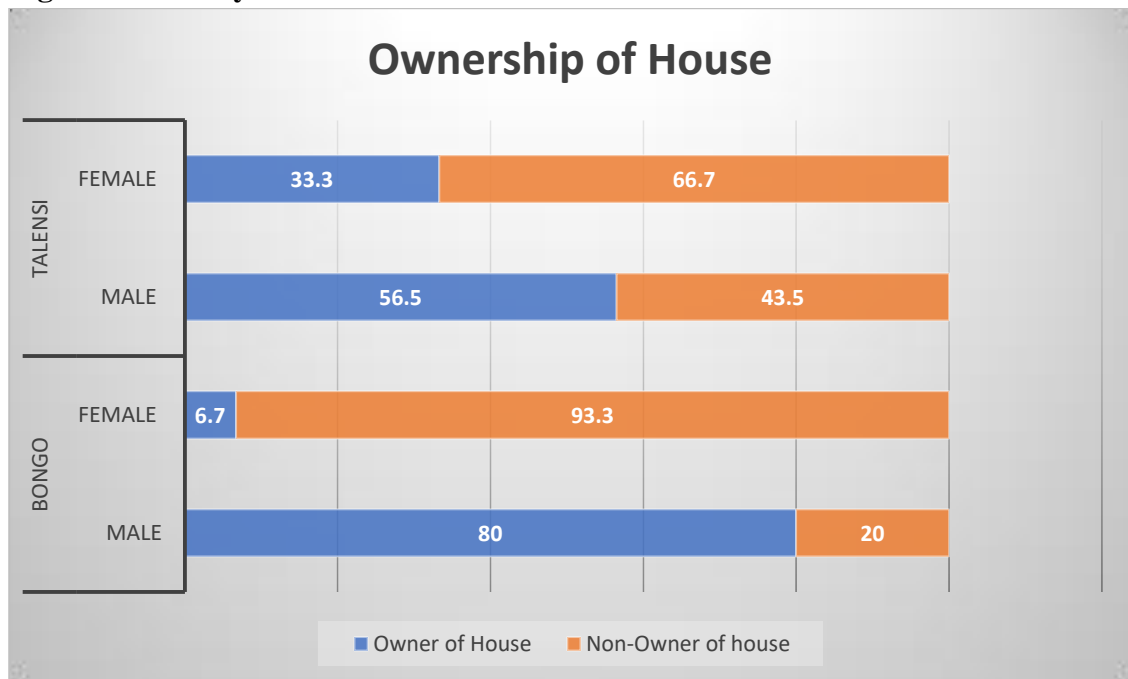
Source: Field survey, 2019.

Further analysis was done on the housing types in the two districts as well as the forms of ownership structure. The outcome of the analysis as revealed in the table below indicates that there were not many single rooms compared to the detached and semi-detached houses in the two districts. Depending on the family size, the elderly particularly the married ones shared a room while the children also shared one for themselves.



Evidently and commonly with most northern communities there are more compound houses in the Bongo and Talensi districts as revealed in the analysis. Upon further enquires it was disclosed that due to the communal living coupled with the emphasis predominantly on the extended family system, they lived in compact villages with close association with their families hence preferred the compound houses more.

Figure 4. 5: Are you the owner of the house?



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Source: Field survey, 2019.

Investigations into the house ownership structure in Bongo and Talensi revealed that predominately most houses were owned by the males. This is due to the cultural system in the northern regions which places more emphasis on the patriarchy system. The study also discovered that those who had no ownership to the houses in the communities either rented them or could only have access to them since they were family members.

4.3 Gender Experiences of Drought In The Bongo And Talensi Districts

4.3.1 Knowledge about Drought and Climate Change

Table 4. 3: DO you know anything about drought and climate change?

	Bongo		Talensi	
	Male	Female	Male	Female
Yes	100	100	56.5	66.7
No	0	0	43.5	33.3
If yes, what is your understanding				
Inadequate/absence/lack of rain	80	93.3	15.4	7.7
Dry spells of weather	20	6.7	0	0

Source: Field survey, 2019.

Table 4.3 reveals that whiles all respondents in the Bongo district had an idea about drought, 43.5% and 33.3% of male and female farmers in the Talensi districts had no knowledge about drought. The researcher sought to understand if farmers from both districts had knowledge about drought and climate change conditions since the past five years. The outcome shows that farmers have noticed the changes in the weather situation over the last five years and these changes have affected their crop yield and productivity. Many farmers disclosed that drought is the absence of rain for a long time whiles some believed drought is as a result of dry spells weather. Hence, apart from the scientific explanation to drought, some of the respondents attached spiritual reasons to drought.



4.3.2 Understanding about Drought and Climate Change

4.3.3 Experiences of Climate Events

Table 4. 4: Climate events experienced in your lifetime in the last five years

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Flood	27.3	30.6	18.5	20
Extreme Heat	12.7	10.2	37	30
Rainstorm	27.3	28.6	14.8	10
Drought	27.3	28.6	20.4	30
Fire Outbreaks	5.4	2.0	9.3	10

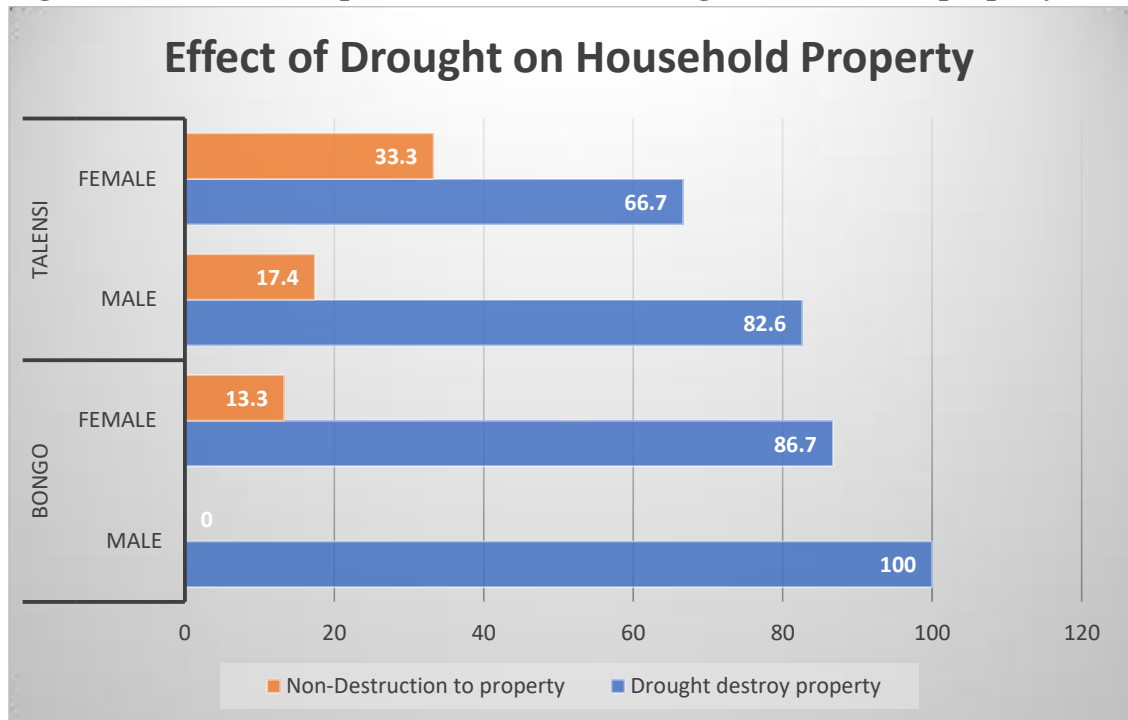
Source: Field survey, 2019.

As shown in table 4.4, about 27.3% and 18.5% of males in Bongo and Talensi districts respectively and another 30.5% and 20% of females in Bongo and Talensi district respectively experienced floods at least once in the last 5 years. Extreme heat events were more in the Talensi district (as indicated by 37% and 30% of males and females respectively) than the Bongo district. Droughts events were experienced more than other climate events. 27.3% and 20.4% of males in the Bongo and Talensi districts experienced drought event at least once in the last 5 years while 28.6% and 30% of females in Bongo and Talensi districts experienced drought event at least once in the last 5 years. Using the last five years as reference point, all the respondents in the study areas disclosed that due to changes in the climate they have experienced flood on some occasions, extreme heat, rainstorm, drought and fire outbreaks. These events are due to the changes in the weather although events such as fire outbreak could also be triggered by human actions.



4.3.4 Effects of drought and climate change events experienced

Figure 4. 6: Views of respondents on effect of drought on household property



Source: Field survey, 2019.

As shown in figure 4.6, all males and 86.7% of females interviewed in the Bongo district indicated that drought episodes had resulted in the destruction of property. Conversely, 82.6% and 66.7% of males and females respectively in the Talensi district indicated drought episodes had destroyed their property.



Table 4. 5: Views of respondents on the effect of drought on water sources

	Bongo		Talensi	
	Male	Female	Male	Female
Contaminate water sources	43.5	38.1	33.3	12.4
Destroy water storage facilities	13	23.8	27.3	6.3
Affect water quality	30.5	23.8	36.4	75
Destroys aquatic lives	13	14.3	0	0
Drying of water bodies	0	0	3	6.3

Source: Field survey, 2019.

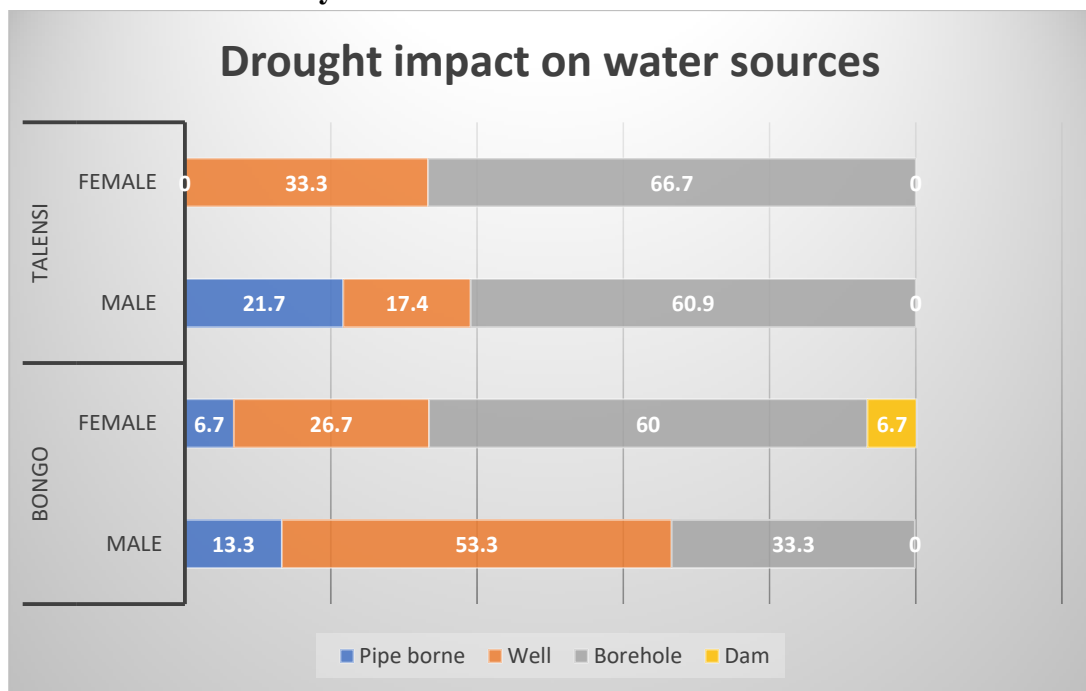
Table 4.5 reveals that droughts contaminate water sources and affects its quality in the studied districts. 43.5% and 33.3% of males in Bongo and Talensi districts viewed droughts effects on water contamination to be on the rising while 38.1% and 12.4% of females in the Bongo and Talensi districts share the same view. Regarding reduction in water quality, 30.5% and 23.8% of males and females respectively in the Bongo district stated that droughts affects water quality. Whereas 36.4% and 75% of males and females in the Talensi district share similar view. No respondent in the Bongo district mentioned drying up of water bodies as an effect of drought. This is so because the Bongo district has the Vea dam as a main water source.

The study revealed that at any point in time that there was disaster, respondents had their sources of livelihoods including their shelter destroyed. Some respondents disclosed that whiles the floods displaced them from their communities, fire outbreak also burnt down their crops and animals. Evidently drought affected the water bodies and aquatic life in the environment. The table 4.5 shows that all respondents in



both Bongo and Talensi districts experienced the effect of drought on the availability and quality of water. A study by Mosley (2015) has also observed that droughts are increasing in frequency and severity in many communities owing to climate change, which often causes hydrological effects such as reduced catchment runoff, river flows and lake levels as well as significant changes in water quality of freshwater systems (rivers, streams, lakes, reservoirs) (Mosley, 2015; Barbeta et al., 2015).

Figure 4. 7: Views of respondents on the effects of drought on the Main source of water in the community



Source: Field survey, 2019.

The study investigated into the various sources of water to the communities in Bongo and Talensi districts. The outcome of the study shows that for both districts, majority of the households as shown in figure 4.7 had their water from the dug-out well or from the boreholes except a few affluent persons in the communities who had access to pipe borne water. Days that there was shortage of water in the communities, the study identified that the women and children had to trek for long distances in order to fetch water. This according to the women affected their well-being and was also



stressful. This finding is in tandem with Watt & Chamberlain (2011). The vulnerabilities of women are confounded by poverty, food insecurity natural hazards and extreme weather events which further compromise their health and well-being (Watt & Chamberlain, 2011).

4.3.5: Level of drought exposure to both genders in Bongo and Talensi Districts

From the study, it was revealed that both males and females considered decreased rainfall amounts during prolonged dryness without rains and irregular rainfall patterns as characteristics of drought when asked about respondents' knowledge on drought. Consequently, it suffices to say that both male and female small-holder farmers had similar knowledge of what constitute drought and that both were affected equally by drought-related conditions. These findings confirm the disclosure by Arku (2013) on similar subject about men and women understanding of climate change.

The stress on drier conditions as revealed by the study is not surprising as about 71.1% of the males and 29.9% of the females disclosed that drought affected their ability to access healthcare. However, about 76.8% of both males and females asserted that the drought does not necessarily affect their children's education since they sold their livestock to support their children's education, as well as had relatives outside the communities who supported them financially to take care of their children and provide their needs. Nevertheless, about 23.2% of the respondents were of the opinion that droughts have negative impacts on their children's access to education. Households are unable to afford the tuition cost for their wards, which would have been obtained from sale of farm produce and livestock, but due to droughts, productivity levels have declined drastically. Majority of respondents also indicated that droughts also affect their health outcomes since they are unable to finance the



cost of health insurance or even pay their hospital bills. Similarly, as noted by Acquah and Onumah (2011), the erratic rainfall patterns have heightened the uncertainties among farmers regarding the planting time. Consequently, the drought situation exposes crops to pest and diseases leading to mass crop failure. Some of these uncertainties about the planting time were expressed during the interview as:

“Most of my crops did not yield well due to inadequate rains. It never rained at the usual planting season as compared to the past where during the planting season, there was enough rainfall. Since the rain pattern is now unpredictable, these days I have to wait for a long time before I plant. However, it rains for a short period and stops which is accompanied by hot sunshine. Due to this most of the crops do not do well and die” (female farmer, July 2019; Gorogo community in Talensi district).

“I suffered a lot during the planting season anticipating that there will be enough rains but it rained for a short time and that was all. The rainfall pattern has changed and it is affecting the farming activities. I did not have enough to harvest last year which led to hunger since there was not enough to feed the family” (male farmer, July 2019; Namoo community in the Bongo district).

From the analysis, it is evident that changes in the rainfall pattern resulting from decreased rainfall during the rainy season, prolonged dryness and drought consequently affects agricultural outputs especially crop production and livestock raising.

From a discussion with an Agriculture extension officer at the Talensi District office, he asserted that: *“Drought affect farming activities and livelihood of small-holder*



farmers, hence the situation sometimes results in hunger, divorce, sickness and poverty” (MOFA Officer, July 2019; Bongo district).

This confirms the disclosure in the study by Wringly-Asante et al. (2019) that mental stress from men’s inability to support their families invariably affects their traditional role of providing for the family thereby resulting in marriage instabilities and divorce in some instances.

In the Bongo district, about 86.8%, 9.4% and 3.8% of both males and females indicated that in a normal farming year, they cultivate 1-5 acres, 6-10 acres and 21+ acres of lands respectively. Whiles in the Talensi district, 86.8%, 7.5% and 5.7% of both males and females cultivate 1-5 acres, 6-10 acres and 6-10 acres of land respectively during the normal farming period. The difference between men and women was not statistically significant. One’s gender does not have influence on the amount of land cultivated on either a normal or drought period.

4.3.6: Corroborating the Extent of Drought

To assess the extent of drought in the study districts, a time series analysis of climate (rainfall and temperature) data obtained from the Ghana Meteorological Agency (GMA) for the entire Upper East Region was conducted.

4.3.6.1: Total Annual Rainfall for the Upper East Region

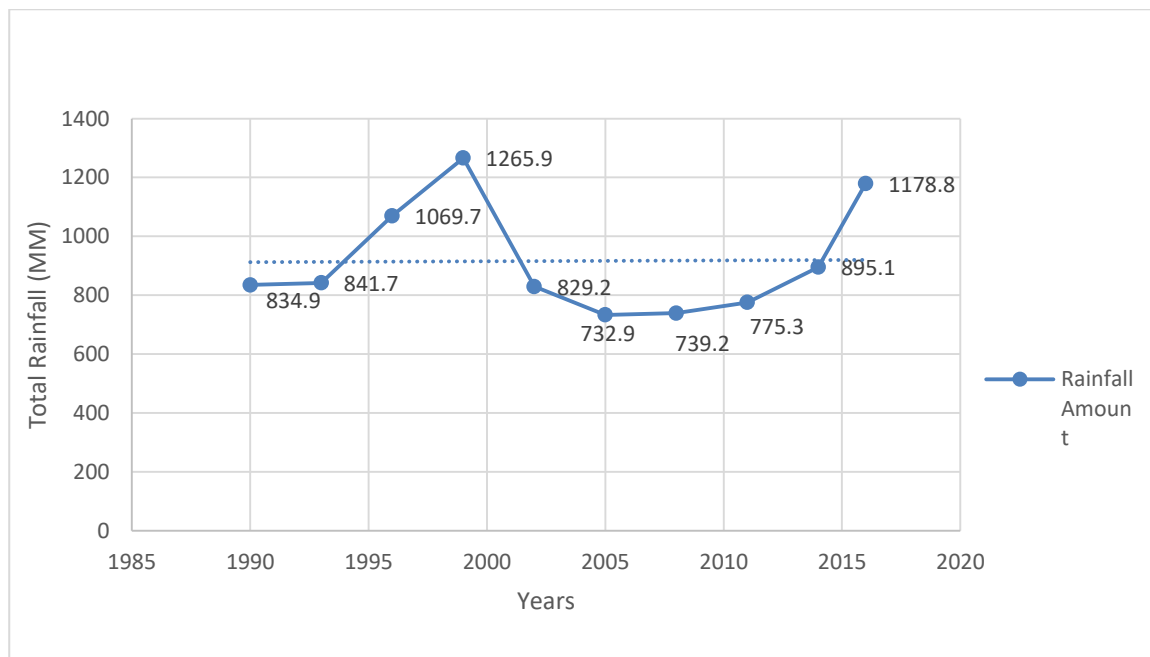
There is strong evidence of rainfall variability in the Upper East Region (UE/R). This is provided by climatic records from 1990-2016 obtained from GMA. The climatic records as shown in figure 4.8 indicates that there have been some agriculture and hydrological droughts events in the UE/R. Figure 4.8 shows that droughts (rainfall variability) has been detected in the UE/R. The region recorded the lowest rainfall amount of 732.9 mm in 2005. There have been many other severe droughts years. The



annual rainfall amount considered adequate for crop production is 950 mm, so considering 950 mm as the baseline for defining agriculture droughts, the data shows that there has been about 7 years out of 10 years that can be considered drought years (rainfall amount less than 900mm) and this is considered very risky for crop production and livestock raising. The climate records have confirmed the observations by respondents in the study districts that droughts events have been widespread. These observations are in tandem with previous studies (Assan et al., 2009; Antwi-Agyei, 2012; Aniah, 2016).



Figure 4. 8: Total Annual Rainfall for the Upper East Region

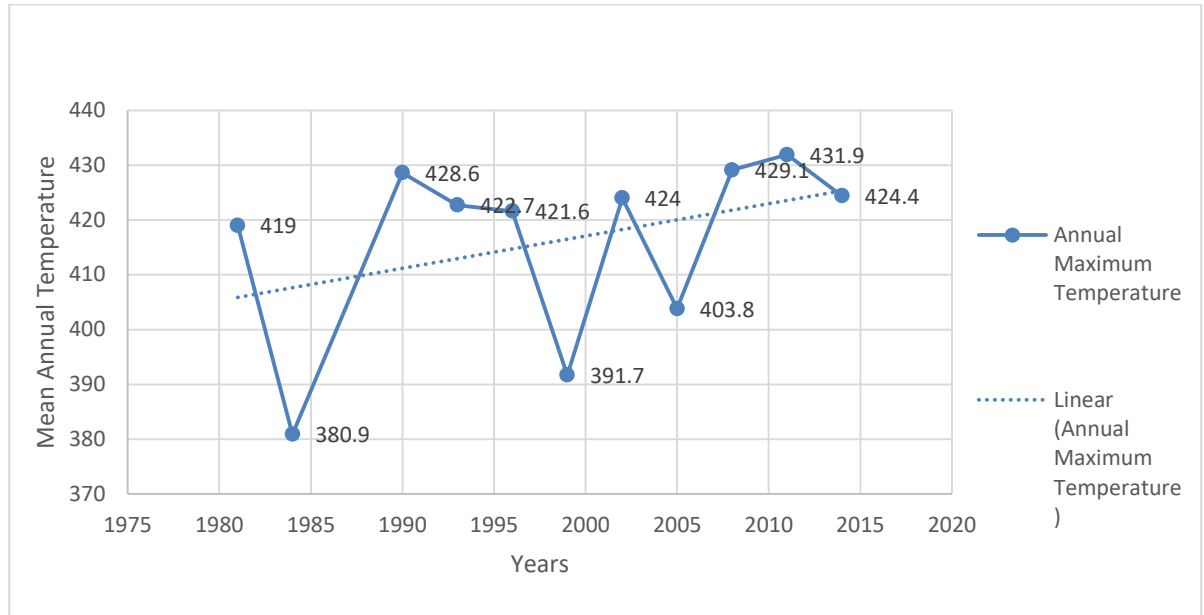


Source: GMA, 2019.

Temperature is one more vital element of agricultural production. A time series analysis of maximum and minimum annual temperatures in the UE/R reveals significant variations in mean annual temperatures. The UE/R has recorded an increase of about 0.6 °C for the maximum temperature over the period 1982- 2016.

Figure 4.9 reveals an average maximum temperature increases of about 0.6⁰C. Similar trends have been observed by Aniah (2016).

Figure 4.9: Annual Maximum Temperature

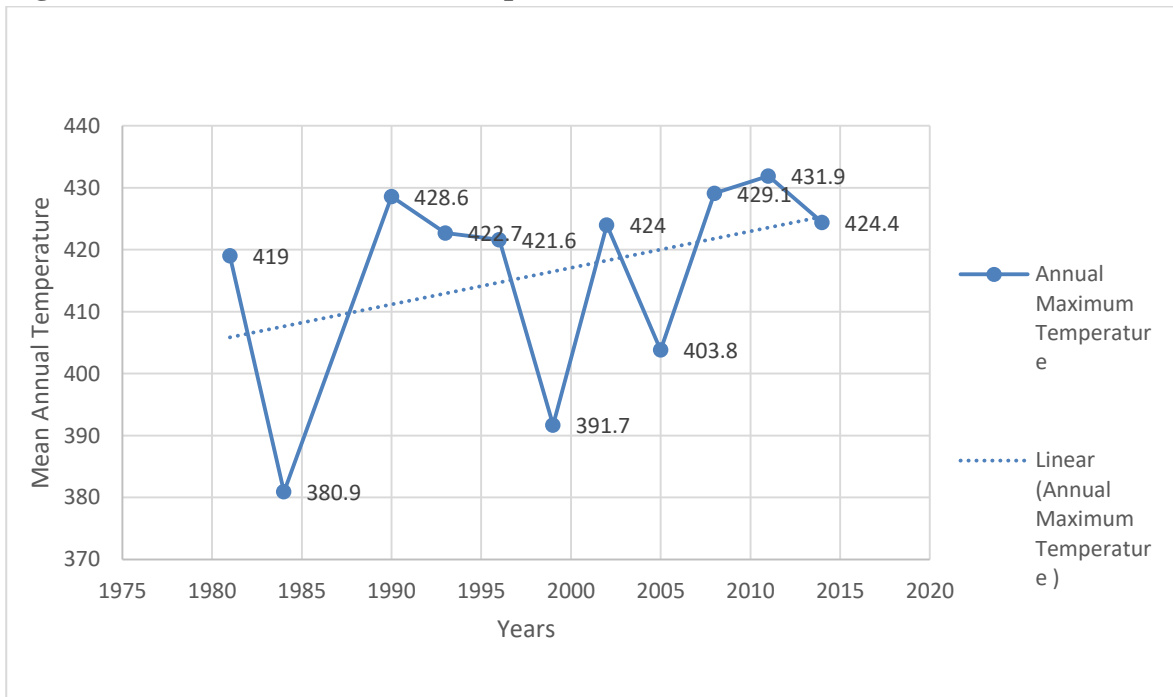


Source: GMA, 2019.

Similar trends are noticed for the minimum annual temperature in the UE/R as shown in figure 4.10. There are clear fluctuations in minimum annual temperature resulting in a rise of about 1.4⁰C. Indisputably, several studies have substantiated the increase in the temperature trend in the UE/R (Antwi-Agyei, 2012; Aniah, 2016). The results of this study further suggest that there was an intense vulnerability of crop production to droughts and livestock production in both studied districts and women were more affected than men. Antwi-Agyei (2012), and Aniah (2016) noted that the soils of the UE/R have lost its fertility, hence any drought event had the tendency to severely affect crop production and subsequently livelihood security.



Figure 4. 10: Annual Minimum Temperature for the UE/R



Source: GMA, 2019.

4.4 Different Sensitivity Levels Of Drought Between Men And Women

Droughts episodes are events that affects the livelihoods of smallholder farmers. An assessment of gender vulnerability to droughts from an angle of sensitivity levels should endeavor to analyze livelihood activities, occupation, crops cultivated and sources of earning of both men and women. These are discussed in the succeeding sections.



4.4.1 Livelihood Activities of Men and Women

Table 4. 6: What is your major occupation?

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Not working	6.7		8.7	0
Farmer	73.3	33.3	56.5	66.7
Weaver	0	60	0	0
Trader	6.7	0	0	33.3
Teacher	13.3	0	21.7	0
Miner			8.7	0
Geologist			4.3	0

Source: Field survey, 2019.

As shown in table 4.6 majority of respondents across gender and district were farmers. 73.3% of males and 33.3% of females in the Bongo district were farmers while 56.5% of males and 66.7% of females in the Talensi district were farmers. Apart from the farming activities engaged in by both males and females in the Bongo and Talensi districts, other household livelihood activities include mining, trading, basket and hat weaving and formal employment. Women particularly were engaged in domestic work such as fuel wood and water fetching, baby-sitting, cooking, washing dishes and house cleaning. The study in the two districts identified that most of the farmers had their farms within the community. About 93.3% and 100% of males and females in the Bongo district had their farms located within the community while 68.2% and 66.7% of males and females in the Talensi district had their farms located within the community. Hence in terms of proximity, they could access the farms easily and went to the farms both in mornings and in the evenings before sunset.



4.4.2: Major crops cultivated in studied districts

Table 4. 7: Major crops cultivated in the study districts

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Rice	14.3	5.4	28.1	10
Millet	33.3	40.5	35.1	30
Groundnut	4.8	2.7	5.3	10
Maize	21.4	18.9	26.3	20
Guinea corn	19	24.4	0	0
Wheat	2.4	2.7	0	0
Sorghum	4.8	5.4	0	0
Okro	0	0	1.7	10
Beans	0	0	3.5	10
Tomatoes	0	0	0	10

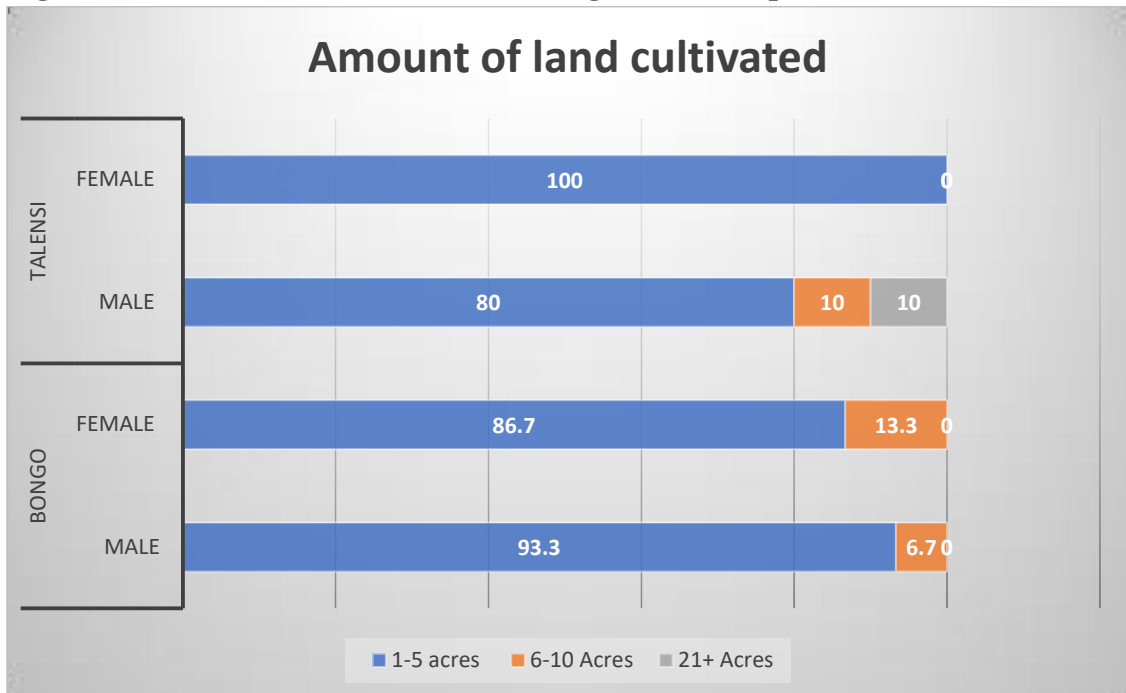
Source: Field survey, 2019

As shown in table 4.7, the major crops grown in both studied districts were millet, maize, guinea corn and rice. The major crops grown by females were millet, groundnuts, maize, beans, tomatoes, okro and rice. The male farmers preferred to grow millet and maize for sale to raise income while most of the crops grown by female farmers were for household consumption. Farmers in the Bongo and Talensi districts are noted in the cultivation of rice, millet, groundnut, maize, guinea corn, wheat, sorghum, okro, beans and tomatoes. According to the farmers they get good harvest during the normal farming season but the yield reduces when there is drought. In mitigating the drought situation, the study identified that farmers engage in other coping activities including change in cropping system. The outcome in these changes shows that changes in the cropping systems subsequently improve crop yield since some varieties of drought resistant seedlings have been introduced to the farmers.



4.4.3: Area of land cultivated during the normal period

Figure 4. 11: Area of land cultivated during the normal period



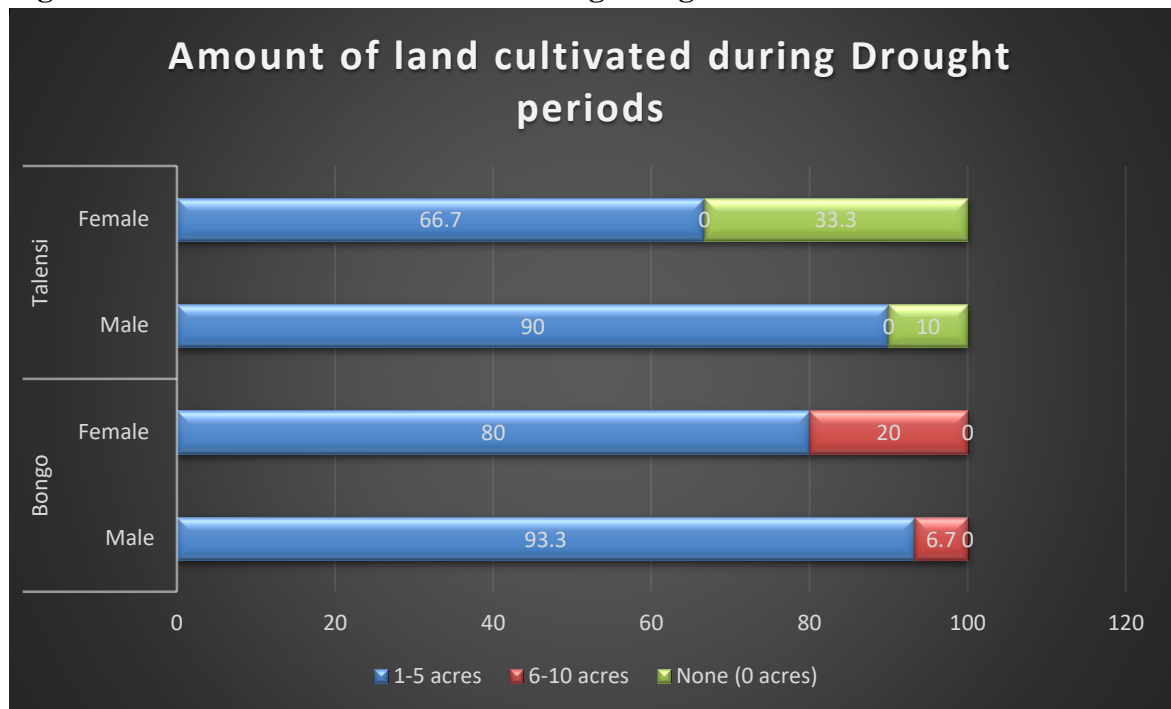
Source: Field survey, 2019.

Regarding acreage of land cultivated, male farmers generally cultivated more than female farmers. The findings suggest that in the normal farming season about 93.3% and 86.7% of male and females in Bongo cultivated 1-5 acres of land while 80% and 100% of male and female farmers in Talensi district cultivated 1-5 acres of land. Due to land scarcity in the Bongo district and high population density, farmers are unable to cultivate above 10 acres while in the Talensi district, about 10% of male farmers cultivate up to 21 acres. The farmers also revealed that they had good harvest during the normal farming season. Similarly, some of the respondents as shown in the table could also cultivate between 6-10 acres of land for both consumption and commercial purposes.



4.4.4: Area of land cultivated during drought

Figure 4. 12: Area of land cultivated during drought



Source: Field survey, 2019.

Although farmers cultivate various acreages of land during normal season, when drought episodes occur, many farmers do not wish to gamble and take risk. As a result, more farmers cultivate small portions of land size so as to minimize risk. The results suggest that about 93.3% and 80% of male and female farmers in the Bongo district and another 90% and 66.7% of female farmers in the Talensi district cultivate just 1-5 acres. About 33.3% and 10% of farmers in the Talensi district indicated they do not cultivate at all during drought episodes. The results as shown in figure table 4.12 reveals that there is a minimal reduction in the number of farmers engaged in large farm cultivation from both districts. By implication, this consequently has negative impacts on food security situation of the farmers.

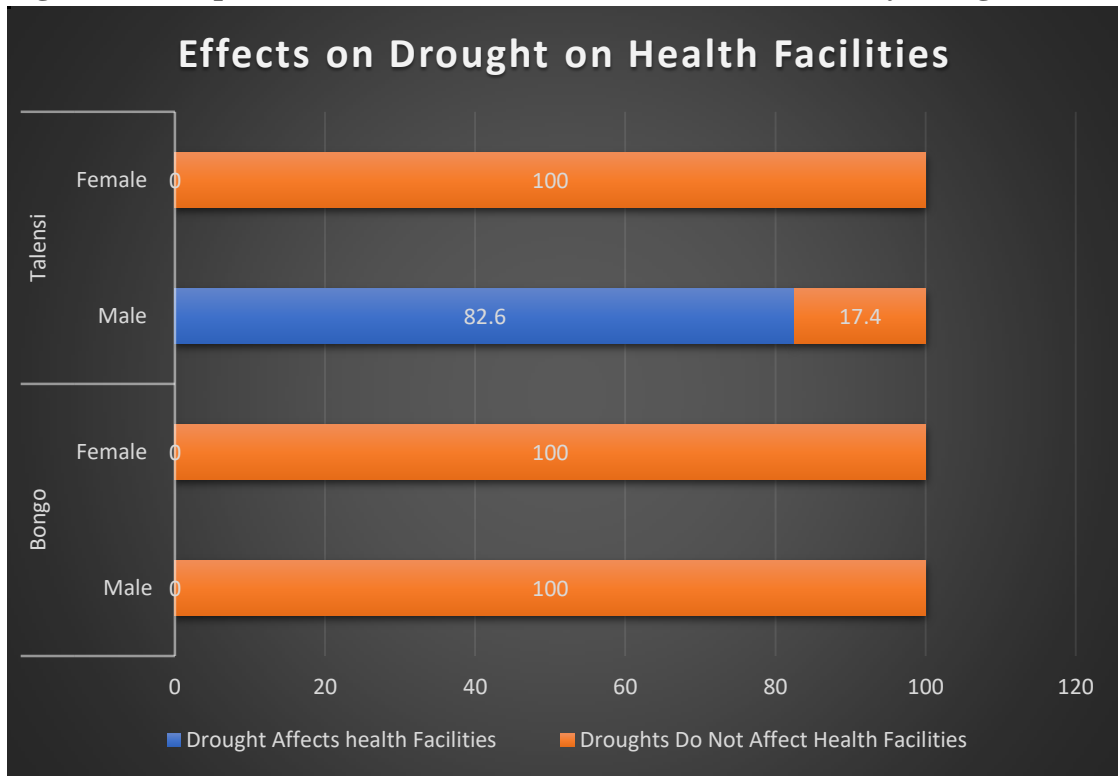
4.4.5: Sources of household earnings

In finding alternative ways to address drought conditions in the districts as well as improve coping strategies, majority of the respondents interviewed acclaimed that for the past five years they had received some form of education on climate change which has been of great benefit to their occupation. It was noted during the interviews that the households had different sources of income. Predominantly, households generated their income from the following sources as revealed during the study; sale of livestock and remittances from family members, sale of charcoal and firewood, sale of drinks such as pito and dry gin, sale of farm produce, family savings, personal savings, petty trading, by-day contract such as working on someone's farm for a fee or doing masonry work, motor fitting shop, from monthly salary on the part of government workers, Village savings and loans association. It is evident from the sources of income that at least households were earning some amount of money however there were reports from some section of the respondents that their income was so meager and could not cater for the entire family.



4.4.6: Impact of drought on healthcare facilities

Figure 4. 13: Opinion on whether health care facilities affected by drought



Source: Field survey, 2019

The responses from respondents in the Bongo district suggest that drought episodes do not affect health care facilities. However, in the Talensi districts respondents (82.6% males) indicated that drought affects health care facilities. Those respondents that indicated that drought affects health care facilities, revealed that medical supplies are destroyed and inadequate water hindered effective work among others.

4.4.7: Effects of drought on education

Although respondents from the Bongo district indicated that despite the drought situation, it didn't affect access to education of their children, the situation was however different in Talensi. Respondents from Bongo indicated that the presence of the school feeding program took the burden away from them to provide meals and pocket money for their children. In Talensi, respondents indicated that despite the



school feeding program, parents needed money to buy books, pens, pencils, school uniform and other reading materials for their children, however they were unable to do so particularly during the drought period since they were unable to cultivate much to feed themselves and sell the surplus to earn income. About 47.8% and 66.7% of males and females respectively in the Talensi district indicated that drought events have negative implication on education.

4.4.8: Effects of drought on household food security

Food security is an important element in every household and as a coping strategy in relation to drought. During an interview with some respondents, 45% of male respondents asserted that in difficult times they relied on their stored foods while 55% of female respondents indicated that they had no food reserve to depend on. Additionally, about 56.7% of the female respondents indicated that they pledged their assets in exchange of some household items during drought events while 43.3% of male farmers said they never did that. Additionally, the study has disclosed that during the drought period, 66.7% female respondents engaged in harvesting wild fruits and vegetables. Most of the females also engage in shea nut picking, dawadawa harvesting, baobab fruit while most of the male respondents indicated they engage in hunting and game. Also, the study revealed that 68.3% of females in both studied districts reported rendering on-farm services, usually paid labour or assistance in exchange for food during the drought period. This situation affirms the severity of drought on crop production. These findings are corroborated by many previous studies (Antwi-Agyei, 2012; Aniah, 2016; Aniah et al., 2016).



4.5 The Role of Socio-Economic Factors in Determining the Adaptive Capacity of Farmers to Drought

This section presents results and discussions of the explanatory variables (social and economic variables) that determine adaptive capacities of farmers to droughts. Based on previous studies, we hypothesized that education, farming experience, land ownership, household size, financial capital, assets, gender, location among others are factors that play significant role in determining the adaptive capacity of farmers (Aniah, 2016; Below et al., 2012).

Table 4. 8: Socio-economic variables expected to be significantly correlated with adaptation

Name	Measuring unit	Male	Female
Perception of droughts events and weather-related problems within last 5 years *	Mean number of changes notice	4.00	4.00
School years attained by household head	Mean of years	4.40	3.80
Household size	Mean number of members	4.00	6.00
Farming experience of household head *	Mean of years	21.00	22.00
Distance to drinking water *	Percent	19.00	19.00
Private land ownership*	Mean hectares	1.20	3.00
Financial capital asset index *	Mean index value	3	3.69
Soil fertility index (5 = very fertile. . .1 = not productive at all) *	Median	5	4.00
Dependency ratio*	Mean ratio	0.30	0.40
Annual per capita income*	Mean in USD	160.75	69.46
Distance to market for inputs	Percent	56.00	73.15
Productive asset index	Mean	15.93	19.93
Household is female headed	Percent	24.70	18.10
Membership in social groups *	Mean number	0.20	0.10
Number of extension visits within last year	Mean	0.95	1.00
Location of the household	Percent	50.17	49.83

*The distribution differs significantly between both genders (level of significance: 0.05).



The characterization of the two genders is made possible by the description of the explanatory variables as shown in the table 4.8. The amount of land holding per farmer or household (about 16-10 acres and 1-5 acres) for men and women respectively in both study districts generally reflect the fact that females are more dominated by subsistent farmers than males. There is significant difference in average annual income among males and females in both Bongo and Talensi district, this is a reflection that females are characterized by higher rates of poverty than males. The average annual income for males is USD 160 while that of females is USD 70. The income of farmers in both districts between males and females maybe higher than estimated in this study because information on the vital livelihood activities were gathered and information on other sources of income including remittances and government support were not estimated.

A significant number of both male and female farmers in Bongo and Talensi district reported experiencing changes in weather parameters (e.g. drought) on the average over the last 5 years. This implies that cropping activities of both male and female farmers are already affected by droughts and the difference is not statistically significant. Hence, the variable ‘amount of perceived weather-related problems within the last 5 years’ is not specific enough to depict significant difference between the two genders.

From the 16 explanatory variables that have been derived from literature review (table 4.8), 12 variables out of the 16 variables are statistically significant in determining farmers adaptation and coping measures (adaptive capacity). A remarkable study by Nelson et al. (2010) and Below et al. (2012) have indicated that Sub-Saharan Africa requires a total sum of 3 billion USD investment to enable the poor and vulnerable counteract the effects of climate change. Much of these resources should be devoted



to infrastructure and measures that improve technical production efficiency. This present study in tandem with these findings further indicated that social and financial capital of the household, education and gender of the household head were statistically significant and very relevant for improving farmers' adaptive capacity.

The qualitative interviews reveal that the major occupation of study respondents in the two study districts was farming. Aside the major occupation in the study areas, other occupations identified included weavers, traders, teachers and miners. Most of the respondents disclosed that they receive information about weather forecast from sources such as the Ghana meteorological services, TV/FM/Radio stations and also from friends. This information serves as an early warning system and enables them to develop appropriate coping and planned actions to reduce the negative impact of the weather events. Some farmers indicated occasionally, agricultural extension officers offer them trainings about weather events and the likely effects on production. The outcome of the education and training provided to farmers on drought by the extension officers has tremendously impacted positively on their agricultural output and improved their planned adaptation and coping strategies.

The qualitative interviews also revealed that in terms of belonging to social groups such as Farmer Based Organizations (FBOs) or cooperatives, about 66.7% of the male respondents and 80% of the female respondents in Bongo belonged to at least one social group compared with 43.5% male respondents and 33.3% female respondents in Talensi district. For those who belonged to the FBOs, it was revealed that they enjoyed support such as, the provision of agricultural inputs, education and finance from such organization. Many indicated that this has enabled them to reduce their vulnerability to drought. Similar support was also provided by MOFA to more than



60% of farmers in both districts, however, the proportion of female farmers were quite less (52%). Most of the support farmers received from these farmer-based organizations were usually logistical, education but usually not financial. 71.4% of farmers in the Bongo district who received supported from farmer-based organizations indicated the support was beneficial and enabled them to cope with drought impacts while 67% of farmers in Talensi indicated that the support they received from associations and social groups was not timely and did not really reduce their vulnerability to drought impacts much.

Similarly, in terms of decision-making processes, about 80% of the male respondents and 60% of the female respondents in Bongo district indicated that they were always consulted on the decision-making process regarding managing drought related disasters. Nonetheless, in the Talensi district, it was revealed that, about 82.6% of the male respondents and 66.7% of the female respondents indicated that they were never consulted on any decision-making process regarding managing drought related disasters. This implies that farmers are not adequately consulted when taking critical decisions with drought impacts. This explains why most development interventions at the local level usually are not sustainable.

4.6 Measures Employed By Both Genders to Cope With Droughts Episodes

The study has revealed that both male and female farmers are reported to be using similar coping strategies which comprised of different agronomic practices. The study also shows that small-holder farmers irrespective of gender have had some information from agricultural extension officers and NGOs about how to cope with shocks and stress resulting from drought. Many have also relied on their indigenous/traditional knowledge to cope and adapt to drought impacts.



4.6.1: Livelihood coping strategies in the Bongo and Talensi Districts

Table 4. 9: Measures adopted to cope with the effects of drought

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Minimize expenses	0	0	0	0
Purchase grains	26.7	66.7	0	0
Avoid unplanned sale of produce	33.3	6.7	0	0
Preserve grains for future use	20	13.3	0	0
Save money to buy needs	0	0	5.3	0
Government intervention	0	0	0	50
Mulching	0	0	47.4	50
Farming in the morning when there is moisture	0	0	31.6	0
Plant early maturity varieties	20	13.3	10.5	0
Delaying in cropping	10	9	5.3	3

Source: Field survey, 2019.

Table 4.9 demonstrate that 26.7% and 66.7% of male and female farmers in Bongo district reported purchasing grains in times of food shortfalls. About 50% of female farmers in Talensi districts benefitted from Government support during a drought episode. Mulching was more prevalent in Talensi district as 47.4% and 50% of male and female farmers reported practicing it to retain the moisture content in the soil. Another 31.6% of male respondents in Talensi district indicated they weed during the early hours of the morning during drought to prevent the damage to crops. Other key coping strategies implemented by farmers to reduce the effect of drought included planting early maturing crop varieties as indicated by 20% and 13.3% of male and female farmers in the Bongo district and 10.5% of male farmers in Talensi district. It was also a common practice by farmers to consciously delay the planting time of



crops as indicated by 10% and 9% of male and female farmers in Bongo and 5.3% and 3% of male and female farmers in Talensi district. The variation in coping strategies are noticeable among male and female farmers and among the 2 districts.

Key informant interview reiterated that *‘Intercropping, agroforestry and mulching were also noted to be key agronomic coping strategies that both male and female farmers used. The practice from the study is noted to improve yields. Comparatively, more males than females have access to agricultural inputs than females due to the fact that men had a higher control over household financial resources and could also access bank loans’*.

According to a female respondent *“the Assembly considers both genders when implementing drought related projects/programs which targets vulnerable communities. However, men subordination and dominance prevent full involvement of women”*.

Similarly, another respondent asserted that *“there is collaboration between an NGO by name READY and the District Assembly to see how they can address climate change issues. They introduced dry-season garden farming for women and bee-keeping for both women and men. That is 20% for men and 80% for women”*. These alternative livelihoods enable the poor and vulnerable to cope with food shortfalls associated with droughts.

This confirms other studies that indicate that more women do not have access to financial support to cope with the impacts of drought (Wringley-Asante et al, 2019). The issue of access to finance and agricultural inputs is also confirmed by the study of Antwi-Adjei (2012) study which revealed that lack of access to resources impede adaptation among women farmers. Generally, it is evident from this study and



confirmed by previous studies that men have access to agriculture inputs and finance and productive lands more than women in many communities across Ghana especially the Northern part.

As a way of adjusting to the effects of drought or erratic rainfall pattern, a total of 38.2% of the respondents disclosed that planting more drought tolerant crop varieties in recent times ensured adequate and sustained crop yields. However, about 61.8% of the respondent disclosed that they do not change their cropping system when there is drought. Those who adopted the use of drought tolerant crop varieties indicated that (about 82%) the practice has been beneficial in increasing their yields. Many studies have reported the use of migration as a coping and adaptation strategy to droughts, this study saw about 74% of respondents indicating they have not migrated to other areas before during drought.

The study noted that the drought situation has compelled farmers to adopt other strategies such as Agro-forestry, irrigation farming and mixed cropping for both gender as adaptation practices as revealed in an interview with one MOFA Officer.

Similarly, at the district level, it was disclosed that MOFA officials encouraged early planting and harvesting of crops among farmers.



4.6.2: On-farm agronomic practices engaged in by farmers in Bongo and Talensi district

Table 4. 10: On-farm agronomic practices engaged in by farmers

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Preparing land	23.6	24.1	0	0
Sowing seeds	21.8	22.2	0	0
Weeding	27.3	27.8	40	25
Harvesting	27.3	25.9	20	25
Compost fertilizers	0	0	20	25
Irrigation farming	0	0	20	25

Source: Field survey, 2019.

Many on-farm coping and adaptation mechanisms were reported in both study districts and by both genders. It is interesting to note that land preparation and seed sowing were practiced in Bongo district (23.6% males and 24.1% females) whiles none was practiced in the Talensi district. It was only weeding and harvesting of premature crops that was practiced in both districts as indicated in table 4.10. Zia composting and Irrigation was not practiced in the Bongo districts but 20% and 25% of males and females reported practicing these key coping strategies in Talensi district.

The questionnaire could not capture all the possible list of on-farm agronomic practices engaged in by farmers in the district, hence key informant interviews revealed that intercropping was prevalent among males than females. The few women who practiced intercropping usually planted tomatoes, pepper, beans, groundnuts with millet or maize whiles the men intercropped millet, maize with sweet potatoes and



cowpea. Many studies including the World Bank (2009) have confirmed this study's findings by highlighting the prevalence of intercropping as an on-farm adaptation practice to climate change and drought impacts (World Bank, 2009).

4.6.3: Farmers Off-farm coping and adaptation strategies in the Bongo and Talensi districts

Table 4. 11: Off-farm coping practices engage by both male and female farmers in Bongo and Talensi districts

	Bongo		Talensi	
	Male (%)	Female (%)	Male (%)	Female (%)
Shea nut picking and butter Processing	34.1	35.7	2	23
Retail in farm produce	34.1	33.3	16	27
Reducing food Consumption	31.8	31	0	0
Craftsmanship	5	10	50	15
Trading of general commodities	0	20	0	40
Mining	0	0	50	4

Source: Field survey, 2019.

As revealed in table 4.11, about 20% and 40% of the female farmers in Bongo and Talensi district respectively were trading in general commodities as an alternative livelihood strategy to cope with droughts situations. About 50% of male farmers in Talensi were also engaged in small scale mining popularly called 'Galamsy' (gather and sell) as an off-farm livelihood activity. Diversification into craftsmanship such as carpentry, basket weaving, smock weaving, masonry among others were engaged by 50% and 15% of male and female respondents in Talensi districts as well as 5% and 10% of male and female respondents in the Bongo district. About 31.8% and 31% of



male and female households in the Bongo district also mentioned reducing food consumption as a way of coping with drought related food shortfalls. A number of households in Bongo and Talensi district were also engaged in picking shea-nut and processing its butter as well as retail in farm produces as shown in table 4.11.

During Focus Group Discussions and Key informant interviews, it was revealed that majority of the men particularly preferred migrating outside the communities to seek for greener pastures while the females remained at home to engage in petty trading to support the household. Few males were also engaged in livestock rearing. A key informant noted that; *'family remittances, property income and government grants in the case of cash transfers under the LEAP program supplements the household income'*. Aniah, Kaunza-Nu-Dem & Ayembilla (2019) have confirmed these findings in their study of smallholder farmers' adaptation to climate variability and ecological change in the savannah agro-ecological zone. Their study particularly also identified reducing food consumption, changing diets, retail in farm produce, harvesting wild products like shea, livelihood diversification into off-farm activities as key coping and adaptation strategies implemented by farmers in the Upper East Region to ameliorate the negative impact of droughts and climate change. The findings of this study are also confirmed by Antwi-Agyei, (2012) and Yaro et al. (2013). Other studies have also confirmed that men are particularly engaged in other livelihood activities usually off-farm which does not depend on rainfall. Engaging in such livelihood activities such as retail, craftsmanship and labor work as coping mechanisms to drought related impacts enables men to withstand the negative impacts of drought more than women (Arku, 2013). The women are mostly engaged in processing and sale of agricultural produce which can be severely affected if yields are low due to drought impacts. This confirms the studies by Arku's (2013) and Dzah's (2011) studies in the Eastern and



Central regions of Ghana which stressed on sale of agricultural produce and other trading activities by women as key coping strategies.



CHAPTER FIVE

SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Chapter five presents summary of the major findings of the study and conclusions based on the findings. Recommendations are also made based on the findings to help address the challenges identified. Recommendations for future studies are also offered.

5.2 Summary of findings

The thesis purposed to throw light on the gender vulnerability to drought among small-holder farmers in the Bongo and Talensi districts. The major findings of the study are summarized below.

- The study identified that both males and females in Talensi and Bongo districts had knowledge about the nature of the drought situation as well as they could describe the environmental changes experienced over time including rise in temperature, decreased precipitation as well as variation and inconsistencies in the rainfall pattern.
- The study also noted that both male and female farmers were both affected by drought-related challenges, however, the severity of the impact varied.
- From the study, farmers of both genders were worried that the prolonged drier conditions have led to declining crop production resulting in livelihood and food insecurity.
- The study identified that small-holder farmers have adopted different coping and adaptation strategies to address drought related challenges. These coping and adaptation strategies differed among the study districts and by gender.



However, there some strategies that were common to both districts and gender.

- Key among the coping and adaptation strategies included crop diversification, livelihood diversification, on-farm agronomic practices using indigenous knowledge, changing diets and reducing food consumption and migration.
- Both male female farmers consciously implemented adaptation strategies as a way of reducing drought impacts on their livelihood and increasing food security.
- Resource constraints, negative cultural practices that inhibit women from owning assets (e.g. land) and skewed programs that target men in time past have hindered the effective implementation of adaptation strategies by women, however, this trend is changing in recent times.

5.3 Conclusions

Gender vulnerability to drought impacts in the Bongo and Talensi district in the Upper East Region is made worse by the inability of female farmers to implement appropriate coping and adaptation practices. Both male and female farmers are increasingly experiencing the manifestation of drought and related impacts. Droughts have impacted severely on livelihood strategies, food security, education and health outcomes of both men and women in Bongo and Talensi districts. However, men have developed better resilience and adaptive capacity to drought impact more than females due to their access to resources (e.g. fertile land, credit, knowledge and experience and membership to social group) which most women lacked. Although both men and women implemented on-farm, off-farm and non-farm livelihood coping and adaptation strategies, men had obtained better outcomes than women. Robust adaptation and coping strategies nonetheless have the potential to decrease women's



exposure and sensitivity to droughts impacts and consequently increase their adaptive and coping capacity.

5.4 Recommendations

- Considering some of the variations in the coping strategies among men and women, it is recommended that institutions that support drought-related adaptation initiatives at the local level take cognizance of the gender differences in discussions on drought.
- NGOs and Government institutions working in climate change adaptation areas should incorporate women economic empowerment and gender mainstreaming programs in their activities and projects.
- Agriculture development and rural banks should make credit and small loans accessible farmers especially women in drought prone areas to enable them implement effective coping and adaption measures.
- The district Assemblies should initiate programmes that build the capacity of farmers especially women subsistence farmers through regular sensitization and educational programs on climate change and drought-related conditions.

5.5 Recommendations for further studies

- It is recommended that future research should pay attention to the identification of steps necessary for undertaking effective agronomic practices in order to mitigate drought-related challenges.
- Similarly, it is suggested that studies should be conducted to identify measures that can improve market accessibility to enhance income-generating opportunities for households.



- Also, it is recommended that further studies are carried out to identify how educational programs on drought related issues have impacted the lives of farmers in the study areas and other drought affected areas within the country.

5.6 Policy Implications

The following policy implications were made from the findings of this study.

- There is the need to design programs that will provide improved seeds, early maturing and drought resistant crop varieties to subsistent small-scale farmers to enhance their productivity and income.
- The Government should consider establishing large scale irrigation schemes along lakes and rivers where water is abundantly available.
- Government should consider designing programs that will rehabilitate the existing irrigation schemes such as the Vea dam.



REFERENCES

- Aberman, N. L, Ali, S., Behrman, J., Bryan, E., Davies, P., Donnelly, A., Gathaara, V., Kone, D., Nganga, T., Ngugi, J. And Okoba, B., (2015). Climate Change Adaptation Assets and Group-Based Approaches: Gendered Perceptions from Bangladesh, Ethiopia, Mali, and Kenya. International Food Policy Research Institute (IFPRI) Discussion Paper 01412. Washington D.C
- Acquah, H. D., & Onumah, E. E. (2011). Farmers perception and adaptation to climate change: An estimation of willingness to pay. *Agris on-line Papers in Economics and Informatics*-3, 31–39.
- Action Aid International, (2008). The time is now; Lesson from farmers to adapting to climate change. May13, 2019 from: <http://www.actionaid>.
- Adebayo, A. A., Onu, J. I., Adebayo, E. F., & Anyanwu, S. O. (2012). Farmers' awareness, vulnerability and adaptation to climate change in Adamawa State, Nigeria. *British journal of arts and social sciences*, 9(2), 104-115.
- Adger W. (2006). Vulnerability. *Global Environmental Change* 16:268-81.
- Adger, W. N. (1996). Approaches to vulnerability to climate change. *CSERGE GEC Working Paper*. Available at http://ipcc-wg2.gov/njlite_download.php?id=6421
- Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography*, 24, 347–364. African Development Fund – Human Resource Development Department. (2008). Ghana country gender profile. Accra: ADF-OSHD.
- Adger, W.N. (2006). Vulnerability. *Global Environmental Change*, 16: 268–281.



Adger, W.N., (1999). Social vulnerability to climate change and extremes in coastal Vietnam. *World development*, 27(2), pp.249-269

Adjei P. O, Aboagye, D and Yehoah, T. (2012). Extreme Poverty and Vulnerability Experiences on Urban Highways in Ghana: Assessing Social Protection Policy Responses. *Academic Journal*, vol 3, issue 5, 436.

Agwu, J., and A.A. Okhimamhe. (2009). Gender and climate change in Nigeria: A study of four communities in north-central and south-eastern Nigeria. Heinrich Böll Stiftung, Nigeria. Available at: http://www.boellnigeria.org/downloads/Gender_Climate_Change_in_Nigeria.pdf

Ahmed, S., and E. Fajber. (2009). Engendering adaptation to climate variability in Gujarat, India. *Gender and Development* 17(1): 33–50.

Alley, R. B. (2007). Wally was right: Predictive ability of the North Atlantic “conveyor belt” hypothesis for abrupt climate change. *Annu. Rev. Earth Planet. Sci.*, 35, 241-272.

Alston, M., (2013a), ‘Environmental Social Work: Accounting for Gender in Climate Disaster’, *Australian Social Work*, vol. 66, no.2, pp. 218-233.

Alston, M., (2015). *Women and climate change in Bangladesh*. Routledge

Anderson, C, Ahluwalia, M, Castaneda, I, Moya, X, Van Dyek, R, Fordham, M & Raczke, T. (2009). ‘Making disaster risk reduction gender –sensitive: policy and practical guidelines’. UNISDR, UNDP, and IUCN, Geneva



Aniah, P., Kaunza-Nu-Dem, M. K., & Ayembilla, J. A. (2019). Smallholder farmers' livelihood adaptation to climate variability and ecological changes in the savanna agro ecological zone of Ghana. *Heliyon*, 5(4), e01492.

Aniah, P., Kaunza-Nu-Dem, M. K., Quacou, I. E., Abugre, J. A., & Abindaw, B. A. (2016). The effects of climate change on livelihoods of smallholder farmers in the upper east region of Ghana. *International Journal of Sciences: Basic and Applied Research*, 28(2), 1-20.

Annecke, W. (2002). Climate change, energy-related activities and the likely social impacts on women in Africa. *International Journal of Global Environmental Issues* 2 (3/4): 206–222.

Antwi-Agyei, P. (2012). Vulnerability and adaptation of Ghana's food production systems and rural livelihoods to climate variability. *University of Leeds*.

Apata, T. G., Samuel, K. D., & Adeola, A. O. (2009). Analysis of Climate Change Perception and Adaptation among Arable Food Crop Farmers in South Western Nigeria (No. 1005-2016-79140).

Arku, F. S. (2013). Local creativity for adapting to climate change among rural farmers in the semi-arid region of Ghana. *International Journal of Climate Change Strategies and Management*, 5, 418–430.

Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change* 21 (2): 744–751.

Asante, W. A., Acheampong, E., Kyereh, E., & Kyereh, B. (2017). Farmers' perspectives on climate change manifestations in smallholder cocoa farms



and shifts in cropping systems in the forest-savannah transitional zone of Ghana. *Land use policy*, 66, 374-381.

Ash, A., Thornton, P., Stokes, C., & Togtohyn, C. (2012). Is proactive adaptation to climate change necessary in grazed rangelands?. *Rangeland Ecology & Management*, 65(6), 563-568.

Asheber, S.A. (2010). Mitigating drought: Policy impact evaluation: A case of Tigray region, Ethiopia. University of Twente Faculty of Geo-Information and Earth Observation ITC. Available at: http://www.itc.nl/library/papers_2010/msc/gsim/asheber.pdf.

Assan, J. K., & Kumar, P. (2009). Introduction: Livelihood options for the poor in the changing environment. *Journal of International Development: The Journal of the Development Studies Association*, 21(3), 393-402.

Awen-Naam, M. B. (2011). *Perceptions of climate change and adaptation: a case of peasants in the Builsa district of the Upper East Region of Ghana* (Master's thesis, The University of Bergen).

Ayinde, O. E., Ajewole, O. O., Ogunlade, I., & Adewumi, M. O. (2010). Empirical analysis of agricultural production and climate change: A case study of Nigeria. *Journal of Sustainable Development in Africa*, 12(6), 275-283.

Babugura, A. (2011). Gender and climate change: South Africa case study. Heinrich Böll Foundation Southern Africa. Cape Town, South Africa. Available at: http://www.boell.de/downloads/ecology/south_africa.pdf.

Babugura, A, Mtshali, N & Mtshali, M (2010). 'Gender and climate change: South Africa case study', Heinrich Boil Stiftung Southern



- Baker, P. A. (2002). Trans-Atlantic climate connections. *Science*, 296(5565), 67- 68.
- Barbeta, A., Mejía-Chang, M., Ogaya, R., Voltas, J., Dawson, T. E., & Peñuelas, J. (2015). The combined effects of a long-term experimental drought and an extreme drought on the use of plant-water sources in a Mediterranean forest. *Global change biology*, 21(3), 1213-1225.
- Barbie E., and Mouton J. (2007). *Research Methodology by Numbers- A teaching tool*. Durban University of Technology.
- Bardasi, E., & Wodon, Q. (2006). Measuring time poverty and analyzing its determinants: concepts and application to Guinea. *Gender, time use, and poverty in Sub-Saharan Africa*, 73, 75-95.
- Below, T. B., Mutabazi, K. D., Kirschke, D., Franke, C., Sieber, S., Siebert, R., & Tscherning, K. (2012). Can farmers' adaptation to climate change be explained by socio-economic household-level variables?. *Global Environmental Change*, 22(1), 223-235.
- Benight, C.C.; Harper, M.L. (2002). Coping self-efficacy as a mediator between acute stress response and long-term distress following natural disasters. *J. Trauma. Stress* 2002, 15, 177–186.
- Bennett, C. L. (2005). First year WMAP observations. In *Symposium-International Astronomical Union* (Vol. 216, pp. 18-27). Cambridge University Press.
- Berkes, F. and Jolly, D. (2001). Adapting to climate change: Social-Ecological resilience in Canadian Western Arctic community. *Conservation Ecology* 5(2),18.



Berman, R., Quinn, C., & Paavola, J. (2012). The role of institutions in the transformation of coping capacity to sustainable adaptive capacity. *Environmental Development*, 2, 86-100.

Biskup, J. L., & Boellstorff, D. L. (1995). The effects of a long-term drought on the economic roles of Hacendado and Ejidatario women in a Mexican Ejido.

Bradshaw, S. (2004). Socio-economic impacts of natural disasters: A gender analysis. Santiago, Chile: United Nations.

Bradshaw, S., (2010). 'Women, poverty and disaster: exploring the links through Hurricane Mitch in Nicaragua'. The international handbook of gender and poverty. Northampton, Edward Elgar Publishing

Brant, S. (2007). Assessing the Vulnerability to Drought in Ceara, Northeast Brazil. Master's Thesis, University of Michigan, Ann Arbor, MI, USA, 2007.

Brooks, N. Adger, W. N. Kelly, P. M. (2005). The determination of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Glob. Environ. Chang.* 2005, 15, 151–163.

Bryan, E. And Bechman, J.A, (2013). Community-based adaptation to climate change: a theoretical framework overview of key issues and discussion of gender differentiated priorities and participation. CAPRI Working Paper 109. International Food Policy Research Institute (IFPRI). Washington, DC

Bryant, C.R., Smit, B., Brklacich, M, Johnston, T. R., Smithers, J., Chjotti, Q. And Singh, B., (2000). Adaptation in Canadian agriculture to climate variability and change. *Climate change*, 45 (1), pp. 181-201



Cardona, O., D (2004). The need for rethinking the concepts of vulnerability and risk from a holistic perspective: a necessary review and criticism for effective risk management', Mapping vulnerability: Disaster, development and people, vol. 17.

Carney, D. (1999). *Approaches to sustainable livelihoods for the rural poor* (p. 32). ODI Poverty Briefing, Brighton, UK: Overseas Development Institute.

Carver, C.S. Scheier, M.F. Weintraub, J.K. (1989). Assessing coping strategies: A theoretically based approach. *J. Personal. Soc. Psychol.*, 56, 267–283.

Challinor A, Wheeler T, Garforth C, Craufurd P, Kassam A. (2007). Assessing the vulnerability of food crop systems in Africa to climate change. *Climate Change* 83(3): 381-99.454.

Chambers, R. (1989). Vulnerability, coping and policy-Introduction.

Chambers, R., & Conway, G. (1992). *Sustainable rural livelihoods: practical concepts for the 21st century*. Institute of Development Studies (UK).

Charlotte Wrigley-Asante, Kwadwo Owusu, Irene S. Egyir & Tom Mboya Owiyo (2017): Gender dimensions of climate change adaptation practices: the experiences of smallholder crop farmers in the transition zone of Ghana, *African Geographical Review*, DOI: 10.1080/19376812.2017.1340168

Codjoe, S. N. A., & Owusu, G. (2011). Climate change/variability and food systems: Evidence from the Afram Plains, Ghana. *Regional Environmental Change*, 11, 753–765. doi:10.1007/s10113-011-0211-3



Codjoe, S. N. A., Atidoh, L. K., & Burkett, V. (2012). Gender and occupational perspectives on adaptation to climate extremes in the Afram Plains of Ghana. *Climate Change*, 110, 431

Coelho, A.E.L. (2004). Psychological Responses to Drought in Northern Brazil. *R. Interam. Psicol.* 38, 95–103.

Cooper, P. J. M., Dimes, J., Rao, K. P. C., Shapiro, B., Shiferaw, B., & Twomlow, S. (2008). Coping better with current climatic variability in the rain-fed farming systems of sub-Saharan Africa: An essential first step in adapting to future climate change?. *Agriculture, Ecosystems & Environment*, 126(1), 24-35.

Cordova, D., Benner, E. A., Sacher, M. D., Rauh, J. J., Sopa, J. S., Lahm, G. P., & Rhoades, D. F. (2006). Anthranilic diamides: a new class of insecticides with a novel mode of action, ryanodine receptor activation. *Pesticide Biochemistry and Physiology*, 84(3), 196-214.

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social science quarterly*, 84(2), 242-261.

Dankelman, I. et al. (2008). Gender, climate change and human security: Lessons from Bangladesh, Ghana and Senegal. WEDO/ABANTU/ENDA.

Dasgupta, A & Baschieri, A (2020). ‘Vulnerability to climate change in rural Ghana: Mainstreaming climate change in poverty-reduction strategies’, *Journal of International Development*, vol 22, no.6, pp. 803-820



Davidson, D.; Williamson, T.; Parkins, J. (2003). Understanding climate change risk and vulnerability in northern forest-based communities. *Canadian Journal of Forestry Research*. 33: 2252–2261.

Davies, S. (2010). Do shocks have a persistent impact on consumption? The case of rural Malawi. *Progress in Development Studies* 10 (1): 75–79.

De Haan, L. and Zoomers, A. (2005) Exploring the Frontier of Livelihoods Research. *International Institute of Social Studies*, 36 (1): 27-47.

Demetriades, J & Esplen, E (2008). ‘The gender dimensions of poverty and climate change adaptation’, *IDS Bullentin*, vol.39, no. 4,pp. 24-31

Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter? *Gender & Development*, 10(2), 10-20.

Denton, G. H., & Hughes, T. J. (2000). Reconstruction of the Ross ice drainage system, Antarctica, at the last glacial maximum. *Geografiska Annaler: Series A, Physical Geography*, 82(2-3), 143-166.

Denzin, N. K., & Lincoln, Y. S. (Eds.). (2011). *The Sage handbook of qualitative research*. Sage.

Djagbletey, G., Bosu, P., Ametsitsi, G., Addo-Danso, S., Foli, E., Cobbinah, J., Nkrumah, E. (2012, June 25–30). Assessment of coping and adaptation strategies to climate change in Offinso North and South Districts, Ashanti Region, Ghana. 1st UFRO-FORNESSA Regional Congress, Nairobi Kenya.



Dzah, D. E. E. (2011). Gender dynamics of climate change in Ghana: An intersectional perspective. (MA thesis). International Institute of Social Studies, The Hague, Netherlands. Retrieved March 12, 2018, from [Climate%20Change/Ellen_Dzah_WGD_2011.pdf](#)

Eakin, H.; Bojorquez-Tapia, L.A. (2008). Insights into the composition of household vulnerability from multi-criteria decision analysis. *Glob. Environ. Chang.*, 18, 112–127.

Egyir, I. S., Owusu, K., Jatoe, J. B. D. & Wrigley-Asante, C. (2014). Climate change and agricultural adaptation measures in the transition zone of mid-Ghana: Final research report. Ghana: US Agency for International Development (USAID) and Multi-Features and Capacity Enhancing Services (MFCS)

Ellis, F., & Mdoe, N. (2003). Livelihoods and rural poverty reduction in Tanzania. *World Development*, 31(8), 1367-1384.

Enarson, E & Fordham, M (2011). ‘From women’s needs to women’s rights in disasters’, *Environmental Hazards*, vol.3,no.3,pp.133-136

Enarson, E, Fothergill, A & Peek, L (2007). ‘Gender and disaster: Foundations and directions’, in *Handbook of disaster research*, Springer, pp. 130-146

Esplen, E. And Broody, A. (2007). *Putting Gender Back in the Picture: Rethinking Women’s Economic Empowerment* Institute of Development Studies: Bridge (development-gender).

Ethlet, C. Yates, R. (2005). *Participatory Vulnerability Analysis: A Step-by-Step Guide for Field Staff*; Action Aid: London, UK, 2005.



Farrington, J., Carney, D., Ashley, C., & Turton, C. (1999). *Sustainable livelihoods in practice: early applications of concepts in rural areas*. Overseas Development Institute: London-UK

Few, R, Ahern, M, Matthies, F. And Kovats, S., (2006). *Floods, health and climate change: a strategic review*. Norwich: Tyndall Centre for Climate Change Research.

Fosu-Mensah, B. Y. (2012). *Modelling maize (Zea mays L.) productivity and impact of climate change on yield and nutrient utilization in sub-humid Ghana*. Zentrum für Entwicklungsforschung.

Fosu-Mensah, B. Y., Vlek, P. L., & MacCarthy, D. S. (2012). *Farmers' perception and adaptation to climate change: a case study of Sekyedumase district in Ghana*. *Environment, Development and Sustainability*, 14(4), 495-505.

Fosu-Mensah, B. Y., Vlek, P. L., & MacCarthy, D. S. (2012). *Farmers' perception and adaptation to climate change: a case study of Sekyedumase district in Ghana*. *Environment, Development and Sustainability*, 14(4), 495-505.

Fosu-Mensah, B. Y., Vlek, P. L., & MacCarthy, D. S. (2012). *Farmers' perception and adaptation to climate change: a case study of Sekyedumase district in Ghana*. *Environment, Development and Sustainability*, 14(4), 495-505.

Füssel, H. M. (2007). *Vulnerability: A generally applicable conceptual framework for climate change research*. *Global environmental change*, 17(2), 155-167.



Gamble, T., Simons, A. M., Colli, G. R., & Vitt, L. J. (2008). Tertiary climate change and the diversification of the Amazonian gecko genus *Gonatodes* (Sphaerodactylidae, Squamata). *Molecular Phylogenetics and Evolution*, 46(1), 269-277.

Ghana Statistical Service (2010). Population and Housing Census, Balsa North District *Analytical Report*. GSS, Accra

Gillard, M. Paton, D. (1999). Disaster stress following a hurricane: The role of religious differences in the Fijian Islands. *Aust. J. Disaster Trauma Stud.* 1999, 1999-2. Available online: <http://www.massey.ac.nz/~trauma/issues/1999-2/gillard.htm>

Gillard, R., Gouldson, A., Paavola, J., & Van Alstine, J. (2016). Transformational responses to climate change: beyond a systems perspective of social change in mitigation and adaptation. *Wiley Interdisciplinary Reviews: Climate Change*, 7(2), 251-265.

GSS (2013B). 2010 Population and Housing Census” Regional Analytical Report, Greater Accra Region, Government of Ghana, Accra.

GSS (2014). Ghana Demographic and Health Survey, 2014, Ghana Statistical Service, Ghana Health Service, Rockville, Maryland, USA

Gyampoh, B. A. (2009). Vulnerability and Adaptation of Livelihood to Climate Change and Variability in River Offin Basin in Ghana (Doctoral dissertation).

Habitat, U. N. (2003). Handbook on best practices, security of tenure and access to land. *UN Habitat, Nairobi*.



Habitat, U. N. (2003). The challenge of slums: global report on human settlements 2003. London: Earthscan.

Haigh, C. and B. Vallely, (2010). Gender and the Climate Change Agenda: The Impacts of Climate Change on Women and Public Policy. London: Women's Environmental Network.

Hallman, K. (2000). Mother-father resources, marriage payments, and girl-boy health in rural Bangladesh. Washington, D.C.: International Food Policy Research Institute. Available at:
<http://www.ifpri.org/sites/default/files/publications/fcndp93.pdf>

Hanna, J.M. (2007). Native communities and climate change: legal and policy approaches to protect tribal legal rights. Boulder, CO: University of Colorado School of Law: 4–69.

Hannan, C. (2011). An overview of women, gender and climate change issues. Education International's World Conference "On the Move for Equality", Bangkok, 20–23 January 2011.

Hansen, J. E., Ruedy, R., Sato, M., & Lo, K. (2006). NASA GISS surface temperature (GISTEMP) analysis. Trends: A Compendium of Data on Global Change.

Hansen, J., Sato, M., Ruedy, R., Lo, K., Lea, D. W., & Medina-Elizade, M. (2006). Global temperature change. Proceedings of the National Academy of Sciences, 103(39), 14288-14293.

Hulme, M., Doherty, R., Ngara, T., New, M., & Lister, D. (2001). African climate change: 1900-2100. Climate research, 17(2), 145-168.



Hulme, M., Mitchell, J., Ingram, W., Lowe, J., Johns, T., New, M., & Viner, D. (1999). Climate change scenarios for global impacts studies. *Global Environmental Change*, 9, S3-S19.

IDMC, I. D. (2011). Global Overview of Trends and Developments in 2010.

Institute of Social Statistical and Economic Research. (2014). The state of the Ghanaian economy report 2014. Retrieved from

<http://isser.edu.gh/index.php/sger/50-the-state-of-the-ghanaian-economy-report-2014>.

Institute of Statistical, Social and Economic Research (ISSER). (2014). The state of the Ghanaian economy in 2010.

IPCC (2001). *Climate Change 2001: The Scientific Basis*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2001; Available online:http://www.grida.no/climate/ipcctar/wg1/pdf/wg1_tar-front.pdf

IPCC (2005). Special report on carbon dioxide capture and storage.

IPCC (2007). Contribution of working groups I, II and III to the fourth assessment report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland: Intergovernmental Panel on Climate Change. Available at: http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.htm

IPCC (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups 1 and 2 of the Intergovernmental Panel on Climate Change*, CU PRESS, Cambridge, UK, and New York, NY, USA



ISDR, U., & OCHA, U. (2008). Disaster preparedness for effective response: guidance and indicator package for implementing priority five of the Hyogo Framework. *United Nations, New York, Geneva.*

Jazayeri, A. (1996). Food and Nutritional Program in Iran: A Complete Guide towards Poverty Resolutions; Planning and Budget Organization, Center for Socio-Economic Documents: Tehran, Iran.

Kandlinkar, M., & Risbey, J. (2000). Agricultural Impacts of Climate Change. If Adaptation Is the Answer, What Is the Question? *Climate Change*, 45, 529- 539.

Karl, T. R., Melillo, J. M., Peterson, T. C., & Hassol, S. J. (Eds.). (2009). Global climate change impacts in the United States. Cambridge University Press.

Kemausuor, F., Dwamena, E., Bart-Plange, A., & Kyei-Baffour, N. (2011). Farmers' perception of Climate change in the Ejura-Sekyedumase district of Ghana. *ARNP Journal of Agricultural and Biological Science*, 6, 26–37.

Keshavars, M.; Karami, E. (2008). Factors determining drought management and its impact: Structural equation modeling. *J. Sci. Technol. Agric. Nat. Resource*. 2008, 12, 267–283.

Knutson, C.; Hayes, M.; Philips, T. (1998). How to Reduce Drought Risk. Available online: <http://drought.unl.edu/portals/0/docs/risk.pdf>



Knutson, G.L.; Blomstedt, M.L.; Slaughter, K. (2001). Result of a rapid appraisal study: Agricultural producers' perceptions of drought vulnerability and mitigation-Howard County, Nebraska. In Drought Network News (1994–2001); International Drought Information Center and the National Drought Mitigation Center: Lincoln, NE, USA, 2001; p. 20. Available online: <http://digitalcommons.unl.edu/droughtnetnews/20>

Kristjanson, P., Mango, N., Krishna, A., Radeny, M., & Johnson, N. (2010). Understanding poverty dynamics in Kenya. *Journal of international development*, 22(7), 978-996.

Kromker, D. Mosler, H. J. (2000). Environment and security: Coping strategies in the face of environmental scarcities. In Proceedings of the Transition Towards a Sustainable Europe Ecology Economy-Policy: 3rd Biennial Conference of the European Society for Ecological Economics, Vienna, Austria, 3–6 May 2000.

Lambrou, Y., & Laub, R. (2007). Gender, local knowledge and lessons learnt in documenting and conserving agrobiodiversity. In *Food Insecurity, Vulnerability and Human Rights Failure* (pp. 161-194). Palgrave Macmillan, London.

Lankao, P. R., & Qin, H. (2011). Conceptualizing urban vulnerability to global climate and environmental change. *Current opinion in environmental sustainability*, 3(3), 142-149.

Leary, N. (2012). *Climate change and adaptation*. Earthscan: London-UK.



- Liverman, D.M.; Merideth, R. (2002). Climate and society in the U.S. Southwest: the context for a regional assessment. *Climate Research*. 21: 199–218
- Lyimo, J. G., & Kangalawe, R. Y. (2010). Vulnerability and adaptive strategies to the impact of climate change and variability. The case of rural households in semi-arid Tanzania. *Environmental Economics*, (1, Iss. 2), 89-97.
- Mallory, M.; Gilchrist, G.; Akearok, J. (2006). Can we establish baseline local ecological knowledge on wildlife populations? In: Riewe, R.R.; Oakes, J.E., eds. *Climate change: linking traditional and scientific knowledge*. Winnipeg, Manitoba: Aboriginal Issues Press: 21–29.
- Masih, I., Maskey, S., Mussá, F. E. F., & Trambauer, P. (2014). A review of droughts on the African continent: a geospatial and long-term perspective. *Hydrology and Earth System Sciences*, 18(9), 3635.
- McCusker, B., & Carr, E. R. (2006). The co-production of livelihoods and land use change: Case studies from South Africa and Ghana. *Geoforum*, 37(5), 790-804.
- Merriam, S. B. (1998). *Qualitative Research and Case Study Applications in Education. Revised and Expanded from "Case Study Research in Education."*. Jossey-Bass Publishers, 350 Sansome St, San Francisco, CA 94104.
- Mertz, O., Mbow, C., Reenberg, A., & Diouf, A. (2009). Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel. *Environmental management*, 43(5), 804-816.



Met Office (2015). What is climate change?. Accessed on 12/03/2016 at <http://www.metoffice.gov.uk/climate-guide/climate-change>

Mettle M. (2011). “*Forced Resettlement in Ghana: The Dam and the Affected People. The Bui Hydroelectric Power Project in Ghana*” Dissertation submitted to the Department of Geography at Norwegian University of Science and Technology (NTNU) in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Geography.

Mishra, A. K., & Singh, V. P. (2010). A review of drought concepts. *Journal of hydrology*, 391(1-2), 202-216.

Mitchell, V. W. (1999). Consumer perceived risk: conceptualisations and models. *European Journal of marketing*.

Monre, M. O. N. R. A. E. (2008). National target program for climate change response. *Hanoi: Vietnamese Government*.

Morello-Frosch, R.; Pastor, M.; Sadd, J.; Shonkoff, S. (2009). The climate gap: inequalities in how climate change hurts Americans & how to close the gap. Los Angeles, CA: University of Southern California: 1–32.

Morton J. (2007). The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the National Academy of Sciences of the United States of America* 104(50): 19680.

Moser, S. C., & Ekstrom, J. A. (2012). *Identifying and overcoming barriers to climate change adaptation in San Francisco Bay: Results from case studies*. California Energy Commission.



Mosley, L. M. (2015). Drought impacts on the water quality of freshwater systems; review and integration. *Earth-Science Reviews*, 140, 203-214.

Nelson, G.C., et al. (2009). Climate Change: Impact on Agriculture and Costs of Adaptation. Washington, D.C.: International Food Policy Research Institute. Available at: <http://www.ifpri.org/sites/default/files/publications/pr21.pdf>.

Nelson, R., Kokic, P., Crimp, S., Martin, P., Meinke, H., Howden, S. M., ... & Nidumolu, U. (2010). The vulnerability of Australian rural communities to climate variability and change: Part II—Integrating impacts with adaptive capacity. *Environmental Science & Policy*, 13(1), 18-27.

Nelson, V & Stathers, T (2009). ‘Resilience, power, culture, and climate: a case study from semi-arid Tanzania, and new research directions’, *Gender & Development*, vol. 17,no.1,pp.81-94

Newby, P., Bradley, J., Spiess, A., Shuman, B., & Leduc, P. (2005). A Paleoindian response to Younger Dryas climate change. *Quaternary Science Reviews*, 24(1-2), 141-154.

Nhemachena, C., & Hassan, R. (2007). Micro-level analysis of farmers’ adaptation to climate in Southern Africa (IFPRI Discussion Paper No. 00714). Washington, DC: International Food Policy Research Institute.

Nkhata, R. (2014). Does irrigation have an impact on food security and poverty: Evidence from Bwanje Valley Irrigation Scheme in Malawi (Vol. 4). Intl Food Policy Res Inst.



Norris, F. H. (2002). Psychosocial Consequences of Disasters. Available online:
<http://www.ptsd.va.gov/professional/newsletters/researchquarterly/V13N2>.

pdf

Nutsugah, S., (2013). Developing Resilient Farming Systems in Northern Ghana.
CSIR-Savannah Agriculture Research Institute.

O'Brien, G., O'keefe, P., Rose, J., & Wisner, B. (2006). Climate change and
disaster management. *Disasters*, 30(1), 64-80.

O'Brien, K. L., & Leichenko, R. M. (2000). Double exposure: assessing the
impacts of climate change within the context of economic
globalization. *Global environmental change*, 10(3), 221-232.

O'Brien, K., Eriksen, S., Nygaard, L. P., & Schjolden, A. N. E. (2007). Why
different interpretations of vulnerability matter in climate change
discourses. *Climate policy*, 7(1), 73-88.

O'Brien, K., Sygna, L., Leichenko, R., Adger, W. N., Barnett, J., Mitchell, T., &
Mortreux, C. (2008). Disaster risk reduction, climate change adaptation and
human security.

Okhimamhe, A.A., (2009). Climate Change, Its Impacts and Adaptation: Gendered
Perspective from Northern Nigeria. Lagos: Heinrich Böll Stiftung (HBS).

Owusu K., and Waylen P. R., (2013). The changing raining season climatology of
mid-Ghana. *Theoretical and Applied Climatology*, 112 (3-4), 419-430.

Paavola, J. (2008). Livelihoods, vulnerability and adaptation to climate change in
Morogoro, Tanzania. *Environmental Science & Policy*, 11(7), 642-654.



- Panu, U. S., & Sharma, T. C. (2002). Challenges in drought research: some perspectives and future directions. *Hydrological Sciences Journal*, 47(S1), S19-S30.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE Publications, INC.
- Pearce, D., Pearce, C., & Palmer, C. (Eds.). (2002). *Valuing the environment in developing countries: case studies* (Vol. 1). Edward Elgar Publishing.
- Peduzzi, P.; Dao, H.; Herold, C.; Mouton, F. (2009). Assessing global exposure and vulnerability towards natural hazards: The disaster risk index. *Nat. Hazards Earth Syst. Sci.*, 9, 1149–1159.
- Polsky, C.; Neff, R.; Yarnal, B. (2007). Building comparable global change vulnerability assessments. *Vulnerability. Scoping Diagr. Glob. Environ. Chang.*, 17, 472–485.
- Quisumbing, AR, Kumar, N & Behrman, JA (2011). ‘Do shocks affect men’s and women’s assets differently?’. A review of literature and new evidence from Bangladesh and Uganda. International Food Policy Research Institute (IFPRI), Washington, DC, USA.
- Ramamasy, S., & Baas, S. (2007). *Climate variability and change: adaptation to drought in Bangladesh. A resource book and training guide*. FAO.
- Repo-Carrasco-Valencia, R. A. M., & Serna, L. A. (2011). Quinoa (*Chenopodium quinoa*, Willd.) as a source of dietary fiber and other functional components. *Food Science and Technology*, 31(1), 225-230.



- Reyes, E., White, M. L., Martin, J. F., Kemp, G. P., Day, J. W., & Aravamuthan, V. (2000). Landscape modeling of coastal habitat change in the Mississippi Delta. *Ecology*, 81(8), 2331-2349.
- Risbey, J., Kandlikar, M., Dowlatabadi, H., & Graetz, D. (1999). Scale, context, and decision making in agricultural adaptation to climate variability and change. *Mitigation and adaptation strategies for global change*, 4(2), 137-165.
- Roncoli, C, K. Ingram, and P. Kirshen. (2001). The costs and risks of coping with drought: Livelihood impacts and farmers' responses in Burkina Faso. *Climate Research* 19 (2): 119-132. Available at: <http://www.int-res.com/articles/cr/19/c019p119.pdf>.
- Satterhwaite, D, Huq, S, Pelling, M, Reid, H & Romero-Lankao, P (2007). Building climate change resilience in urban areas and among urban populations in low-and middle-income nations', *Innovations for an urban world*, the Rockefeller Foundation's Urban Summit, Bellagio, Italy.
- Saunders, M. A., Qian, B., & Lloyd-Hughes, B. (2003). Summer snow extent heralding of the winter North Atlantic Oscillation. *Geophysical Research Letters*, 30(7).
- Scoones, I. (1998). Sustainable rural livelihoods: a framework for analysis. International Forestry Resources and Institutions Program (IFRI) Working Paper# W08I-6 350-367. IFRI: Michigan-USA.
- Sen, A. (1997). Editorial: human capital and human capability. *World Development* 25 (12): 1959- 61.



- Sen, A. K. (1984) *Resources, Values and Development*. Blackwell: Oxford.
- Sen, A., (1981). 'Poverty and famines: an essay on entitlement and famines', Oxford: Clarendon Press.
- Shaw, R. (2008). Environmental aspects of the Indian Ocean tsunami recovery. *Journal of environmental management*, 89(1).
- Shaw, W. D., & Loomis, J. B. (2008). Frameworks for analyzing the economic effects of climate change on outdoor recreation. *Climate Research*, 36(3), 259-269.
- Sherbinin, A. D., Carr, D., Cassels, S., & Jiang, L. (2007). Population and environment. *Annu. Rev. Environ. Resour.*, 32, 345-373.
- Shields, P., & Rangarian, N. (2013). A Playbook for Research Methods: Integration.
- Shiferaw, B. Tesfaye, K. Kassie, M. Abate, T. Prasanna, B. M. Menkir, A. (2014). Managing vulnerability to drought and enhancing livelihood resilience in sub-Saharan Africa: Technological, institutional and policy options. *Weather Clim. Extremes* 2014, 3, 67–79.
- Singh, A., Agrawal, M., & Marshall, F. M. (2010). The role of organic vs. inorganic fertilizers in reducing phyto availability of heavy metals in a wastewater-irrigated area. *Ecological Engineering*, 36(12), 1733-1740.
- Smit, B. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change* 16:282-92.



Smit, B. and Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Glob. Environ. Chang.* 16, 282–292.

Smith, J. B., Huq, S., & Klein, R. J. (2003). *Climate change, adaptive capacity and development*. Imperial College Press.

Stake, R. E. (1995). *The art of case study research*. Sage.

Terry, G., (2009). ‘No climate justice without gender justice: An overview of the issues’, *Gender and Development*, vol. 17, no. 1, pp.5-18

Tessema J. A. (2008). *Livelihood Adaptation, Risks and Vulnerability in Rural Wolaita, Ethiopia*. Noragric Norwegian University of Life Sciences, UMB. ISBN: 978 – 82 – 575 – 0849 – 4.

Teye, J. K., Yaro, J. A., & Bawakyillenuo, S. (2015). Local farmers’ experiences and perceptions of climate change in the Northern Savannah zone of Ghana. *International Journal of Climate Change Strategies and Management*.

Thomas, D.S.G., Twyman, C., Osbahr, H., Hewitson, B.W. (2007). Adapting to climate change and variability in southern Africa: Farmer responses to intra-seasonal precipitation trends. *Clim. Chang.* 2007, 83, 301–322.

Thompson J, Millstone E, Scoones I, Ely A, Marshall F. (2007). *Agri-food system dynamics: pathways to sustainability in an era of uncertainty*. Brighton: STEPS Centre. Working Paper 4.



Turner, M. D. (2011). The new pastoral development paradigm: Engaging the realities of property institutions and livestock mobility in dryland Africa. *Society and natural resources*, 24(5), 469-484.

UNDP. (2010). Guide to UNDP Democratic Governance Practice.

UNISDR, U., (2009). Terminology on disaster risk reduction', Geneva, Switzerland.

UNISDR. (2008). Gender perspectives: Integrating disaster risk reduction into climate change adaptation. United Nations International Strategy for Disaster Reduction. Available at: http://www.unisdr.org/preventionweb/files/3391_GenderPerspectivesIntegratingDRRCC

United Nations (2007). Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries.

USAID. (2012). USAID/Peru country development cooperation strategy.

Vásquez-León, M.; West, C.T.; Finan, T.J. (2003). A comparative assessment of climate vulnerability: Agriculture and ranching on both sides of the US-Mexico border. *Glob. Environ. Chang.* 13, 159–173.

Wall, E., & Marzall, K. (2006). Adaptive capacity for climate change in Canadian rural communities. *Local environment*, 11(4), 373-397.

Wall, E., & Smit, B. (2005). Climate change adaptation in light of sustainable agriculture. *Journal of sustainable agriculture*, 27(1), 113-123.



Watt, S., & Chamberlain, J. (2011). Water, climate change, and maternal and newborn health. *Current Opinion in Environmental Sustainability*, 3(6), 491-496.

Watts, M & Bohle, H. G., (1993), 'Hunger, famine and the space of vulnerability', *Geojournal*, vol. 30, no. 2, pp. 117-125

WMO, A. O. (1986). Global ozone research and monitoring project report No. 16. *World Meteorological Organization, Geneva*.

World Bank. (2009). *Gender and agriculture: Sourcebook*. Washington, DC: The International Bank for Reconstruction and Development/World Bank, FAO, IFAD.

World Health Organization. (2009). *Gender, climate change and health: Draft discussion paper*. Available at: http://www.who.int/globalchange/publications/reports/gender_climate_change/en

World Health Organization. (2011). *Health in the green economy: health co-benefits of climate change mitigation-housing sector*. World Health Organization.

Wright, H., Chandani, A., Mainaly, J., Dossou, K., Ali, B., Nyandiga, C., & Sidi, A. (2014). Gender in scaling up community-based adaptation to climate change. In *Community-Based Adaptation to Climate Change* (Vol. 226, No. 238, pp. 226-238). ROUTLEDGE in association with GSE Research.



- Wrigley-Asante, C., Owusu, K., Egyir, I. S., & Owiyo, T. M. (2019). Gender dimensions of climate change adaptation practices: the experiences of smallholder crop farmers in the transition zone of Ghana. *African Geographical Review*, 38(2), 126-139.
- Yaro, J. A. (2010). The social dimensions of adaptation to climate change in Ghana. *World Bank Discussion Paper*, 15, 88.
- Yaro, J.A. (2006). Is deagrarianisation real? A study of livelihood activities in rural northern Ghana. *J.Mod. Afr.Stud.* 2006, 44, 125–156.
- Zarafshani, K., Sharafi, L., Azadi, H., & Van Passel, S. (2016). Vulnerability assessment models to drought: toward a conceptual framework. *Sustainability*, 8(6), 588.
- Zoellick, R. B. (2009). *A Climate Smart Future: The Nation Newspapers*.



APPENDIX

Household Questionnaire

Community Name:

Date of interview:

Contact No. (Optional)

Please tick the correct response in the box provided

Demographic characteristics

- 1. Age of respondent
- 2. Sex of respondent: a. Male [] b. Female []
- 3. Level of education: a. None [] b. Primary [] c. Middle/JSS [] d. SSS/Tech [] e. Training colleges [] f. Tertiary []
- 4. Marital status? A. single [] b. Married [] c. Divorced/separated [] d. Widowed []
- 5. Are you the head of the household? A. Yes [] b. No []
- 6. Household size:

4. To identify gender experiences of drought vulnerability and measures that they have taken to cope during and immediately after a drought, and to adapt to an increased frequency of droughts and intensity of dry climate.

7. Do you know anything about drought and climate change? A. Yes [] B. No []

8. If Yes, what is your understanding about drought and climate change?

9. Please identify the following climate events that you have experienced in your community in the past five years (you may tick more than one)

- a. Flood [] b. extreme heat [] b. rainstorm [] c. drought [] d. fire outbreaks []

10. In your opinion, do you know the cause of drought in your community?

- a. Yes [] b. No []

11. Have you been affected by any of the following?

- a. Fire outbreak
- b. Soil erosion
- c. Flooding
- d. Extreme heat



- 12. Did any property of yours get destroyed as a result of any these events in Q11?
 - a. Yes [] b. No []
- 13. Is your water sources affected by any climatic events such as soil erosion, or flooding?
 - a. Yes [] b. No []
- 14. If Yes to Q13, how is your sources affected? (you may tick more than one response)
 - a. Contaminate water sources [] b. destroy water storage facilities [] c. affect water quality [] d. any other (specify)

Housing and infrastructural Conditions

- 15. Housing type. A. single room [] b. detached [] c. semi-detached [] d. compound []
- 16. Are you the owner of the house? a. Yes [] b. No []
- 17. If No, what type of tenancy agreement do you have with the household owner?
 - a. Rented [] b. family house [] free occupancy [] d. other (specify)
- 18. What is the main source of water in your community? A. Pipe borne [] b. well [] c. borehole [] d. dam [] e. other (specify)
- 19. Is your source of water affected by drought conditions? A. Yes [] b. No []
- 20. Are your health care facilities affected by drought? A Yes [] b. No []
- 21. If Yes, how does drought affect your health care facilities? A. medical supplies destroyed [] b. work of health personnel hindered [] c. other, (specify)

B. To examine the role of different socio-economic and environmental resources played in increasing their adaptability to drought as well as reduce their vulnerability to drought exposure.

- 22. Identify any of the household chores you undertake daily. (you may tick more than one)
 - a. Fetching water [] b. baby-sitting [] c. collecting of firewood [] d. cooking [] e. washing dishes [] f. house cleaning []
- 23. Besides any of these activities, do you have time to engage in any other activities?
 - a. Yes [] b. No []
- 24. How does the performance of any of the above household chores affect your ability to engage in income generating activities?

.....

.....

.....
- 25. In the past five years, has these activities changed as a result of drought? a. Yes [] b. No []



Drought and Livelihood security

- 26. What is your major occupation?
.....
- 27. Apart from your major occupation, are you engaged in any other occupation?
- 28. A. Yes [] b. No []
- 29. Where is your farm located?
a. Within the community [] b. outside the community []
- 30. What major crops do you cultivate on your farm?
.....
- 31. Anytime you experience drought, do you have to change your cropping?
a. Yes [] b. No []
- 32. Was change in the cropping system helpful?
a. Yes [] b. No []
- 33. Will you say drought affected access to education for your children? A. Yes []
b. No []
- 34. If Yes to Q33, please explain:
.....
- 35. How did the water shortage affect your crops? A. Little [] b. very much [] c.
Not all []
- 36. What area of land do you cultivate during normal period?
.....
- 37. What area of land do you cultivate during drought period?
.....
- 38. Have you received any information or education on climate change in the past
five years? A. Yes [] b. No []
- 39. If Yes, from which source did you receive the information? A. Meteorologist []
b. TV/FM/Radio stations [] c. Friends []
- 40. Do you consider such information received helpful? A. Yes [] b. No []
- 41. If Yes, how?
- 42. If No, why?
- 43. Are you a member of any social group? A. Yes [] b. No []
- 44. Do you receive any support from your social group in relation to drought
hazards?
- 45. A. Yes [] b. No []
- 46. If Yes, what kind of support do your receive from your social group?
a. Financial support in times of sickness [] b. financial support in times of
disaster [] c. welfare purpose [] d. other, please state
.....
- 47. Is this support timely and effective in helping you to cope with drought related
hazards? a. Yes [] b. No []

Gender participation in decision making

- 48. Are you consulted on decision making regarding mitigating and managing
drought related disasters? A. Yes [] B. No []



49. If Yes, were you satisfied with the level of engagement in the decision making process? A Yes [] B. No []
50. What do you think can be done to improve your participation in decision making in relation to drought hazards?
.....

C. To assess the different sensitivity levels of drought between men and women in the Bongo and Talensi district.

51. What measure do you adopt in coping with the effects of drought and what are your reasons for your choice?
.....
52. Reasons for choice of measure to mitigate drought disasters. a. Financial consideration [] b. safety consideration [] c. knowledge of measures [] d. appropriateness of measures []
53. What on-farm agronomic practices are you engaged in?
.....
54. What off-farm agronomic practices are engaged in?

Interview guide for local authorities

1. Does the Assembly have any drought related projects /programs targeting vulnerable communities? If yes, does these projects/programs consider gender as priority as an issue?
2. Does the Assembly use gender disaggregated approach in implementing drought related projects/programs in the district?
3. Does the Assembly have any collaboration with any NGO/CBO's in drought mitigation and management?
4. Does the Assembly have drought/climate change desk? If Yes, what are the functions of this desk with regards to projects in assisting vulnerable communities to deal with drought related challenges?
5. What challenges confronts the Assembly in the development and implementation of drought related projects for vulnerable communities?



Interview guide for women

1. What drought related challenges have you experienced in the past five years?
2. Around what part of the year do you experience drought? (seasonal calendar can be used)
3. What do you consider to be the cause of the drought in your community?
4. List the roles only performed by women in the household?
5. What extra responsibilities do women perform apart from the common responsibilities they engage in?
6. Do the extra responsibilities bring any burden on your ability to engage in income generating activity?
7. Has these roles changed due to drought?
8. Do women now share roles that were previously performed by them with men in the household?
9. Are these roles dependent on availability of natural resources such as water and fuel?
10. Are these roles routinely performed or when needed?
11. What are the main livelihood activities engaged in by women in this community?
12. Do these livelihood activities differ from that of men?
13. Have there been shifts in livelihood activities of women as a result of drought?
14. What type of resources are mostly owned and controlled by women in this community?
15. Are you consulted on decision making with regards to drought challenges?
16. What agronomic practices do you engage in during drought? Identify for On-farm agronomic practices and off-farm agronomic practices
17. How does drought affect you as a woman?
18. Any suggestion for preventing/mitigating/managing drought related hazards?



Interview guide for men

1. What drought related challenges have you experienced in the past five years?
2. Around what part of the year do you experience drought? (seasonal calendar can be used)
3. What do you consider to be the cause of the drought in your community?
4. List the roles only performed by you in the household?
5. What extra responsibilities do men perform apart from the common responsibilities they engage in?
6. Do the extra responsibilities bring any burden on your ability to engage in income generating activity?
7. Has these roles changed due to drought?
8. Do men now share roles that were previously performed by them with women in the household?
9. Are these roles dependent on availability of natural resources such as water and fuel?
10. Are these roles routinely performed or when needed?
11. What are the main livelihoods activities engaged in by men in this community?
12. Do these livelihood activities differ from that of women?
13. Have there been shifts in livelihood activities of men as a result of drought?
14. What type of resources are mostly owned and controlled by men in this community?
15. Are you consulted on decision making with regards to drought challenges?
16. What agronomic practices do you engage in during drought? Identify for On-farm agronomic practices and off-farm agronomic practices/
17. How does drought affect you as a man?
18. Any suggestion for preventing/mitigating/managing drought related hazards?

