UNIVERSITY OF CAPE COAST

# FLOODING AND LIVELIHOOD ADAPTATION STRATEGIES OF FARMERS IN BUILSA SOUTH AND TALENSI DISTRICTS IN THE UPPER EAST REGION

WILLIAM ADUAH YOROSE

2019

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# FLOODING AND LIVELIHOOD ADAPTATION STRATEGIES OF FARMERS IN BUILSA SOUTH AND TALENSI DISTRICTS IN THE UPPER EAST REGION

BY

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Thesis submitted to the Department of Integrated Development Studies of the School for Development Studies, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Doctor of Philosophy degree in Development Studies

JANUARY 2019

# DECLARATION

## Candidate's Declaration

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

Candidate's Signature: …….Date: ……..

Name:……..

## Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: **…….**Date: **……..**

Name:……

Co-Supervisor's Signature: ……Date: …….

Name:……

## ABSTRACT

The livelihoods of farmers in the Upper East Region of Ghana, is based on crop production which is often been affected by floods. As a result, farmers have continuously been adjusting their livelihood against the impacts of floods. This study examined the effects of flooding on farmers' livelihood and the adaptation strategies of farmers to ensure food security. Using cross-sectional and descriptive designs, a concurrent mixed method approach involving both quantitative and qualitative research methodologies were used. The sample size was 343 respondents who were selected using multi-stage and simple random sampling techniques. In addition, four key informants were purposively selected for in-depth interviews while two focus group discussions with male and female farmer groups were also conducted. Analysis of data involved the application of descriptive statistics and chi-square test. The study found that respondents largely had access to farmlands for crop production even though they did not have absolute control over the lands. Also, floods negatively affected farmers, leading to the reduction in crop production. The major challenge confronting flood adaptation was finance and inadequate institutional support. However, the study concludes that floods contributed to serious food security challenges among farmers in the selected districts. It was, therefore, recommended that farmers should engage in small scale enterprises in the form of petty trading and joint businesses to support their traditional livelihood source which can boost their food security. Farmers should also work with the various NADMO coordinators in the districts to develop a comprehensive public information system within their localities to create awareness on the dangers and impacts of floods as a way of preparing themselves for the floods.

**KEY WORDS**

Adaptation

Farmer

Flood

Food security

Livelihoods

Vulnerability

## ACKNOWLEDGEMENTS

This work could not have been written without the help and support of a number of people. In this respect, I wish to record my sincere thanks and appreciation for the help and support received from all the respondents who kindly provided me with information.

I would specifically like to thank my supervisors, Dr. Emmanuel Yamoah Tenkorang and Prof. Simon Mariwah, whose coordinated efforts and time made it possible to finish this work. I am also grateful to the School for Development Studies of the College of Humanities and Legal Studies, University of Cape Coast, for giving me the opportunity to enrol on this PhD programme. Particular acknowledgement and thanks go to all my colleagues, especially Daniel Azongo of the Navrongo Health Research Centre and the Headmaster of Awe Senior High/Technical School.

My sincere thanks also go to my wife, Regina, and my children: Marcel, Mernerzi and Marcance. I am deeply appreciative of their continuous interest and support for my studies despite the sleepless nights and difficulties faced.

## DEDICATION

To my family

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## LIST OF ACRONYMS

| | |
|---|---|
| EU | European Union |
| FAO | Food and Agriculture Organisation |
| GSS | Ghana Statistical Service |
| IDS | Institute of Development Studies |
| IFAD | International Fund for Agricultural Development |
| IFRC | International Federation of Red Cross |
| IPCC | Intergovernmental Panel on Climate Change |
| NADMO | National Disaster Management Organisation |
| NFPA | National Fire Protection Association |
| NGOs | Non-governmental Organisations |
| NRC | National Research Council |
| RAN | Resilient Africa Network |
| SWRMP | Site Waste and Recycling Management Plan |
| UNDP | United Nations Development Programme |
| UNHCR | United Nations High Commissioner for Human Rights |
| UNISDR | United Nations Office for Disaster Risk Reduction |
| USAID | United State Agency for International Development |
| WCD | Women and Child Development |
| WHO | World Health Organisation |
| WMO | World Meteorological Organization |

# CHAPTER ONE

# INTRODUCTION

## Background to the Study

Globally, disasters are seen to have one of the most devastating effects on economic development, livelihoods and human life. Disasters are said to be sudden accidental events, which are categorised into natural and manmade. Among the natural disasters include floods, hurricanes and typhoons, earthquakes, tornadoes, tsunamis, wildfires, volcanic eruptions and landslides. On the other hand, disasters attributed to the activities of man include accidents involving airplanes, ships or trains; the collapse of buildings, bridges, tunnels and mines as well as fire explosions (Dolcemascolo, 2004). Natural disasters such as floods can have significant effects on vulnerable households. In the last three decades, there has been a significant increase in the number of flood events in the world, causing severe damage to livelihoods, economic losses and personal tragedies (Sena, 2006).

Livelihoods are activities that allow people secure the basic necessities of life, such as food, water, shelter and clothing. Engaging in livelihood activities means acquiring knowledge, skills, social networks, raw materials and other resources to meet individual or collective needs on a sustainable basis with dignity (United Nation High Commission for Refugees, 2014). Livelihood activities are usually carried out repeatedly within an income stream such as agriculture, pastoralism, fishing, trading or entrepreneurship. Ideally, people work

within one or multiple streams providing goods and services to a market economy based on cash exchange or barter.

Many livelihoods, according to Chambers and Conway (1991), are largely predetermined by accident of birth; such livelihoods may be inherited. For example, children who are born into a caste with an assigned role as potters, shepherds, or washer people are more likely to earn their livelihoods on that. In some communities, gender, as socially defined is also a pervasive determinant of livelihood activities.

Some people improvise livelihoods with degrees of desperation; in that, what they do is largely determined by the social, economic and ecological environment in which they find themselves. A person or a household may also choose a particular livelihood as a result of education and migration. Work provides the basis for people's livelihood and self-reliance and adds some stability, prosperity and peace to a household and a community at large (UNHCR, 2014).

The World Poverty Report (2011) indicates that one of the demographic characteristics of the developing world is the rural nature of its population. About 3.1 billion people or 55 percent of the population in developing countries live in rural areas. The basic fact is that most of these people in the rural areas depend largely on agriculture or crop production for their livelihoods. While some households in Africa rely primarily on one type of activity, most seek to diversify their livelihood-base as a way of reducing risk. In most African countries,

smallholder farmers produce greater proportions of staples and mostly at the peasant levels.

Livelihoods derived from agriculture are determined by complex interactions among farmers, policies and nature (Nelson, 2009). Nelson stated that crop and animal production is affected by changes in temperature and precipitation as well as changes influenced by human investment such as irrigation systems, transportation infrastructure, animal shelter and market conditions. In rain-dependent agricultural economies, erratic rainfall causing unexpected floods can create devastating impacts on the livelihoods of the people. Flooding is the most common natural disaster that causes loss of life and economic damage in various parts across the globe. It results in loss of property and destruction of the environment and many times, loss of lives (Vaitla, 2006).

Floods are as old as human history, but the dramatic increase in the damages they have caused in the recent past has become a cause of national and international concern. Over the past decade, the number of natural and manmade floods has increased. Many people have given different perceptions and interpretations of the concept or term, "flood".

This study associates itself with Ward's (1978: p23) definition of flood as a "body of water which rises to overflow land which is not normally submerged. Flooding may result from the increase in water volumes in a water body such as a river or lake which overflows its boundaries to flood areas which usually do not contain water". It is comprehensible from the above that flooding involves large volumes of running water engulfing areas or places that, under normal conditions,

are dry. Regular floods are part of people's lives in various regions of the world, recurring with varying magnitudes and frequencies to which people have adapted for centuries. These floods are generally expected and welcomed in many parts of the world since they enrich the soil and provide both water and livelihoods (Ward, 1978).

In disparity, flooding resulting from extreme hydro and meteorological events that take place in unexpected magnitudes and frequencies can cause loss of lives, livelihoods and infrastructure. They can, also, damage the environment (Integrated Flood Management Tools Series Flood Forecasting & Early Warning, 2013). Generally, it has been analysed that flood is the most destructive natural hazard causing extensive damage to the built and natural environment worldwide. Economic losses resulting from damages caused by floods have, also, increased significantly around the world (Integrated Flood Risk Management in Asia, 2005).

Flood losses reduce the assets of farmers, communities and societies through the destruction of standing crops, dwellings, infrastructure, machinery and buildings, aside the tragic loss of life. In some cases, the effect of extreme flooding is dramatic, not only at the individual household level but also in the community as a whole (Integrated Flood Management Concept Paper, 2009).

Floods have serious impacts on the four dimensions of food security: food availability, food accessibility, food utilization and food system stability. The effects are being felt in global food markets and are likely to be particularly significant in specific rural locations where crops fail and yields decline.

Likewise, the impacts are felt in both rural and urban locations where supply chains are disrupted, market prices increase, assets and livelihood opportunities are lost, purchasing power falls, human health is endangered and affected people are unable to cope (IFMCP, 2009).

In some African countries including Kenya, Mozambique, Namibia, Zambia and Zimbabwe, specifically in Mozambique, floods caused a loss of, at least, one third of maize (which is a staple food) production and a loss of 80 percent of her cattle (Mirza, 2003). It also destroyed large proportions of croplands. A similar situation was observed in 2006 when floods destroyed an estimate of 40,000 hectares of maize cropland in Mozambique (SADC, 2006). Cases of destroyed croplands were also reported in Angola and Malawi.

One of the most effective ways to withstand floods impact is to prepare and adopt strategies to mitigate the flooding. Several explanations of flood preparedness and adaptation have been offered by many writers. Some of these explanations are traceable to the individual, geographical, cyclical, cultural and resilience theory of adaptation by Hollings. According to Smit (1993: p32), adaptations are "adjustments to enhance the viability of social and economic activities and reduce their vulnerability to disasters, including its current variability and extreme events as well as longer term". Adaptation is not only an important component of floods and vulnerability assessment but also one of the policy options in response to floods (Fankhauser, 1996; Smith & Lenhart, 1996; Smit, 1999 cited in Smit & Skinner, 2002).

The resilience theory of adaptation originated in the 1970s in the field of ecology, from the research of Holling who defined resilience as "a measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973: p. 14). Drawing from Carpenter (2001), resilience can best be described by three crucial characteristics: the amount of disturbance a system can absorb and still remain within the same state or domain of attraction; the degree to which the system is capable of self-organisation and the ability to build and increase the capacity for learning and adaptation.

The resilience theory indicates that farmers must respond to any environmental disaster by the initiation of a series of physiological, behavioural, ecological, and genetic changes that restore its ability to respond to these disasters and subsequent unpredictable environmental disasters (Holling, 1973). On the other hand, Garmezy (1993) asserted that the theory of resilience has focused on two major issues: the characteristic risk factors of farmers and the environments that predispose farmers to maladjustment following exposure to adversity and the characteristics of protective factors that shield them from such major adjustment.

Flood preparedness action is closely related to how individuals perceive and act on risk information (Tierney, 2001). Preparedness measures have the big advantage of being able to address root causes and dynamic pressures instead of symptoms in a system, which is more stable than after a disaster (Enenkel, 2010). It is also true that no two flood events and disasters are exactly the same, but the many aspects of the full life cycle of disaster management can help mitigate a

flood disaster. Flood preparedness plan (FPP) for farmers is about putting in place a set of appropriate arrangements in advance for an effective response to floods. This is an important phase of flood disaster management which is almost being neglected in developing countries. There is a tendency to rely more on what governments can do while neglecting self-help options.

The preparedness dimension also includes activities that are designed to ensure that emergency operations will be carried out effectively when floods strike. These activities include training, drills and exercises as well as educational activities for members of households and the public. Preparedness also includes developing policy, vision and mission statements; developing and using enabling authorities; setting performance objectives and assigning responsibilities in areas such as oversight and coordination (Tierney, 2001).

Ghana is an agrarian country where small-scale peasant producers pre-dominate agricultural production. But small-scale traditional production has come under pressure because of unfavourable weather conditions, questioning its capacity to cope with the problems of livelihood construction, environmental protection and poverty reduction. In this regard, one questions the extent to which the goals of attaining food security, poverty reduction and the provision of basic services can be achieved if disasters and vulnerability continue to grow rapidly (Ministry of Food and Agriculture, 2011).

Admittedly, floods have been one of the numerous phenomena that have posed substantial challenges to the economy of Ghana and developing countries at large (Actionaid International, 2006; World Bank, 2010). In Ghana, flooding has

become a seasonal worry to most communities as well as the government. Across the country, some communities experience periodic flood disasters of varying scale and intensity whenever there is a downpour. In 1999, rainfall-induced storm caused coastal floods that resulted in many deaths across the coastal parts of Ghana, with Accra being the worst affected (Karley, 2009). In June 2001, torrential rains caused widespread flooding in Ghana and particularly Accra, leaving 20 people dead and over 100,000 without homes (Karley, 2009).

Additionally, Ghana experienced severe flooding in 2005 with about 350,000 people severely affected. Several hundred hectares of crops were also completely washed away. In 2008, it was estimated that the flooding in July and August caused more than US$1 million worth of damage (Vanguard Assurance, 2008). Flood disasters in Ghana have caused major disruptions in the socio-economic development of the people. In many instances, floods have washed away huge investment projects such as roads, making the expenditure on such projects recurrent on the government (Karley, 2009).

Agriculture is the main occupation of rural communities in northern Ghana and also an important source of livelihood. Farmers in northern Ghana are heavily dependent on climate-sensitive sectors such as agriculture and forestry. Majority of the population dwell in rural areas where agriculture, especially crop production, is the main source of farmers' livelihood. The Upper East Region, which represents the geographical focus of this research, is not endowed with natural resources (Catholic Relief Services [CRS], (2014).

The impact of floods on agriculture in the region cause significant damages to food crops, and farmers' seed supply for the coming agricultural year are jeopardised. Floods, therefore, affect seed supply either through affecting crop production (on farms) or destroying seed stores (in homes). Either way, the lack of seeds for subsequent planting could generate a reinforcing effect of lower food insecurity. By reducing food production, floods may limit farmers' income and reduce their ability to buy seeds, which also creates another reinforcing effect of lower production and, even, a lower ability to raise enough income to afford seed purchases (MoFA, 2013).

Livelihoods of farmers in the region have been affected by incidence of disasters such as flood crises caused by severe adverse weather conditions, natural hazards and shocks or a combination of these factors. These have been rising since the early 1980s. Most people are recurrently rendered homeless due to flooding. The Region is prone to floods during the months of July – September. In 1995, 1997, 2004, 2007, 2008, 2009, 2010, 2015 and 2016, the region was hit by floods. The worst flood, which was in August 2007, resulted in loss of lives and property with more than 1,300 households rendered homeless. Many buildings were submerged and over 3,000 hectares of farmlands were destroyed. Additionally, the floods caused an outbreak of water-borne diseases including diarrhoea, cholera and malaria, particularly among children (National Disaster Management Organisation, 2007).

The way a farmer copes with and withstands economic shocks and floods depends on the options available in terms of households assets such as: capital,

social, financial, physical, human and natural assets and activities, (Dercon & Krishnan, 1996; Ellis, 1998). This is important from both a positive and negative viewpoint. In fact, farmers belonging to different socio-economic groups have different strategies to earn their own living which, in turn, may ensure different levels of resilience to livelihood insecurity. As a result, farmers belonging to different socioeconomic groups (for example, a farmer's household vs. a household whose main income source is public sector employment) require different interventions. Comprehending the driving factors of each livelihood strategy is, therefore, crucial for improving the response mechanisms related to food insecurity and poverty in developing countries.

Awudu and Wallace (2007) argued that the effects of floods on natural resource-dependent communities in the Upper East Region of Ghana are complex. Being essentially agricultural producers, the main consequence of flooding has been the decline in food production. A decline in food production can lead to starvation which may, in some cases, last for several months after each episode of floods. Starvation, together with a decline in environmental quality resulting from flood-related damage, fuels the desire for migrating from these rural areas. The reduction in food production resulting from floods also means loss of income for many people in these communities. This further reduces their ability to purchase food and thereby contributes to the increasing problem of food shortages and starvation within a farmer's households.

Additionally, farmers develop or adapt mechanisms such as migration to urban areas to work, relying on relatives, withdrawal of children from school and

sometimes reducing food intake to deal with the situation. Often times, these coping strategies tend to be immediate and short-term making them unsustainable. There is, therefore, an increasing need to focus on disaster reduction through prevention, mitigation and preparedness (Aikins & Binka, 2013; Norman, 2013).

**Problem Statement**

Ghana ranks high amongst African countries most exposed to disasters from multiple weather-related hazards, particularly natural hazards such as floods and droughts (UNDP/NADMO, 2009). Floods have characterised Ghana's recent past, causing a considerable loss of life and property, a reduction in economic growth which affects livelihoods and a crisis in power generation from hydroelectric dams which has affected urban life the most. It is expected that an increased level of cyclonic storms, to a great extent, and storm surges, to a lesser extent, will be associated with future disasters and may increase flood occurrences in spatial patterns similar to those of the present (Rain, Smith & Sussan, 2011). Significant flood events in Ghana have been recorded in 1973, 1986, 1995, 1999, 2001, 2002 and, recently, in 2015. Along with property damage, the ability of flood waters to spread pollutants from solid and industrial waste to sewerage is an important health and environmental issue particularly in poor areas (Rain, et al, 2011).

In the Upper East Region, floods present several uncertainties over the livelihoods of communities that depend heavily on farming (Al-Hassan & Poulton, 2009; Athula & Scarborough, 2011). It influences land use and livestock management by fluctuating crop, forage and livestock growth and yield (Mu &

McCarl, 2011). According to FAO (2009a), floods negatively affect the basic elements of food production and security such as soil, water and biodiversity. The World Bank (2010a) notes that vulnerable farmers are more susceptible to the impacts of floods as a result of a combination of a number of factors including gender-based cultural norms, inheritance structures and household responsibilities.

Rainfall variability and unreliability often have devastating effects on agriculture. Increasing rainfall variability results in droughts, leading to a reduction in soil moisture that also leads to a decline in agricultural productivity. This, subsequently, results in a decrease in farmer incomes and food security (Molua & Lambi, 2006).

What is uncertain is whether or not all the flood occurrences in the past had attracted the needed attention as they resulted in an annual loss of lives, property and livelihoods (UNDP/NADMO, 2009). Humanitarian assistance and emergency response operations in the Upper East Region have been the medium through which communities affected by floods of any sort are addressed. Short-term coping measures to floods have also been proposed as potential strategies for helping subsistence farmers adapt to floods (Challinor, Wheeler, Garforth, Craufurd, & Kassam, 2007; Verchot, Noordwijk, Kandji, Tomich, Ong, Albrecht & Bank, 2008). Research also suggests that short-term coping strategies to floods improve farmers' well-being and food security (Verchot, 2007; Garrity, 2006; Leakey, 2010; Scherr & Franzel, 2002). Yet, there are a few studies that explicitly

examine how short-term measures can reduce farmers' vulnerability to floods and, hence, improve food security (Scherr & Franzel, 2002).

Al-Hassan and Poulton (2009) noted that as a result of climatic shocks such as floods, it is not uncommon for smallholder farmers in the Builsa South and Talensi Districts in the Upper East Region to struggle every year between the months of March and July to obtain enough food. Even though several technologies and practices (both indigenous and innovative/introduced) are available to adapt to or cope with the effects of climate change, it appears these technologies and practices have not been comprehensively documented in the adaptation literature in Ghana. Farmers in the Builsa South and Talensi districts are, therefore, not able to fully take advantage of the technical and economic opportunities around them since adoption only takes place after awareness creation. According to Bediane (2012), smallholder farmers in the Upper East Region must, first of all, overcome the hurdle of adapting to climate change and variability in order to make more meaningful contributions towards a green economy.

While humanitarian aid and emergency operations have historically addressed these needs and have been critical in saving lives and helping people deal with their immediate needs, these assistance and emergency response operations have not been able to provide long-term resilience, which is critically needed (Resilient Africa Network, 2015).

## Objectives of the Study

The main objective of the study was to examine the effects of flooding on farmers' livelihood and their adaptation strategies to ensure sustainable livelihoods in the Upper East Region. Specifically, the study sought to:

1. Assess livelihood assets available to farmers.
2. Assess farmers' perception and vulnerability to flooding.
3. Evaluate the effects of flooding on farmers' livelihood resources.
4. Explore the livelihood adaptation strategies of farmers and preparedness in response to floods.
5. Assess farmers' challenges to adaptation strategies to flooding.

## Research Questions

The study was guided by the following research questions:

1. What are the livelihood assets of the farmers?
2. To what extent are farmers vulnerable to floods?
3. How does flooding affect farmers' livelihood resources?
4. What are the resilience mechanisms and livelihood adaptive strategies of households in response to floods?
5. What are the challenges to adaptation strategies of farmers to flood?

## Significance of the Study

The study examines livelihood adaptation to flooding in the Upper East Region of Northern Ghana. The findings from the study and the recommendations may be useful to government and other stakeholders in formulating policies which could improve livelihood adaptation strategies when implemented. In effect, it may help rural households in Ghana to succeed, survive and improve on their income to satisfy their basic needs and contribute to national development.

Findings from the study may also be used by other regions to help improve their rural livelihoods. This study, therefore, adds up to the knowledge-base on livelihood adaptation to risks, disaster and vulnerability in Ghana. Thus, the findings of the study would be useful to researchers and students who want to undertake similar studies.

## Delimitation

Even though this study was on livelihoods adaptation to flooding in the Upper East Region of Ghana, geographically, it covered only two districts: Builsa South and Talensi districts. Thus, the conclusions that were drawn and the generalisation made were applied to these districts. However, they may be applicable to other districts with the same characteristics within and outside the region. Agricultural extension officers in the region at large as well as household members from communities within the two districts were selected for the study.

## Limitations of the Study

The study encountered four main limitations: first, although floods affect the entire region, not every district was covered in the data collection for the

study; it would have been extremely expensive, time consuming and a herculean task to accomplish. To overcome this limitation, reliable sampling methods were used to fairly cover the population of the study.

Secondly, the two districts selected have several communities which were always affected by floods. The study was not able to cover all these communities completely due to inadequate resources and time constraints. However, the communities covered had various degrees of severe floods posing serious effects on their livelihoods.

The third limitation was that the study could not access institutional data from the National Disaster Management Organisation (NADMO), Meteorological Agency, District Assemblies and the Ministry of Food and Agriculture due to difficult administrative procedures in obtaining data. However, the researcher was able to obtain information from individuals of the above mentioned institutions to support the findings of the study.

The fourth limitation was that the present study was conducted in only two districts in the region, with their distinct socioeconomic characteristics. It was, thus, quite difficult to predict the extent to which the study's findings can be applied in other districts in the northern sector. One, therefore, has to be careful in generalising the study's findings to other regions in northern Ghana although there are some similarities. These four main limitations were tackled in a way that ensured that the quality of data and objectivity in the data analysis were not compromised.

**Organisation of the Study**

The study covered eight chapters. The first chapter consists of the background to the study, problem statement, objectives and research questions of the study, delimitation of the study, significance of the study, limitation of the study and organization of the study. Chapter two presents the theoretical and conceptual perspectives that were used in the study as well as the conceptual framework that guided the study while chapter three discusses empirical issues in livelihood adaptation to disaster. Chapter four continues with a discussion on the methodology employed in the study and gives a description of the agricultural attributes of the administrative districts selected for in-depth investigation at household levels. Chapter Five, Six and Seven discusses the results of the study. The last chapter, chapter eight, presents the summary, conclusion and recommendations of the study.

# CHAPTER TWO

# THEORETICAL AND CONCEPTUAL PERSPECTIVES

## Introduction

Literature review helps researchers to sharpen the research problem to be investigated and provides an explanation of the current state of knowledge in a chosen research area as found in academic books and journal articles (Kumapkor, 2003). In this regard, review of related literature provides a starting point for researchers to refine the problem, identify gaps, compare, contrast, critique, summarise and evaluate information in the chosen field of study (Creswell, 2003).

Furthermore, it provides information on theories, concepts and empirical evidence for a critical analysis of the methodologies and approaches other researchers have used in solving similar problems (Babbie, 2005). It, also, highlights the strengths, weaknesses, contestations, inconsistencies and contradictions in the existing literature and draws lessons to inform the design and conduct of the new study (Bryman & Bell, 2007). This chapter reviews literature on theories and conceptual issues related to livelihoods adaptation to flood disasters and how they inform rural development.

## Theoretical Framework

Twumasi (2001) defines a theory as a coherent group of general propositions used to explain a phenomenon. A theoretical framework on the other hand, is the foundation and structure or scaffold of a study (Yin, 1993) that can be considered as a lens. Good and Hart (1952) emphasise that theoretical orientation functions mainly by bringing the range of facts that are to be investigated and

explained in a study together by the use of theories to highlight the relationships among the variables in the study. They contend that social science research is theory based, operated and guided by relevant concepts and principles of human behaviour.

Several theories have been propounded to explain the fundamental and complex relationship between flood disasters and vulnerability and how farmers respond to them. However, this study discussed how the theory of resilience (Holling, 1970) is used to explain farmers' adaptation to flood disasters. The chapter also emphasizes major theories in livelihood adaptation to risk, disaster and vulnerability which include the theory of sustainable livelihoods approach (Chambers & Conway, 1992). Additionally, pressure and release and the access models were also reviewed.

The theory of resilience

The theory of "resilience" originated in the 1970s in the field of ecology from the research of C.S. Holling who defined resilience as "a measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973, p. 14). The theory of resilience has brought forth various perspectives and voices (Dugan, & Coles, 1989; Glantz, & Johnson, 1999; Joseph, 1994; Taylor, & Wang, 2000; Thomsen, 2002; Unger, 2005). Despite the vast body of research on resilience, there is little agreement on a single definition of resilience among scholars. In fact, scholars define the construct of resilience in a multitude of ways (Carle & Chassin, 2004).

Richardson (1990) contended that resiliency is the process of coping with disruptive, stressful, or challenging life events in a way that provides the individual with additional protective and coping skills than prior to the disruption that resulted from the event. Similarly, Higgins (1994) described resiliency as the "process of self-righting or growth" (p. 1), while Wolins (1993) defined it as the "capacity to bounce back, to withstand hardship, and to repair oneself (p. 5). Resiliency is also defined as a "positive adaptation considered in a demonstration of manifested behaviour on social competence or success at meeting any particular task at a specific life stage" (Luthar & Cicchetti, 2000, p. 110). In short, resilience is best defined as "the ability of a system to absorb disturbances and still retain its basic function and structure" (Walker & Salt, 2006, p.1). In other words, resilience is the capacity to change in order to maintain the same identity (Folke et al., 2010).

Whilst analysing the behaviour of ecological systems, Holling (1973) suggested that behaviour could best be defined through two distinct properties: resilience and stability. Resilience regulates the perseverance of relationships within a system and is a degree of the ability of these systems to absorb changes of state variables, driving variables and restrictions and still persist. In this definition, resilience is the property of the system to persist or probably go extinct. Stability, on the other hand, is the ability of a system to return to an equilibrium state after a provisional disturbance.

Resilience is commonly explained and studied in the context of a two-dimensional construct concerning the exposure of adversity and the positive

adjustment outcomes of that adversity (Luther & Cicchetti, 2000). While the construct of resilience is examined across various studies and scholarly articles, there is little consensus as to how researchers define adversity, let alone what defines positive adjustment outcomes. Garmezy (1993) asserted that the study of the theory of resilience has focused on two major issues: the characteristics – risk factors – of households, families and environments that predispose households to maladjustment following exposure to adversity and the characteristics of protective factors that shield them from such major adjustment.

Garmezy's (1991) model of resilience provided a widely accepted ecological framework for understanding the resilience process. Multiple scholars have used this framework to study resilience (Gordon & Song, 1994; Morales & Trotman, 2004; Werner & Smith, 1982). The triadic model described the dynamic interactions among risk and protective factors on three levels (individual, family and environmental). The model also emphasised that resilience is a process that empowers individuals to shape their environment and to be shaped by it in turn. Similarly, Cicchetti and Lynch's (1993) interactive ecological-transactional model of development highlighted how certain contexts (e.g. culture, neighbourhood, family) interact with each other over time to shape development and adaptation. These ecological models highlight the intersection of varying influences upon one's development and how risk and protective factors can interact to enhance or inhibit a person's resilience.

Implicit in the concept of resilience as a dynamic process is the understanding that resilience can grow or decline over time depending on the

interactions taking place between an individual and their environment and between risk and protective factors in an individual's life (Borman & Rachuba, 2001; Werner & Smith, 1992). Therefore, an individual may be resilient at certain times, but not at others, depending upon the circumstances and relative strength of protective factors compared to risk factors at the given moment (Winfield, 1991). Masten (1994) contributed to the idea that resilience is a pattern over time, characterised by good eventual adaptation despite risk, acute stressors, or chronic adversities.

Sercombe (2002) asserted that the widely held view of resilience as an individual character, family trait, or community phenomenon is inadequate. Resiliency cannot be understood or improved in significant ways by merely concentrating on these individual-level factors. Instead, a careful attention must be paid to structural insufficiencies in society to introduce social policies that families need in order to become stronger, more experienced and better functioning in adverse situations.

Relevance of the theory to the study

In evolutionary terms, farmers respond to any environmental change by the introduction of a series of physical, behavioural, environmental and hereditary changes that re-establish their ability to respond to subsequent erratic environmental changes (Holling, 1973). In Holling's terms, the perspective of resilience stresses the need for persistence. In this perspective, striving for a management approach based on resilience would accentuate the need to keep choices open, the need to view events in a local rather than a regional context and

the need to emphasize heterogeneity, (therefore requiring) a qualitative capacity to develop systems that can absorb and accommodate future events in whatever unforeseen form they may take (Holling, 1973).

Sustainable development has the objective of generating and maintaining prosperous social, economic, and ecological systems (Folke et al. 2002). Humanity has a need for persistence, and since farmers depend on services of ecosystems for their livelihoods and security, farmers and ecosystems are deeply linked. As a result, humanity has the imperative of striving for resilient socio-ecological systems in the light of sustainable development. A focus on ecosystems is therefore important to understand the concept of resilience. In reality, natural and social systems behave in nonlinear ways and exhibit marked thresholds in their dynamics whereas social-ecological systems act as strongly coupled, complex and evolving integrated structures (Folke et al, 2002).

Resilience thinking is unavoidably systems thinking; at least, as much as sustainable development is. In fact, when considering systems of humans and nature (social-ecological systems), it is central to consider the system as a whole. In this framework, where resilience is associated with systems thinking, three concepts are crucial to hold (Walker & Salt, 2006): humans live and operate in social systems that are intimately linked with the ecological systems in which they are embedded; social-ecological systems are complex adaptive systems that do not change in a predictable, linear, incremental fashion and resilience thinking provides a framework for viewing a social-ecological system as one system

operating over many linked scales of time and space. Its focus is on how the system changes and copes with disturbance.

**Sustainable Livelihoods Approach**

The livelihood approach has been at the centre of rural development. It categorises assets into five main types: human, social, natural, physical and financial capitals, which jointly determine farmers' status and survival strategies. It takes the multi-dimensional understanding of farmers' livelihoods and compares tangible and intangible assets on which poor people draw (Ellis, 2000). These assets are determined by a wider context of formal institutions, regulations and cultural norms. The limitation is that this classification of assets implies a unitary household model where members have identical preferences; as such, they are assumed to make best use of resources. In this regard, assets are allocated on the basis of comparative advantage to maximise household welfare.

However, households comprise people with different interests and needs such that decision making becomes a negotiating process between different parties. Even if households were unitary places, their composition could change and the assumed assets get destabilised. It is significant to note that households can also be sources of inequality. A study conducted by Van Driel found that the weight of coping with disasters is unevenly distributed within households (Van Driel, 2009).

The quality of household assets matters, for example large stocks of human capital without skills would be of little use. The more assets people command in the right mix, the greater their capacity to cushion external shocks

(Moser, 1998). Households with members lacking skills would be vulnerable on the labour market; as a result, their capacity to improve livelihoods gets impaired. In addition, the belief in social capital implies that poor people have endless resources from which they continuously draw. De la Rocha, who developed the shift from resources of poverty to poverty of resources, contended that reciprocity, solidarity and mutual help among the poor could reach limits (De la Rocha, 2007). The notion of social capital legitimises shifting costs of poverty reduction from the state to communities because reliance on social capital in communities characterised by high rates of poverty could perpetuate poverty as the poor keep diminishing resources at their disposal. Social capital could also turn out to be a source of patronage and class formation within poor populations.

The livelihoods perspective has often been described as too complex and not attuned with real-world challenges and decision-making processes. While recognizing these limitations, this study assumes that farmers' resources and strategies can, in turn, aggregate to complex livelihood means at household, village and district levels (Scoones, 2009).

The framework improves understanding of rural livelihoods and the impacts of policy measures upon them; it focuses on people and their capacity to facilitate positive change by broadening understanding of complex livelihoods in marginal areas (Ellis, 2000). Household resources depend on the strength of each other. Though the framework does not show how these assets interlink, it could be asserted that giving remittances to households would improve other household

resources. Policies, institutions and practices shape the extent to which people are able to develop assets that sustain livelihoods.

**Linkages to the Study**

The sustainable livelihoods approach helps to answer research questions relating to poor farmers' asset portfolio, livelihood strategies among households and the contribution of remittance to these livelihoods. Poor people use remittances to build assets that, in the end, facilitate positive livelihood outcomes and change.

*Farmers' Assets*

Giving remittance to poor farmers provides a direct injection into immediate financial assets. Bryan contends that poor people experience an increase in incomes as the remittance becomes the basic income guarantee (Bryan, 2005). The increase in income does not automatically improve livelihoods because the remittance amount is not enough to meet all household basic needs. In view of this, households spend on other assets to generate savings. Tiny remittances are often invested in income generation activities, education and acquisition of productive assets which can play a key role in reducing chronic poverty and improving livelihoods (Devereux, 2002). This kind of expenditure contributes to building the household asset base.

Tembo and Freeland reported that cash remittances had a positive impact on consumption expenditure, with Upper East, the poorest region, having more impact on consumption than other regions (Tembo & Freeland, 2009). Remittances are usually shared within the household. Sherlock argues that cash

remitted have effects on the household's finances, economic activities and access to social services (Sherlock, 2006).

*Community Assets*

Other resources for poor households include community networks that form social capital. These include kinship ties, social association, support groups and other institutions of society upon which the poor draw to maintain their survival. Poor households or communities have social relations that provide an incentive for informal safety nets among households. Although communities may have common livelihoods, households' susceptibility or resilience to livelihood shocks is not equally distributed. It depends on the relative wealth and access to alternative income sources including support from extended family and social networks (Devereux, 2001). Those that are relatively poor accumulate more assets as they benefit from cash remitted; they could become sources of income for other community members by hiring them in farm labour. Social capital could, also, cushion the impact of livelihood shocks by allowing the poor access to resources that could be easily available through membership to support groups.

*Livelihood Strategies*

A well-built asset base would allow diversification of livelihood strategies. Rural households invest in household assets in order to diversify livelihoods and enhance future capabilities. Measures employed by households are described as household asset strategies (Ellis, 2000). Households that diversify their livelihood strategies by engaging in non-farm activities are often more resilient to flood shocks. Diversification has positive attributes for livelihood security that

outweigh the negative connotations it may possess (Ellis, 1998). Social networking also builds assets among poor households; thus, they become an essential contributor to community livelihood.

*Livelihood Outcomes*

Livelihood diversification is a means to sustainable livelihood base that could promote poverty reduction. Sustainability refers to coping with immediate shocks and stresses where local capabilities and knowledge are effectively supported (Scoones, 2009). Sustainable livelihoods come from different livelihood sources that contribute to building rural households' asset base. Varied livelihood strategies are less vulnerable than undiversified ones because these offer different options for survival when the household is confronted with un-anticipated livelihood failure.

A sustainable livelihood portfolio would contribute to livelihood outcomes that reduce poverty and vulnerability. Due to investments made in assets, most households would abandon negative livelihood strategies. Households could engage in petty trade activities and pay for agricultural labour using the cash and assets purchased. It could be argued that petty trading brings desired change by contributing to positive livelihood outcomes that facilitate growth and poverty reduction among the rural poor.

**The Pressure and Release Model of Households Vulnerability to Disaster**

The pressure and release model of vulnerability (PAR) in Figure 1 was developed by Blaikie, Cannon, Davis and Wisner (1994) as an expression of the complex interactions between the underlying social processes that create

vulnerability and the hazard itself. The model is built upon the juxtaposition between these two opposing forces. The basis for the PAR is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and the natural hazard event (or sometimes a slowly unfolding natural process) on the other.

The pressure side of the model indicates a progression of vulnerability that starts with the root causes including limited access to power, structures and resources, as well as vulnerabilities created through specific political and economic ideologies. These root causes are widespread processes that impact the distribution of resources and are a reflection of the distribution of power in a society (Blaikie *et al,* 1994). Individuals and groups who are marginalized and lacking in power, either economically, politically and/or socially, are exposed to a double source of vulnerability. These groups are less likely to have secure access to quality livelihoods and resources and have a tendency towards lower priority for government action and intervention (Blaikie et al., 1994).

In this model, the 'pressure' builds through increasing vulnerability and exposure to hazards, while the 'release' conceptualises the actions taken to reduce the impact of the disaster - the reduction of vulnerability (Blaikie, 1994). Figure 1 depicts the PAR model - specifically the progression of vulnerability from root causes through to their manifestations as unsafe conditions.

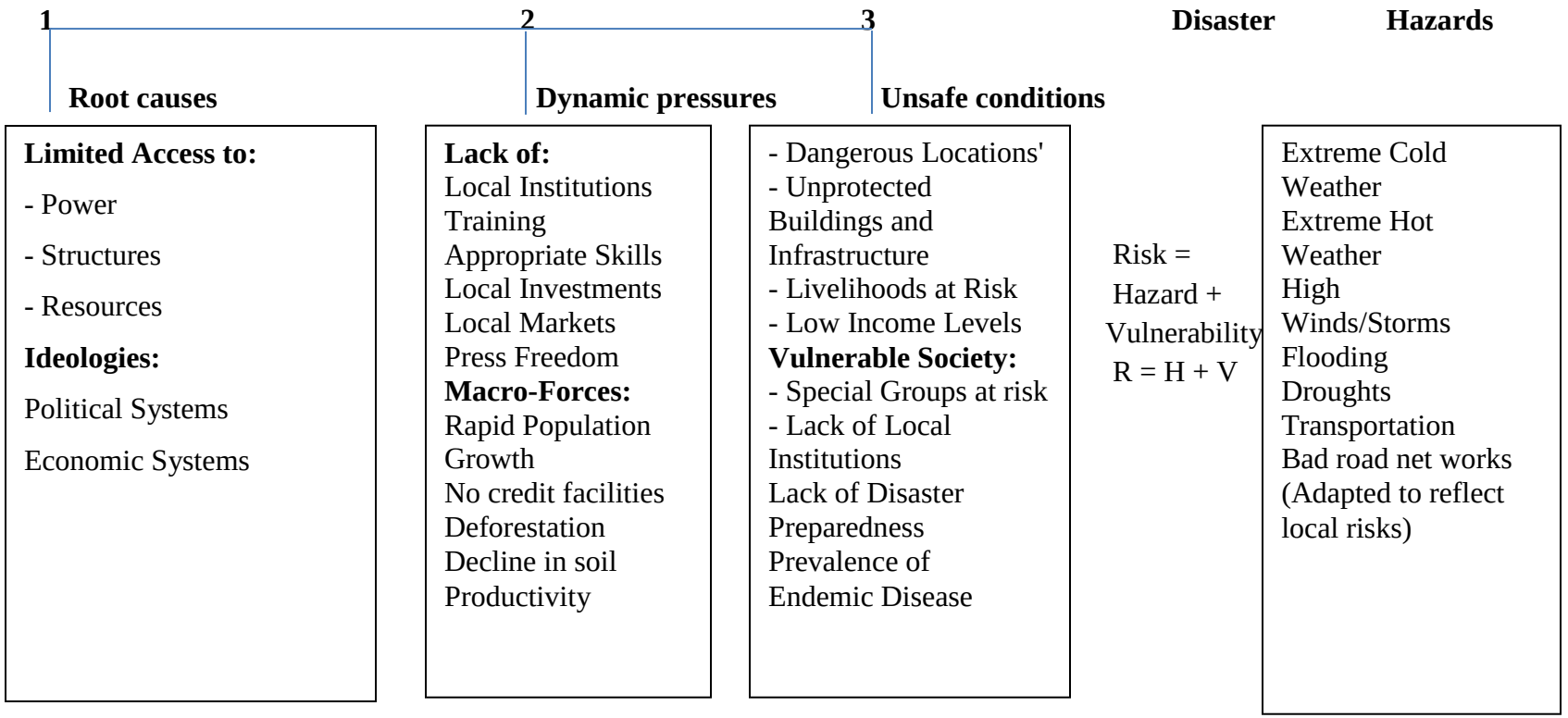


**Figure 1: Pressure and Release Model – Progression of vulnerability**

Source: Blaikie, et al 1994

The Dynamic Pressures channel the root causes into particular forms of insecurity and are visibly manifested as unsafe conditions (Blaikie, 1994). These processes range from economic investments in human capital to macro demographic trends and environmental sustainability. The unsafe conditions in the PAR model are the actual or visible populations that experience vulnerability during a disaster event. Unsafe conditions are the specific forms in which the vulnerability of a population is expressed in time and space in conjunction with a hazard (Ben, 1994). Therefore, each manifestation of vulnerability can be traced back to larger, widespread social, economic and political processes that work to generate vulnerable populations.

The Pressure and Release model has some limitations, including the explicit focus on the 'pressures' or vulnerabilities, with little emphasis on the 'releases' that could increase resiliencies and overall coping capacity. There is, also, an inherent oversimplification of the juxtaposition of two opposing forces. This suggests that the hazard is separate from social processes and independent of the conditions that create vulnerability (Terry, 1994). As well, the model presents a static depiction of vulnerability. In this model, the generation of vulnerability is not adequately integrated with the way in which hazards themselves affect people; it exaggerates the separation of the hazard from social processes in order to emphasize the social causation of disasters (Blaikie et al., 1994).

For these reasons, Blaikie et al. also developed the 'Access' model of vulnerability which is essentially an expanded analysis of the core components of the PAR model. The Access model examines the specific political and economic

processes that generate vulnerability and focuses on incorporating the hazards themselves as a process of creating vulnerability. The Access model, shown in Figure 2, is essentially cyclical and examines how individuals and households manage their access to assets and resources under the domination of social, political and economic systems. In this regard, the socially constructed process of differential access to natural resources leads to differential exposure to hazards themselves (Blaikie *et al.*, 1994).

The Access model is designed to draw attention to the socio-economic relations which cause disasters or allow them to happen (Blaikie, *et al.*, 1994). Thus, for Watts and Bohle (1993), there is an explicit focus on access to resources and assets as a critical component of vulnerability; yet, they acknowledge that there are underlying processes which work to create these differences.

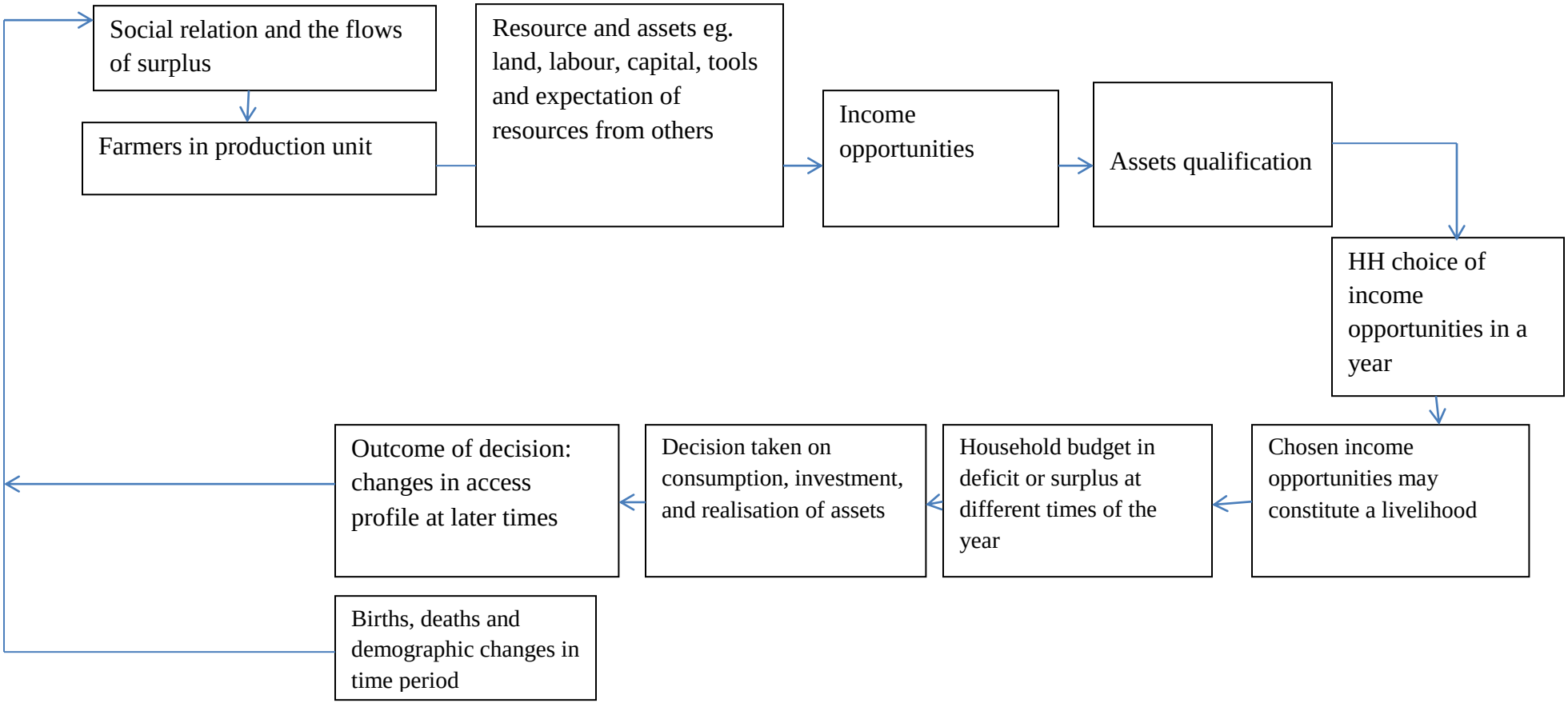


**Figure 2: Access Model to Resources**

Source: Blaikie et al. (1994)

Although the work of Blaikie *et al.* (1994) explores the underlying processes that affect levels of vulnerability, there are two main limitations to this approach. While Blaikie et al. (1994) emphasize the larger political, social and economic processes that manifest themselves as unsafe places; this approach lacks an explicit recognition of the importance of place and geography. Despite similar root causes and dynamic pressures, manifestations of vulnerability may be different depending on smaller-scale, more localised processes as well as individual experiences and perceptions. In general, this approach, similar to other vulnerability models, focuses exclusively on the interactions of negative processes during disaster events and is inherently disempowering through a lack of emphasis on capacity building.

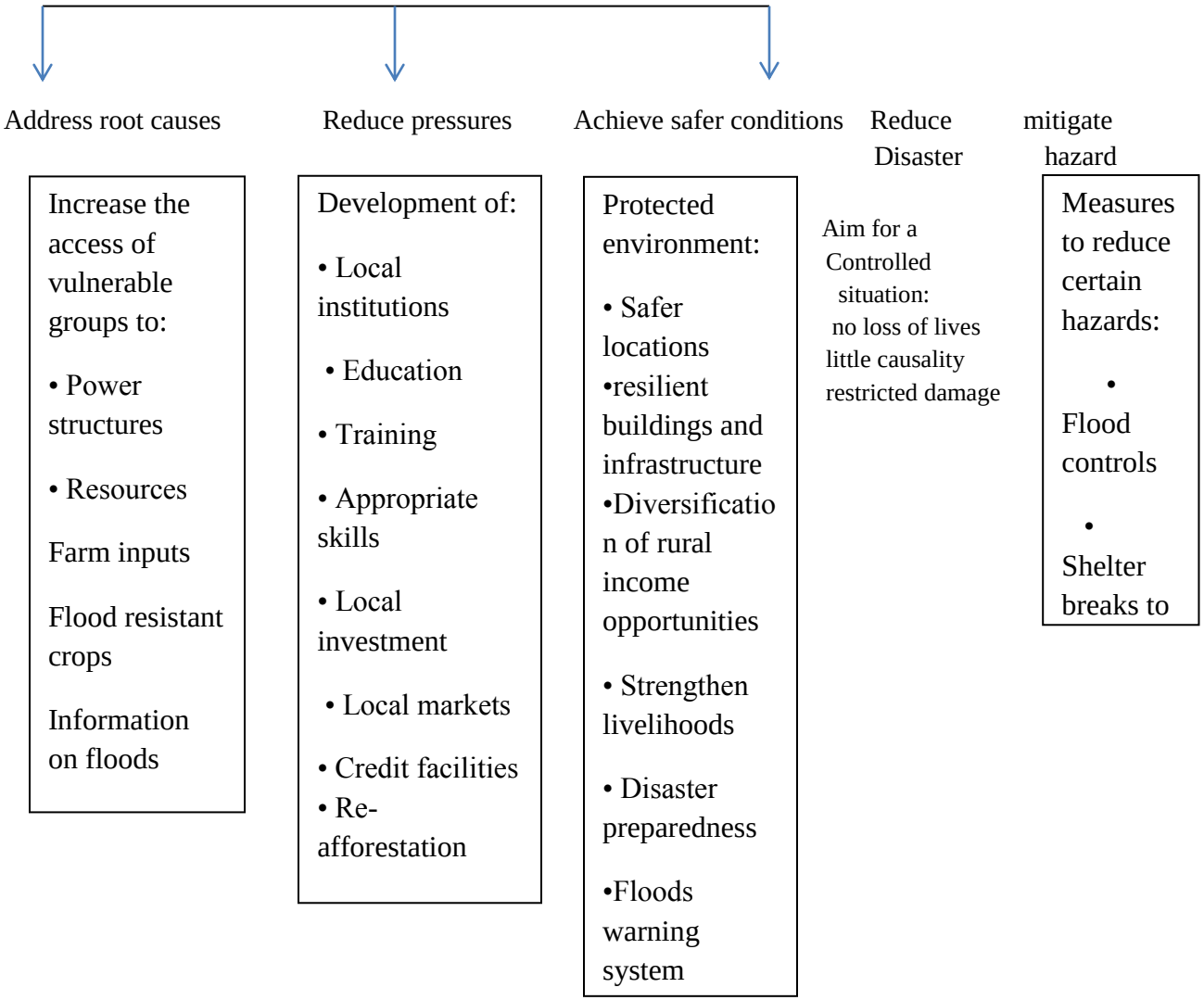


**Figure 3: Disaster release model to counter disaster risk**

Source: Wisner et al. (2004)

Risk and disaster are dynamic and changing. The concepts and theories, empirical realities and management challenges and options that exist with regard to risk and disaster change commensurately. These changes provide the context within which decisions on the scope, orientation, content and strategic parameters of future capacity building and human resource development must be decided. As the context and challenges change, so do the parameters and priority actions required for achieving successful capacity building (Wisner, et al, 2004).

Theoretically, the "pressure" between hazards and vulnerabilities should be released to reduce disaster risk. Hazards should be mitigated to reduce their intensity; that is, to affect vulnerable population less. Vulnerability should also be reduced at different levels: activities need to be undertaken to turn "unsafe conditions" into "safer conditions" while "dynamic pressures" are reduced and "root causes", addressed. These DRR activities aim to achieve a controlled situation and a resilient community, where there is no loss of life, few casualties, restricted damage, food security and capacity to recover quickly from any impact of a hazard (Wisner, et al, 2004).

## Conceptual Issues

This section reviewed concepts related to livelihood adaptation to flood disasters. Among the concepts reviewed are disaster, floods, types and causes of floods, impact of floods, flood management, vulnerability, hazards and shocks, disaster mitigation and preparedness. Finally, the section presents the conceptual framework that guided the study.

### Disaster

Disaster can be classified into three categories – classic, hazards/disasters and socially focused (Perry, 2006). According to Fritz (1961: 655), a disaster is "an event concentrated in time and space, in which a society or one of its subdivisions undergoes physical harm and social disruption, such that all or some essential functions of the society or subdivision are impaired". Physical harm and social disruption (now more commonly labelled physical and social impacts) occur because the event exceeds normal protections (Kreps, 1984).

Disaster is a sudden adverse or unfortunate extreme event, which causes great damage to human beings as well as plants and animals. Disasters occur rapidly, instantaneously and indiscriminately. These extreme events, either natural or man-induced, exceed the tolerable magnitude within or beyond certain time limits, make adjustment difficult, result in catastrophic losses of property and income and leaves life paralyzed. These events aggravate natural environmental processes to cause disasters to human society such as sudden tectonic movements leading to earthquake and volcanic eruptions, continued dry conditions leading to

prolonged droughts, floods, atmospheric disturbances, collision of celestial bodies (Joshi, 2008).

The United Nations define disasters as "serious disruption of the functioning of a community or a society causing widespread human, material, economic and environmental losses which exceed the ability of the affected community/society to cope using its own resources" (UNDP, 2008, p23). According to the IPCC SREX Report, disasters are "severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions and leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery" (IPCC, 2012, p. 5).

It is generally admitted that two competing epistemological perspectives have dominated the disaster field: the behavioural and structural paradigms (Smith, 1999, 1996; Oliver-Smith, 1996; Quarantelli, 1978, 1998; Hilhorst, 2004). Oliver-Smith (1996), Quarantelli (2005) and Calderón (2001) noted that the behavioural paradigm (BP) dominated disaster studies during the 1950s and continues to exert its influence on research and policymaking.

The main assumption of BP is that scientific knowledge and information on natural hazards can make people and decision-making systems aware of the severity of the real risk; therefore, furthering rational decisions to change people's behaviour in order to avoid disaster. Under BP, the origin of disaster causality can be sought in the intrinsic characteristics of the natural hazard, namely, wind speed

in hurricanes, Richter grades in seismic activity, pluvial intensity and frequency of heavy rainfalls and floods as well as droughts among others. Disaster impact is measured in terms of human and material losses, affected people and damages to infrastructure and lifelines and livelihoods.

Floods

Floods, the destructive abundance of water, have occurred many times from the earliest days of documented history until the present, leading to fatalities and high material losses. The term flood or flooding as a concept of disaster and vulnerability has been subjected to various interpretations. The European Union (EU) Floods directive (2007) defines flood as a temporary covering by water of land not normally covered by water. Chow (1956) said flood is a relatively high flow which oversteps the natural channel provided for the runoff. A flood is a natural response of a river or stream or a mere drainage valley/channel that has too much water to cope with (Aderogba, 2012). The academic community is in agreement that flooding is one of the most widespread, disastrous and frequent natural hazards of the world. Floods are triggered by factors which are partly or wholly climatological in nature (Ayoade, 1988), but human activities often escalate the frequency and severity of the floods. Floods can affect the social, economic and political wellbeing of a people.

According to Ward (1978), a flood is a body of water which rises to overflow land that is not normally submerged. Flooding may result from the volume of water within a body of water, such as a river or lake which overflows, with the result that some of the water escapes its usual boundaries. It is

comprehensible from the above that flooding involves large volumes of running water engulfing areas or places that under normal conditions remain dry. A floodplain can be defined as the area of a river valley which is covered with water when the river overflows during floods (SWRMP, 1995). Floods are extreme events or actions of nature, in which the flow of water cannot be contained within the banks of rivers and or retention areas. As a result, it overflows into areas with human settlements, infrastructure facilities and economic activities. Floods become a Disaster when such area become exposed to the hazard without adequate warning and or without means of taking defensive actions and the community suffers loss of life, assets, livelihood and environmental security.

Flooding is associated with seasons such as winter, summer, autumn or spring (Smith & Ward, 1998). Some 30 - 35% of total land surface is flooded every year during the wet monsoon (Hossain, Islam, & Saha, 1987). The frequency of floods is growing, with catastrophic "once in a generation" floods occurring regularly. There have been, at least, 10 major floods between 1974 and 2010, many of which are considered by hydrologists to be of size expected only once in every 20 years (Pender, 2008).

Types of floods

Categorisations of floods vary and are based on a combination of the sources, nature, causes and impacts associated with them. From such combinations, floods can be generally classified, among others, as river or fluvial floods, tidal or coastal floods, flash floods and urban floods (Jha, 2012). Coastal or tidal floods arise from incursion by the ocean or by sea water. They result from

an unexpected relative increase in sea level caused by storm surges or a tsunami. Thus, storms with high wind speeds cause tall and powerful waves, but low pressure fronts cause sea levels to rise above normal levels, creating a dome of water which may be forced towards the land, inundating the coastal zones (Bariweni et al., 2012). This is often sudden and presents a significant danger to life. It is often possible to forecast, with reasonable accuracy, this type of flooding due to the predictability of the tide and trackability of low pressure systems (Dance & Hynes, 1980).

Another type of flood is the flash flooding. According to the U.S. National Weather Service (2006), flash flood is a rapid and extreme flow of high water into a normally dry area. World Meteorological Organisation (2007) defines it as a flood of short duration with a relatively high peak discharge. Flash floods are typically caused by torrential rainfall, but can also occur from a dam break. Urban flash flooding is a serious and increasingly common problem as cities grow and sprawl. Impervious surfaces like concrete or compacted soils create instant high energy runoff from heavy rainfall that can inundate roads and buildings (Jha, 2012). These have been common in urban areas. These types of floods are much devastating and common in many cities, and most cities in the developing countries are worst affected by this type of floods.

Blockages of water courses and flood channels by settlements may also lead to rising water levels. The excess water overflows the banks of the watercourse and spills out into adjacent, low-lying floodplain areas (Jha, 2012). This form of flood is the fluvial or river flood. Preventing this form of flood

demands channel modification to increase channel capacity and more sustainably, keeping human infrastructure away from stream banks and out of floodplains. The latter is the most cost effective means of managing flooding events.

Causes of floods

There are varying beliefs on the causes of flood. While some link it to human interventions which appear varied depending on the locality, others believe it is a natural incident. Floods are attributable to several causes which include natural ones like the geophysical location, topography of flood plain, prolonged and torrential rains and/or human induced ones such as space use and location of economic activities (Zhang, 2008).

There are two main discourses on causes of flood disasters. The first and dominant view is that flood disasters are inherently a characteristic of natural hazards (Dixit, 2003). Floods occur when the soil and vegetation capacity cannot absorb all the down pours allowing the water to run off the land in quantities that exceed stream channels. Floods described by White (1945) as an "act of God" can be caused by heavy rain or prolonged precipitation within a short period over a spatial unit. Floods such as tsunamis result from high tide conditions and increasing storm surges which create tidal waves driven into enclosed bays and batter the coast causing coastal floods (Smith & Ward, 1998).

According to Zhang (2008) and Action Aid (2005), human activities driven by socio-economic factors should be considered responsible for the recent increasing levels of flood risk. White (1945) stated that although humans have been victims of natural flooding, their presence and interventions near rivers and

flood plains contributes to the problem. Flood disasters are created by countless locational decisions of individuals that encourage settlement on and unregulated expansion into flood zones, intrinsic land use and economic development of flood plains (Smith & Ward, 1998).

Unexpected drainage obstructions due to human activities such as landslide, ice or debris can also cause slow flooding upstream of the obstruction (IFRC, 2007). Fast floods include flash floods resulting from convective precipitation (intense thunderstorm) or sudden release from an upstream impoundment created behind a dam. The number of times flood occurs in a given spatial unit within a given time is what is referred to as flood frequency. It could occur once or many times in a year.

According to Nelson (2003) floods occur when a stream discharge increases and oversteps its banks. The stream increases in its depth and width to accommodate the water flows into it from rainfall, tributary streams and underground water seeping into it. The discharge rate of a stream is the amount of water passing any point at a given time. As the amount of water in the stream increases, the stream adjusts its velocity and cross-sectional area in order to form a balance, thereby going beyond its normal channel boundaries (Nelson, 2003).

The velocity of flooding can be slow or fast depending on the frequency, seasonality and/or flood outline. The slow kinds of floods occur when runoff from sustained rainfall or rapid snow melts exceed the capacity of a river's channel to carry (Smith & Ward, 1998). River floods intensification is caused by drainage network and stream channels as rains increase within a spatial area over a short

period of time. It leads to rising levels of shallow basins probably due to very dry conditions (semi-arid conditions). Coastal floods are also called regional floods and they usually occur downstream when torrential rains force river levels to rise inundating large areas and causing widespread economic losses (Abbott, 2006). It can occur due to high tide conditions such as tidal waves and storm surges at the coast.

**Impact of Floods**

Regardless of their causes, floods have a profound effect on people and the economy. On an annual basis, floods leave over 3 million people homeless and affect the personal and economic fortunes of another 60 million people (WCD, 2000). Severe cyclones and floods cause widespread devastation and generate sensational images for months or even years after their occurrence (WMO, 2007). In the 1990s, more than 90 per cent of those killed in disasters lost their lives in hydro meteorological events such as droughts, windstorms and floods, but floods accounted for more than two-thirds (IFRC, 2001). Floods are the most frequently occurring events that affect both rural and urban settlements (Jha et al., 2012).

According to the EM-DAT global disaster database (OFDA/CRED, 2011), between 1985 and 2009, floods were the most common natural disasters accounting for 40 per cent of all natural disasters. Floods, irrespective of the type, impact on people, infrastructure and family assets. In 2010, reported flood disasters killed over 8,000 people directly worldwide (Jha, 2012). Two-thirds of direct deaths from flood events are caused by drowning and one-third by physical

trauma, heart attack, electrocution, carbon monoxide poisoning or fire (Jonkman & Kelman, 2005 as cited in Jha, 2012). The release of contaminants poses serious public health risks for survivors of floods. Flood waters can mix with raw sewage and thus dramatically increase the incidence of water-borne diseases. Such contaminated flood waters eventually contaminate the affected community's drinking water, bringing about death from water related diseases such as diarrhoea and cholera (Kunii et. al., 2002).

Fast flowing floodwaters are also capable of washing away entire buildings and communities. In January 2011, floods in South-Eastern Brazil rendered about 100,000 people homeless and destroyed key infrastructures (Jha, 2012). The economic losses associated with floods cannot be overlooked. The estimated costs and losses in the 2010 flood in Lomé were about $15.5 million in the social sector and $19 million on infrastructure (Amankwah-Ayaeh & Caputo, 2011 as cited in Jha, 2012). The damages and impacts floods exert on human settlements are devastating; therefore, incorporating risk mitigation activities in all phases of disaster management including the response phase cannot be underestimated.

The most immediate impact of erratic rainfall on rural livelihoods is on crop production. Floods undermine farm yields and the national harvest, reducing household and national food availability and agricultural income derived from crop sales. Poor harvests threaten food security and livelihoods from household to national levels and to varying degrees according to the extent that the family or nation depends on agriculture for its food and income (Dorward & Kydd, 2002).

Households and economies that are more diversified are less vulnerable to these direct impacts of droughts and floods, provided that their alternative income sources are neither correlated with rainfall nor directly or indirectly dependent on agriculture (i.e., vulnerability falls to the extent that complementary sources of income and food are non-covariate).

In the longer term, Dorward and Kydd (2002) note that the presence of risk lowers the productivity of rural economies in three ways: (1) reducing returns to investment, (2) distorting investments away from income-maximizing toward risk-reducing activities, and (3) discouraging investment altogether, because returns are low and investors are risk averse. In these ways, weather risks contribute to underinvestment and, consequently, to long-run agricultural stagnation and rural poverty in countries that are dependent on rain-fed agriculture.

Flood-related mortality may lead to demographic changes. In developed countries, men and boys make up the majority of flood fatalities (Jonkman & Kelman, 2005b; Jonkman, 2009). The opposite is the case in developing countries, where women are more likely to die. Floods in developing countries, like natural disasters in general, kill more women than men, and at an earlier age than men (Neumayer & Plumper, 2007). In both developing and developed countries, children and the elderly are disproportionately at risk in floods (Sommer & Mosley, 1972; Bern et al., 1993; Chowdhury et al., 1993; Jonkman & Kelman, 2005b; Telford et al., 2006; Pradhan et al., 2007; Jonkman et al., 2009). Impacts on livelihoods may last for some time as floods may leave lands

waterlogged for several months. After the 2008 Kosi floods in India, land was waterlogged for an average of three months, and in the worst cases, four months (UNDP India, 2009). Land was waterlogged for many months after the 2000 Mozambique floods (Cosgrave et al., 2001) as well.

Storm surges can lead to ecological damage – from inundation or from the deposit of sand and silt (Szczuciński, 2006). Some of these ecosystem damages may directly affect livelihoods (Ramachandran et al., 2005: 195). During the 2004 Indian Ocean tsunami, soils were inundated in the Andaman Islands, leading to salinity problems. However, very high rainfall (6,846 mm) in the following two years leached the salts from the soil, returning them almost to their pre-tsunami condition (Raja et al., 2009).

Evidence suggests that the danger of an epidemic after a flood may have been overstated. Watson et al. (2006) noted that natural disasters that do not result in displacement are rarely associated with an increased risk of epidemics. WHO (2006: 6) warned that while "the overall risk of communicable disease outbreaks is lower than often perceived, the risk of transmission of certain endemic and epidemic-prone diseases can increase following natural disasters". In their review of epidemics after natural disasters, Watson et al. (2007) identified displacement as the primary risk factor for outbreaks of epidemic diseases. This is in line with previous work on both natural disasters and complex emergencies (CDC et al., 1992; Toole, 1997; Toole & Waldman, 1997). Watson et al. (2006) noted that post disaster communicable disease incidence is related more closely to the

characteristics of the displaced population (size, health status, and living conditions) than to the precipitating event.

Kabba, Kenneth and James (2013) argued that severe storms can also inflict considerable damage on valuable economic trees such as mango, orange, coconut, banana, kola trees and oil palm. Such trees provide valuable food and income for many households, and the trees often take several years to recover from the damage and become productive once again. A further impact of severe storms is that people who are affected often become traumatized and fear not having enough food to eat. They also worry over loss of important possessions such as their homes, clothing, other household items and economic trees (Action Aid International, 2006). Farmers commonly transplant their rice seedlings from upland nurseries to their mangrove swamps in mid-July, but newly transplanted rice seedlings are increasingly rotting because of floods and silt deposited in the cultivated swamps.

Flooding perpetuates poverty since no form of profitable economic activity can be undertaken at this time. Artisanal diamond and gold mining, farming and petty trading either come to a complete standstill or become seriously constrained. At the same time, clean water for domestic use often becomes contaminated leading to water shortages, waterborne diseases and mosquito infestation (Kabba et al, 2013).

Floods may destroy crops that may be ready for harvest (ZVAC, 2009), may increase starvation (Armah et al., 2010), influence land-use changes and increase the desire to migrate (Ongwenyi et al., 1993) and have impacts on

agricultural wages (Armah et al., 2010; Banerjee, 2005). It is obvious that extreme floods can have impacts on agricultural production and food security (HDRO, 2007; Toole, 2002). In fact, agriculture is the major source of food security in many deprived communities. Floods can affect agriculture by causing changes in soil fertility, by reducing crop yields or land productivity, damaging and destroying crops, increasing disease burdens, declining household incomes, destroying agricultural lands on which people depend for livelihoods as well as impacting the development of water resources (ADAS, 2007; Armah et al., 2010; McGuigan et al., 2002; Mirza, 2003; Nunes et al., 2010; Toole, 2002).

In some African countries including Ghana, Kenya, Mozambique, Namibia, Zambia and Zimbabwe, specifically in Mozambique, floods caused a loss of at least one third of maize (which is a stable food) production and loss of 80% of cattle (WSWS, 2001 in Mirza, 2003). It also destroyed large proportions of crop lands. A similar situation was observed in 2006, when floods destroyed an estimate of 40,000 hectares of maize cropland in Mozambique (SADC, 2006). Cases of destroyed croplands were also reported in Angola and Malawi. According to McGuigan et al. (2002), farmers risk losing crops as the floods usually occur during the harvesting season. In Bangladesh, both positive and negative effects of floods on agriculture were identified. A study conducted by Banerjee (2005) revealed that floods can have a positive impact on agricultural wages in Bangladesh and may also cause a decline in the districts that are inundated. Similarly, a study conducted in Kenya revealed that flood control may release large areas of land (over 40,000 ha) for annual cultivation, which can have

a positive influence on the agricultural income to almost three times (Ongwenyi et al., 1993). In Niger, flooding was experienced in 2009, and it killed 3,650 livestock (USAID, 2006).

The flood disaster experienced in Namibia in 2008 impacted agriculture in such a way that 63,637 livestock were lost while 150,000 hectares of agricultural land was destroyed (OPM, 2008). In fact, floods can cause inundation of agricultural lands. During the floods experienced in 2009, grazing lands in some parts of Ohangwena Region were inundated by water, and large numbers of livestock (i.e. cattle, sheep, donkeys and goats) were lost (FEMCO, 2009; Hiyalwa, 2009). It was reported that a total of 1,656 farmers in Ohangwena Region lost their grain baskets (grain storages) while a total of 5,671 farmers' crop fields were totally destroyed by floods that were experienced in 2009 (FEMCO, 2009). In total, 10,117 hectares of crop fields were destroyed in Ohangwena Region during that period. Such a disaster left approximately 22,544 people in Ohangwena Region in critical need of food relief.

**Adaptation**

Changes in weather conditions in recent years have required adapting locally to these new patterns and associated problems. Past experience is crucial in building greater resilience to erratic weather changes which can have a significant impact on household livelihoods, sustainability and survival. Although many settlements in developing countries lack the required capacity to deal effectively with the impacts of weather changes (de Haen, 2007), their inhabitants

nevertheless often demonstrate some useful adaptation strategies (Intergovernmental Panel on Climate Change, 2007).

Adaptation is the adjustment of natural and human systems in response to the actual or expected climate stimuli or effects. In addition, Zakieldeen in his vulnerability assessment to climate change for Sudan maintains that adaptation involves individuals or households changing processes or practices either automatically or in a planned way (Zakieldeen, 2009). Traditional knowledge is particularly important in adapting livelihood strategies to changing weather patterns (United Nations Framework Convention on Climate Change Secretariat 2006a, 2006b, 2007a, 2007b). Two categories of local adaptation mechanisms that residents use to build their resilience were social and environmental coping strategies. It, however, conforms with the findings of Oriandi and Zakieldeen (2006) and Zakieldeen (2009) which showed that adaptation depends on access to assets such as human, social and natural resources (Oriandi & Zakieldeen, 2006; Zakieldeen, 2009).

**Flood Management**

Flood management includes activities that prevent floods, reduce the probability of a flood or lessen the damaging effects of unavoidable floods. Until about the middle of the last century, the approach to floods was mainly flood control, such as building levees, dams and local protection works. White (1945) proposed a fundamentally different approach, namely human adjustment to floods. This approach was further elaborated by Hoyt and Langbein (1955). The contemporary approach is one of considering all feasible methods to yield an

optimal cost-effective strategy for a specific flood situation, compatible with the policies, priorities and funds available to a governing agency.

Brian, Burrel, Kersi and Robert (2007) argued that alternative mitigation measures for an identified flood hazard should be evaluated in terms of feasibility (technical capability, available funding, cost-benefit analysis), suitability and environmental consequences. Flood impacts on the local area and on the entire watershed need to be considered when evaluating alternative courses of action. Exposure to a flood hazard creates risk, the magnitude of which is a function of the vulnerability of the built and natural environments to harm. Risk assessment consists of evaluating the probability of a hazardous event causing a certain amount of damage or a statement of the economic impact resulting from such an event (Koch, 2000).

Kumar et al. (2001) identified a need to strengthen floodplain management and flood hazard mitigation at the community level by increasing public awareness of the flood hazard and by building community resilience to floods by facilitating building relocation, flood proofing and investments that strengthen economic, human and social capacity. Flood risk maps must be kept accurate and up to date while associated policies and programs concerning floodplain land use are monitored and enforced. Kumar et al. (2001) recommended economic instruments for flood risk management. These include user taxes, flood insurance, and the user pays principle. Furthermore, it was recommended that flood warning and forecasting services should remain an important component of flood-hazard-

mitigation strategy and, in conjunction, that hydrometric data collection should be strengthened.

Davar et al. (1998; cited in Brian, Burrel, Kersi & Robert, 2007) presented some basic precepts with respect to flood damage reduction and summarised them as follows: potential risks and associated net costs (benefits minus damages), the extent of an action should relate to the severity of the problem and the capability to lessen the problem, flood damage reduction measures should benefit people and, thus, be for the public good whereas flood damage reduction strategies are based on equity; that is, a system of rules based on fairness and a well-founded, reasonable exercise of authority.

Cheng (2005) stated that the essentials of flood risk management involve balancing flood-risk related interests among communities and between humans and nature by means of integrated measures of legislation, administration, economic measures, education and engineering. Abramovitz et al. (2002) suggested that targeted natural resource management has a potential for disaster mitigation and adaptation strategies due to reductions in vulnerability, biodiversity conservation and the greater carbon sink capacity. These flood-risk-related interests are important in understanding the direction and tolerance of future strategic adjustments.

Richardson (2002) stated that designing and planning for flood alleviation and management means assessing future probabilities of inherently unpredictable events, and that unpredictability is increased by the uncertainties of future climate change. He further stated that engineers and others involved in designing projects

need to be aware of the guidance that has been provided as the basis of an appropriate precautionary response to predicted climatic change. Olsen et al. (2000) presented a dynamic model of floodplain management to address changing conditions, including land-use changes, channel modifications, economic development and climate change and variability. This dynamic approach permits zoning, levee construction, and making of other decisions sequentially, rather than exclusively at the present. The dynamic model is formulated as a Markov decision process. A single-floodplain, single-objective and stationary model can be extended to include multiple floodplains, non-stationary and multiple objectives (Olsen et al., 2000).

**Vulnerability**

The concept of vulnerability emerged within development debates in the 1990s (Chambers, 1994) and has also been applied in the area of hazard preparedness engineering based research and projects (Adger, 2006). It has been applied to a wide range of challenges including food insecurity (Sen, 1981; Yaro, 2004) as well as disaster (Wisner, 2004; Cutter *et al.*, 2003) and livelihood and poverty (Chambers & Conway, 1992) assessments and climate vulnerability (Midgeley *et al.*, 2011; Abson *et al.*, 2012; Ericksen *et al.*, 2011). Vulnerability research has largely evolved from three academic communities: development and food security (Chambers, 1989; Watts & Bohle, 1993; Bohle et al., 1994; Ellis, 2000; FAO, 2001; Dilley & Boudreau, 2001), natural hazards (Wisner, 1993; Hillhorst & Bankoff, 2003; Pelling, 2003; Wisner et al., 2004) and climate change (Burton, 1997; Handmer et al., 1999; Klein & Nicholls, 1999; Leichenko &

O'Brien, 2002; IPCC, 2001; and Downing & Patwardhan, 2003). There is a variety of definitions for vulnerability, with no consensus among scholars on what vulnerability is.

In the social sciences, vulnerability usually concerns the socio-economic factors that determine people's ability to cope with stress or change (Pelling, 2003). It is, therefore, a state of any individual, group or community and is defined in terms of their ability to cope with and adapt to any external stress placed on their livelihoods and well-being (Adger & Kelly, 1999). Vulnerability to food insecurity can be defined in terms of exposure, capacity and potentiality, where these three terms are shorthand, respectively, for the risks associated with: exposure to stress and crises, inadequate capacity to cope with stress and the severe consequences of stress and the related risk of slow recovery (Watts & Bohle, 1993). Here, capacity is the most important determinant of vulnerability and should be at the centre of all policy-relevant analysis of vulnerability (Adger & Kelly, 1999).

According to Manyena (2006), vulnerability in this context is described as social vulnerability and physical vulnerability, which represent the human dimension and non-human-involved ecological and environmental fragility, respectively. However, because of the slow onset and "hidden" nature of some hazards, some definitions, especially those that relate to vulnerability to climate change, do not define explicitly the dimensions of exposure, sensitivity and resilience. For example, Adger and Kelly (1999) describe vulnerability to climate

change in terms of poverty, inequality and institutional adaptation, all of which are intrinsically linked to the political economy of markets and institutions.

Vulnerability is usually portrayed in negative terms as the susceptibility to be harmed. The central idea of the often-cited IPCC definition (McCarthy et al., 2001) is that vulnerability is the degree to which a system is susceptible to and is unable to cope with adverse effects (of climate change). In all formulations, the key parameters of vulnerability are the stress to which a system is exposed, its sensitivity, and its adaptive capacity. Vulnerability can also be defined as the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard. The concept is relative and dynamic. Vulnerability is most often associated with poverty, but it can also arise when people are isolated, insecure and defenceless in the face of risk, shock or stress (IFRC, 2013).

This thesis adopts the IPCC definition of vulnerability (to climate change) as the degree to which an environmental or social system is susceptible to and unable to cope with adverse effects of climate change, including climate variability and extremes (IPCC, 2007). This allows broad conceptualisation of the extent to which farming communities and households are unable to withstand the negative impacts of climate variability on livelihoods, allowing the identification of the various adaptive capacities of such communities and households. Scholars working on livelihoods and vulnerability, such as Chambers (1989), Watts and Bohle (1993), distinguish between the external and internal side of vulnerability. The external side relates to the stress that a system or individual is exposed to

while the internal side refers to a lack of inherent ability to cope and recover from a stress or hazard (Birkmann, 2006; Füssel & Klein, 2006).

Discussions of vulnerability include the capacity of the system to withstand the threat posed by changing environmental patterns (Moser, 1998). Therefore, Moser (1998) links vulnerability to asset ownership, as well as the entitlement that the household or community can command in the face of exposure. Hence, communities or households that have fewer assets are more vulnerable compared to those that can command more assets in the face of drought-related crisis such as floods (Moser, 1998). Thus, a system that is vulnerable to climate variability will demonstrate a high sensitivity to modest climate stress and is constrained in its capacity to adapt to such harmful effects (Lioubimtseva & Henebry, 2009).

Central to the interpretation and understanding of vulnerability is the idea of resilience of social-ecological systems (Miller *et al.*, 2010). Though resilience and vulnerability are closely related, care should be taken not to confuse resilience as a flip side of vulnerability (Gallopín, 2006). According to Walker *et al.* (2006), resilience refers to the ability of a system to withstand shocks in order to maintain its structure and identity. Social resilience refers to the capacity of a social group or community to withstand socio-political as well as environmental stresses (Adger, 2000). Fraser (2006) argues that where a seemingly large disturbance causes a relatively small shift in a system's original state, then such a system may be productive resilient. Resilience is defined in this research as situations where major changes and variability in the climate (such as floods)

result in an insignificant loss of crop yield in a particular farming community (Simelton *et al.*, 2009).

All research traditions struggle to find suitable metrics for vulnerability. Vulnerability is a dynamic phenomenon often in a continuous state that shape local conditions; the ability to cope are, themselves, dynamic (O'Brien et al., 2005). The measurement of vulnerability must, therefore, reflect social processes as well as material outcomes within systems that appear complicated and with many linkages that are difficult to pin down. Vulnerability is, thus, not easily reduced to a single metric and not easily quantifiable. While it is easy to recognise, personally, the feeling of vulnerability and perhaps grasp the outcome of vulnerability of others in a similar situation, the translation of this complex set of parameters into a quantitative metric, in many ways, reduces its impact and hides its complexity (Alwang et al., 2001).

**Risk, hazards and shocks**

Risk can be the likelihood of occurrence of a condition of loss or the degree of probability of loss. It is seen as the likelihood of occurrence of an exogenous adverse effect or potentially non-exogenous event such as disability and old age, funerals and others linked to life circles (Farrington, Slater & Holmes, 2004; Siegel & Alwang, 1999). Arguing in relation to Devereux (2001), risk and uncertainty can result in loss of welfare. Risk is analysed based on the exposure and susceptibility to vulnerability conditions.

Risk and the susceptibility of households or farmers come from different sources which include: production risk, which is the likelihood of potential loss

from production due to floods, droughts, pests and diseases; shifts in season and loss of soil fertility among others. Credit risk is the probability of default in servicing loans by smallholder farmers, untimely access to loans. With income risk, income fluctuations are associated with the year to year output and price fluctuations. These situations result from the predominance of rain-fed agriculture and the impact of climate variability and labour risk – farm labour abundance or scarcity at the peak or off seasons. The incidence of diseases can also bring decline in the productivity of labour especially during rainy seasons where malaria incidence is high.

The term hazard has been broadly defined as a condition or event that may cause great harm to humans and their welfare (Downing et al., 2001; Helm, 1996; Jones & Boer, 2003). This includes tropical cyclones, droughts, floods or conditions leading to any outbreak of disease-causing organisms (Jones & Boer, 2003, cited in Brooks, 2003). In the climate change literature, the term "hazard" refers specifically to physical manifestations of climate variability or change such as droughts, floods, storms, episodes of heavy rainfall, long-term changes in the mean values of climatic variables, potential future shifts in climatic regimes and so on (Brooks, 2003). In the disaster risk reduction (DRR) literature, a hazard is referred to as a potentially damaging physical event, phenomenon or human activity, which may cause loss of lives or injury, property damage, social and economic disruption or environmental degradation (Twigg, 2004; UN/ISDR, 2004).

According to the United Nations International Strategy for Disaster Reduction (UN/ISDR), "hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydro meteorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity, frequency and probability" (UN/ISDR, 2004 p34).

The term "hazard" has been defined differently in various researches in both physical and social sciences. The commonest characterisation of a hazard is some form of threat (Cutter, 1993; Blaikie et al., 1994; Smith 2001; Odeh, 2002). Hazards are best viewed as naturally occurring or human-induced processes or events with the potential to create losses. That is, a hazard is a general source of future danger (Smith, 2004). To Blaikie et al. (1994) as well, hazards refer to the extreme natural events which may affect different places singly or in combination at different times

For this research, the definition of hazard would embody that of Smith, (2004) and Blaikie et al., (1994). Thus, a hazard is an extreme natural or human induced event which affects different places singularly or in combination at different times and has the potential to create losses. This definition is used because a hazard could occur at different places maybe at the same time or different times and has the potential to create losses.

**Disaster Mitigation and Preparedness**

What the philosopher John Stuart Mill referred to as Nature's harvest of injustice, ruin and death – droughts, earthquakes, epidemics and storms – shows no sign of abating. On the contrary, changes in global weather patterns and the degrading of the environment mean that such calamities are increasing in terms of frequency, complexity, scope and destructive capacity (Barry, 2007). Mitigation and preparedness are, therefore, among the answers to these calamities.

Social scientists, emergency managers and public policy makers generally organise both research and guidance around four phases of disaster loss reduction: mitigation, preparedness, response and recovery. According to the National Research Council (NRC, 2006), the core topics of hazards and disaster research include: hazards research, which focuses on pre-disaster hazard vulnerability analysis and mitigation and disaster research, which focuses on post-disaster emergency response and recovery. Preparedness intersects with both of these two areas, serving as a temporal connector between the pre-impact and post-impact phases of a disaster event.

The Capability Assessment for Readiness (CAR), which was developed by Federal Emergency Management Agency (FEMA) and the National Emergency Management Association (NEMA) of the United States of America, identifies thirteen elements that should be addressed by states in their preparedness efforts. These elements are Laws and Authorities; hazard identification and risk assessment; hazard mitigation; resource management; direction, control and coordination; communications and warning; operations and procedure; logistics

and facilities; training, exercises, evaluations and corrective action; crisis communications; public education and information, finance and administration (FEMA, 2003).

Mitigation and preparedness are sometimes conflated with one another (as they are in the list above), but they are intertwined in practice. For instance, activities, programs, and systems developed and implemented prior to a disaster/emergency are used to support and enhance mitigation as a response to and recovery from disaster/emergencies (NFPA, 2004).

The Federal Emergency Management Agency (FEMA) defines preparedness as the leadership, training, readiness and exercise support, and technical and financial assistance to strengthen citizens, communities, state, local, and tribal governments as well as professional emergency workers as they prepare for disasters, mitigate the effects of disasters, respond to community needs after a disaster and launch effective recovery efforts (FEMA, 2003).

These definitions make reference to mitigation, but disaster scholars and emergency management professionals generally define mitigation as actions that are taken well in advance of disasters that are designed either to avoid or reduce disaster-related damage. Mitigation measures include appropriate land-use and coastal zone management practices, mandatory and voluntary building codes and other long-term loss reduction efforts. In some cases, mitigation can also include moving neighbourhoods and communities to other locations in order to avoid future losses. Mitigation activities can take the form of specific projects, such as elevating homes for flood protection, as well as process-related activities, such as

hazard and vulnerability analyses, that are designed to lead to future mitigative actions. However, some discussions, such as those cited above, also use the term "mitigation" to refer to actions taken after an event occurs that are designed to contain impacts so that they do not become more severe. In this sense, some would see efforts to contain an oil spill as a mitigative measure, even though spill containment is commonly thought of as an element in oil spill emergency response.

In providing additional clarification, the National Research Council of America report states that hazard mitigation consists of practices that are executed before impact and provide passive protection at the time impact happens. In contrast, emergency preparedness practices involve the development of plans and procedures, the recruitment and training of staff and the procurement of facilities, equipment and materials needed to provide active protection during emergency response (NRC, 2006).

There are a few activities discussed in the disaster literature that appear to span both mitigation and preparedness phases. One example is the development of warning systems, evacuation plans, disaster communications and public education, which some sources (USACE, 2000; Waugh, 2000) view as mitigative because such practices must be implemented long before a hazardous event. As systems or plans, they serve as passive protection to support emergency response and recovery. At the same time, warning systems and plans can also be seen as a key element in disaster preparedness since part of being prepared involves knowing how to respond when warnings are issued.

Preparedness is typically understood as consisting of measures that enable different units of analyses: individuals, households, organisations, communities, and societies to respond effectively and recover more quickly when disasters strike. Preparedness efforts also aim at ensuring that the resources necessary for responding effectively in the event of a disaster are in place and that those faced with having to respond know how to use those resources. The activities that are commonly associated with disaster preparedness include developing planning processes to ensure readiness, formulating disaster plans, stockpiling resources necessary for effective response and developing skills and competencies to ensure effective performance of disaster-related tasks (Sutton & Tierney, 2006).

Preparedness has a variety of dimensions that are, in turn, supported by a number of activities. Dimensions of preparedness consist of the various goals or end-states that preparedness seeks to achieve while activities are concrete actions that need to be taken in order to meet those goals **(**Sutton & Tierney, 2006). All preparedness activities must be based on knowledge about hazards, the likelihood of different types of disaster events and likely impacts on the natural and built environment, households, organisations, community institutions and communities.

The types of information that provide a focus for preparedness activities include the potential for detrimental impacts of the hazards on health and safety, continuity of operations and government, critical facilities and infrastructure, delivery of services, the environment, economic and financial conditions and regulatory and contractual obligations. Community-based disaster scenarios also provide a solid basis for preparedness efforts.

The National Research Council (NRC) report highlights the importance of both emergency preparedness and disaster recovery preparedness and emphasises that response and recovery preparedness involves distinct sets of activities. Emergency preparedness provides short-term solutions during an emergency response that will support the longer term efforts of disaster recovery. Disaster recovery preparedness practices involve participating in activities and gathering materials needed to provide rapid and equitable disaster recovery after an incident no longer poses an impending threat to health and safety (NRC, 2006). Recognising that the immediate post-disaster emergency period is not the time to begin developing disaster recovery strategies; the city of Los Angeles has included a recovery and reconstruction element in its emergency operations plan. One key resource for disaster recovery preparedness is the hazard insurance, designed to provide financial protection from economic losses caused by a disaster event (NRC, 2006).

The resource management dimension of preparedness is closely tied to the planning dimension; in that, plans commonly involve strategies for resource sharing such as mutual aid agreements. Included in the concept of resources are human, material and information sources of support. Skilled and well-trained personnel and staff constitute critical resources. Communication resources are critical for all response activities at all levels of analysis, although communications media can vary from low-tech to very high-tech. Disaster response tasks such as evacuation and other self-protective measures, search and rescue, emergency medical care, fire suppression, debris removal, emergency

transportation, security and credentialing and response coordination have specific resource and logistical requirements that must be taken into account during the planning process.

Preparedness for communications and warning include the development of a communications plan, the establishment of a warning system including developing protocols and procedures, regular testing and support and addressing the interoperability of multiple responding organisations and personnel. The resource dimension also includes efforts designed for mobilising resources to continue with operations when key resources are destroyed. Businesses and communities must prepare for the possibility that an alternate facility, in addition to the primary facility, will be needed for recovery and resumption of services following a disaster event. Emergency preparedness for a community may include an alternate emergency operations centre, efforts to introduce redundancy into key response systems and procedures to locate, acquire, store and test back-up resources. Protecting the health and safety of family members, vulnerable populations, employees and customers as well as community members is a top priority during an emergency or disaster.

Mitigation and preparedness for disasters is critical for households, businesses and communities, but many remain unprepared. Recent disasters serve to highlight the need for individual responsibility, local coordination and continuity plans to ensure the ability of households to respond to and recover from major events. The household is the smallest unit of analysis for preparedness. A household may consist of an individual, a family of two or more,

extended families, single parents with children, persons who are co-residing in a single residential unit or even those who are transient. Just as every disaster is local, preparedness begins in the home with some simple steps that can be taken to improve life safety, property protection and survival from hazardous events (Tierney, 2005).

Households vary in many ways that are important for understanding both disaster vulnerability and disaster preparedness. For households, vulnerability is associated with income, education, ethnicity, age and linguistic isolation. Factors such as income influence access to safe housing options and to insurance. Other axes of stratification play a role in making households either more or less vulnerable or better or less well prepared (Lindell, & Perry, 2005; Tierney, 2005).

**Adaptation and Coping Strategies**

Adaptation and coping do not only differ in terms of timescale, but also in terms of action and strategy. Coping strategies are those that are possible within the current institutional settings (Birkmann, 2011) while adaptation strategies imply activities with longer term implications more likely to involve more fundamental changes in the type of livelihood activity or location (Nelson, Lamboll, & Arendse, 2008). For coping with floods, people take immediate steps to survive and support their families.

In the quest for survival, societies essentially have to develop mechanisms to deal with climate change, adjusting to its impacts and reducing greenhouse gas emissions (mitigation); thereby, reducing the rate and magnitude of climate

change. Adaptation includes adjustments to moderate harm or benefit from current climate variability as well as anticipated climate change.

Effective adaptation strategies imply reducing present and future vulnerability to climate change and include coping strategies or changes in practices and processes in the light of a perceived climatic change. Such actions can be taken by individuals, households, governments and other stakeholders. Adaptation may include policy measures that reduce vulnerability and enhance adaptive capacity or the ability of people and systems to adjust to climate change.

Adaptation can be a specific action, such as a farmer switching from one crop variety to another that is better suited to anticipate conditions. It can be a systemic change such as diversifying rural livelihoods as a hedge against risks from variability and extremes. It can be an institutional reform such as revising ownership and user rights for land and water to create incentives for better resource management. The process of adaptation includes learning about risks, evaluating response options, creating the conditions that enable adaptation, mobilizing resources, implementing adaptations and revising choices with new learning (Nelson et al., 2010).

Specific adaptation measures may differ from sector to sector depending on its anticipated incremental benefits in terms of climate change and environmental and sustainable development. In Ghana, for example, farmers who are experiencing changes in productivity have been adapting to it in their own diverse ways. Examples of some of the measures employed are diversification of crops and livestock as well as the management practices, planting and

conservation of trees, application of chemical fertilizers, outmigration of people etc.

These kinds of adaptive measures, though targeted at increasing reliance of affected people to climate change, is still perceived as reactionary; hence, cannot effectively address impacts that are anticipated in the future. To be able to strategize and fully adapt to the future impacts of climate change, societies must plan ahead on how to deal with the impact without compromising on their socio-economic needs. Adaptation activities can be of different types, from the purely technological (such as sea defence construction), through behavioural (such as shifts in choice of food or recreation) to managerial (such as changes in farming methods) and policy (such as planning regulations) (Nelson et. al., 2010).

Coping strategies

A livelihood strategy is the combination of assets and activities that are required for making a living (Ellis, 1998). A livelihood strategy is often times used interchangeably with coping strategy. However, the latter is a mechanism adopted during crisis while the former represents the strategies people usually adopt in living (DFID, 2000). Scoones (2009) postulates two main coping strategies adopted by the poor: livelihood diversification and migration.

Scoones (2009) intimated the following check questions in analysing livelihood strategies. The first is whether there is a sequence which supposes that a successful livelihood strategy usually should have a starting point and whether one capital asset can be substituted for the other. The second has to do with whether a cluster of assets one had was related to a particular livelihood strategy.

Finally, whether there were tradeoffs faced by people pursuing different livelihood strategies (Scoones, 2009; DFID, 2000).

Corbett (1988) classifies the strategies into precautionary strategies – the strategies that households use in response to repeated exposure to the same type of non-acute risk and crisis strategies to cope with an unusually severe threat to food security. A key argument in coping strategy literature is the sequence in which households take certain strategies according to levels of distress. Watts (1983) suggests that households do not respond arbitrarily to a food crisis for which they are in some sense conceptually prepared; rather, they do so serially, with respect to the intensity of what one might call famine signals. Watts (1983) observed nine most common coping responses in the following sequence: collect borrow grain from kin, sell labor power (migration), engage in dry season farming (migration), sell small livestock, borrow grain or money from merchants/ moneylenders, sell domestic assets, pledge farmland, sell farmland and migrate permanently.

Rahmato (1987) suggests that the elements of famine survival as a result of floods disaster may be grouped into four sequential series of activities. In the first stage of this sequence, households would cope with a risk to their livelihood by austerity and reduced food consumption. At the same time, there would be increased reliance on loans and transfers of food and assets within and between families. Temporary migration in search of wage employment formed the second stage. Once these options had been exhausted, farmers would rely on investment, but this is selective and gradual and the exact sequence in which assets were sold

or mortgaged depends, to a large extent, on current market conditions. The fourth and terminal stage of these strategies was crisis migration, and the decision to resort to this was often taken at a community as well as a household level.

According to Dorward et al (2005), livelihood coping strategies can be categorised into three, relating to the purpose for which it is being adopted. The categorisation consists of the following: the "Hanging In" strategy, where livelihood activities are taken to maintain livelihood levels, often in the face of adverse socio-economic circumstances; the "Stepping Up" strategy, where current activities are engaged in with investments to expand these activities in order to increase production and income to improve livelihoods – the accumulation of productive livestock for example and the **"**Stepping Out" strategy, where existing activities are engaged in to accumulate assets which, in time, can provide a base or launch pad for moving into different activities that have initial investment requirements leading to higher and/or more stable returns – for example accumulation of livestock as savings which can then be sold to finance children's education (investing in the next generation), the purchase of vehicles or buildings (for transport or retail activities), migration or social or political contacts and advancement.

**The Concept of Food Security**

Food security has been defined in many different ways at various times and by different authors and institutions. The most widely accepted definition of food security at the individual level is that of the World Bank: Secure access by all people at all times to enough food for a healthy, active life (Stevens et al

2000). This definition seems to include the three important elements that are widely agreed to be necessary for food security and which are the guarantee (availability) of having access (accessibility) to enough food (utilisation) at any given time. The World Food Summit (Global Education, 2007) defined food security as follows: When all people at all times have both physical and economic access to sufficient food to meet their dietary needs in order to lead a healthy and productive life. This definition also touched on all the elements of food security but has specifically included the two different ways of gaining access to the needed food: physically and economically.

Hubbard (1995) and Lado (2001) give definitions of food security that agree with the above: People should have the economic right to be physically able to obtain the food they need to be healthy and active wherever they acquire it and however it is provided. These definitions indicate that people should be confident that adequate food will be available at all times. The definition by Santorum and Gray (1993) is rather different from the above and states that food security implies accessibility at all times for all groups of the population to food of sufficient quality and quantity as to meet their nutritional needs. This definition, however, does not clearly indicate how all population groups can actually enjoy the physical and economic condition that guarantees access to the food.

Putting it differently, Sanchez et al. (2005) define food insecurity as a term relating to the condition that exists when people do not have physical and economical access to sufficient, safe, nutritious and culturally acceptable food to meet their dietary needs to lead an active and healthy life. To Sanchez et al.

(2005), access to food is closely related to poverty and lack of economic growth. That is, the poor usually do not have adequate means to gain access to food in the required quantities.

In conclusion, on the basis of the above discussion, food security can be defined as all groups of people having the physical and the economic means to have access, at all times, to food of sufficient quantity and quality to meet their nutritional needs. This description means that as food becomes available, people have the means to obtain it at all times and to use it to their benefit.

**Components or Dimensions of Food Security**

Food security can be classified into different components according to the factors that determine it. Food security consists of four components: availability, accessibility, utilisation and vulnerability (FAO, 2012). This description correlates with the World Bank's definition of food security: "secure access (accessibility) by all people (vulnerability) at all times (availability) to enough food for a healthy, active life (utilisation)". Stevens (2000), among others, addresses the components as sets of factors that determine food security. However, this evaluation addresses food security in terms of food components.

Food availability may mean that enough food is available for an active healthy life. Food and Nutrition Technical Assistance (FANTA) (2006) defines food security as sufficient quantities of appropriate, necessary types of food from domestic production, commercial imports or donors, which are consistently available or in reasonable proximity to individuals. Madziakapita, Abifarin and Asante (2004) regard food availability as the physical availability of food in the

proximity of the household, while Tweeten and McClelland (1997) view it as the supply of food present from production, imports or stocks. Simply put, it could be the provision of a sufficient supply of food for all people at all times. Thus, food can be available to a household or a nation through own production, purchase from the markets or food aid.

Runge, Senauer, Pardey, and Rosegrant (2003) discovered that today's supply of food is more than enough for everyone but the problem lies in the general food availability linked to that of distribution. Problems of distribution may be caused by lack of transportation, inefficient market structure, political instability and war. Thus, food availability is a necessity; but, that is not sufficient to ensure food security for a household without access (Benson, 2004).

Food accessibility refers to the manner in which people acquire food. Tweeten and McClelland (1997) point out that food accessibility is the effective demand to acquire available food from earnings or as transfers from others. The problem may be caused by people's inability to access food, even if they have the means to pay for it. They may experience difficulties caused by markets, war, infrastructure and floods. According to Runge et al (2003), people lack access to food because of war, inadequate income and political disadvantage. Food production does not equate to food security, according to Benson (2004). Benson adds that food may be on the fields or in the markets but if families cannot afford to acquire it, they are food insecure. Hungry people have been seen in supermarkets and filled granaries.

Sanchez et al (2005) add that people go hungry despite an abundant world food supply because they cannot obtain food of sufficient quantity or quality because of poverty. FANTA (2006) describes food accessibility as when individuals have adequate incomes or other resources to purchase or barter to obtain the levels of appropriate foods needed to maintain consumption of an adequate diet and nutritional level. An individual may have access to food by growing it, buying it or receiving it as a gift from other people.

The degree to which individuals have access to sufficient food, even within a household, may vary according to sex, age or labour contribution criteria (Benson, 2004). For the urban household, sufficient income is required to acquire food in the markets. For the rural household, however, productive resources are required, together with sufficient labour and tools and the necessary income, to acquire the food that they are not able to produce. Tweeten and McClelland (1997) conclude that while food availability highlights the supply of food at the national level and production and inventory at the farm level, food accessibility highlights the effective demand and purchasing power of consumers.

Food utilisation, according to Tweeten and McClelland (1997), refers to the human body actually making use of the nutrients in food that is consumed, properly digested and absorbed. Food utilisation happens when food is properly used. This, according to FANTA (2006), occurs when there are proper food processing and storage practices, adequate knowledge and application of nutrition and child care and adequate health and sanitation services.

Madziakapita et al (2004) look at it as the actual consumption of food of sufficient quality and quantity to provide adequate energy and nutrients to members of households. In this case, food security concerns the quality and the nutritional value of the available food. Benson (2004) states that to enjoy productive, healthy and active lives (adequate utilisation), all people require sufficient and balanced levels of carbohydrates, protein, fat or calories, vitamins, and mineral fibre in their diets. One of the objectives of the EU's Food Aid Programme is to raise the standard of nutrition of the recipient population and help it obtain a balanced diet (European Commission, 2000).

Food security, therefore, does not simply mean the availability and accessibility of food, but of food that is acceptable, eatable and nutritive. Members of a household or individuals facing deficiencies or other imbalances in diet because of lack of access to the food necessary for a balanced diet are not food secure. Ideally, food security means that all people at all times utilise sufficient quality and quantity of food necessary for an active and healthy life. People experience food insecurity even when food is available and accessible; they may have poor health, poor care and personal preferences and fail to consume and absorb adequate nutrients, with negative nutritional consequences.

**Conceptual Framework**

This framework looks at the complexity of people's livelihoods, especially the livelihoods of the poor, whether they are in rural or urban areas. It seeks to understand the various dimensions of a person's livelihood, the strategies and objectives pursued and the associated opportunities and constraints. There are

various ways of conceptualising the components of a livelihood and the influences upon it, and this is demonstrated to show the variables and their interconnections (Ellis, 2000).

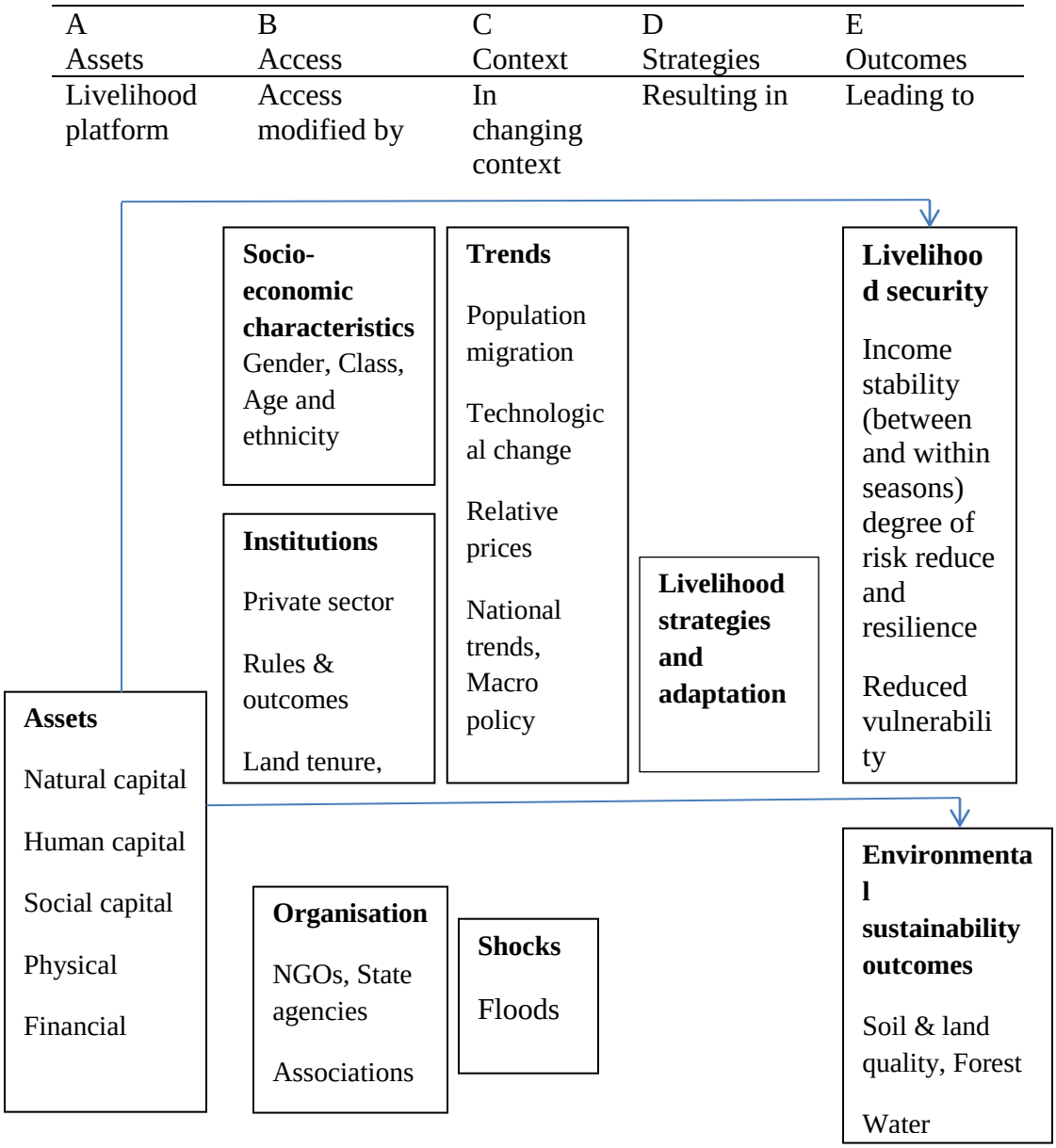


**Figure 4: Conceptual framework**

Source: Adopted from Ellis (2000)

Livelihood strategies

The livelihood strategies and activities of farmers are often complex and diverse. For rural farmers, agriculture and other natural resource-based activities

play an important role, but rural farmers also diversify into other activities. Some of these are linked to agriculture and the natural resources sector while others are not. Strategies may include subsistence production or production for the market, participation in labour markets or labouring in the home. Strategies can come from the perspective of an individual or from the perspective of a household although there are problems with treating the "household" as a unified decision-making unit pursuing a joint strategy with common goals. Poor people usually employ a mix of different "strategies", especially when resources are to some extent pooled. A relatively unified "household" will obviously be able to employ a wider range of strategies than an individual acting alone.

Livelihood outcomes (column E)

In the framework presented, the outcomes of livelihood strategies are divided between the effects on livelihood security and the effects on environmental sustainability. Whilst improved access to livelihood assets and the outcome of greater livelihood security (especially higher incomes, more stable incomes and reduced risk) are usually important objectives in rural livelihood strategies, environmental sustainability may or may not be an objective. That is why in the livelihood framework, the latter is usually labelled along with livelihood security as an outcome variable rather than as an objective.

Livelihood security

Income level is obviously important to people, but to poor people, income stability and risk avoidance may be as important, if not more so. Also, income in the livelihood security box does not just refer to monetary income but to incomes

in kind such as the food produced by smallholder farmers for home consumption. Seasonality refers to the fact that many rural livelihood strategies (especially in agriculture) result in seasonal fluctuations in income. This affects livelihood security, and people usually try to reduce seasonal income fluctuations or their vulnerability to them (Ellis, 2000). Whilst rural people may seek improvements across a wide range of livelihood outcomes, the need to prioritise may force them to make undesirable trade-offs between them, at least, in the short term.

The objective of those wishing to promote sustainable livelihoods is to minimise trade-offs and to maximise complementarities. Over the longer term, the variables in the "livelihood security" box, the "environmental sustainability" box, and the "livelihood assets" box can act positively on each other, provided that the appropriate livelihood strategies are adopted. For example, better access to environmental capital may improve access to financial capital and physical capital. Likewise, greater income stability and lower risk may lead to higher aggregate income in the long term by reducing the probability of having to sell off productive assets in times of crisis or by enhancing the returns to individual assets. Such interactions are important in the increasing attention given by policy-makers to interactions between "social protection" (social transfers and safety nets) and development (Elis, 2000).

Livelihood assets (column A)

All livelihood strategies depend upon access to assets of some kind or other, whether such access involves private ownership or other forms of access. In the livelihood framework, assets are conventionally divided into the following:

natural capital, physical capital, human capital, financial capital and social capital. In conventional economics, such assets are usually known as factors of production and are typically subdivided into land (natural capital), labour (human capital) and capital (physical and financial capital). Conventional economics does not have a social capital category, and precisely what social capital consists of is open to debate. More broadly, social capital may refer to the ability to access and use to advantage socially constructed rules, organisations or relationships (these are also referred to as "institutions"). The use of the term, "capital", implies that it can serve productive ends. However, the institutions that enhance one person's productivity may constrain or diminish the productivity of others (Ellis, 2000).

Access to assets - key influences (column B)

Livelihood assets are something from which people derive a flow of income or consumption. They are also things people invest in so as to increase future flows of income/consumption. Better access to assets is a desirable outcome of any livelihood strategy. Livelihood strategies may focus on increasing the range of assets to which a person or household has access or increasing access to particular types of capital. The ultimate objective of these investment strategies is to improve long-term livelihood security and quality of life, more generally.

On the whole, the more assets someone has the less vulnerable they are to the various shocks and trends outlined earlier. Shocks can wipe out assets very suddenly if they are not protected and adverse trends can result in their being gradually eroded if livelihoods are not able to adapt to change. How effective an individual asset is in providing security will depend upon contextual factors such

as the functioning of markets, social relations and others. These factors influence, not only, what can be achieved with assets, but the access people have to them in the first place (Ellis, 2000).

This category of influences comes under a variety of different headings such as "transforming structures and processes" (Carney, 1998) or "Policies, Institutions and processes" (a more recent classification). This study adopts the classification used by Ellis (2000) and based on the following: social relations, institutions and organisations. It should be fairly clear that all of the listed items can affect an individual's access to assets, although precisely how will obviously depend upon the situation being examined.

Livelihood context (column C)

Another important influence on livelihood strategies is exposure to various trends and shocks. They represent, respectively, gradual and sudden change. In the "shocks" box, one might also add prices since these can also change fairly suddenly. Besides, trends in a community or country may be made up of increasing or decreasing shocks affecting individual people or livelihoods (for example, increasing morbidity and mortality from floods may be a trend in a community but the onset of flood is a shock to those directly affected by it). These trends and shocks are sometimes known in livelihood analyses as the vulnerability context, suggesting that the changes thus represented have potentially harmful effects (Ellis, 2000).

It is worth bearing in mind, however, that some of the trends listed here do offer opportunities as well as act as potential threats (e.g. technological change

and national economic trends). Exposure to change can have a direct influence on livelihoods by weakening them, strengthening them or forcing a new direction. They can also influence livelihood strategies in a slightly less direct way, when people, anticipating the potential impact of trends and shocks, design their livelihood strategies in a way that helps them manage their exposure to sudden or gradual change and cope better with the potentially harmful effects of such a change.

**Concluding remarks**

As with any abstract model, the livelihood framework is not entirely free of ambiguity, especially in relation to what is put in the various "boxes" and the relationship the boxes have with each other. For example, the category of "social relations" overlaps to some extent with "social capital" in the "assets" box. Nevertheless, what the framework does offer is a way of conceptualising, in a simplified way, the complexity of rural livelihoods and the different variables that shape activities, objectives and outcomes. Moreover, it is worth noting that participation is central to the livelihoods approach. The livelihoods framework offers a conceptualisation that can help outsiders work together with the poor to identify the priorities of the poor and the associated opportunities and constraints.

Finally, the more assets any household has access to, the less vulnerable they will be to the negative effects of the trends and shocks described above or seasonality and the more secure their livelihoods will be. Often, increasing one type of capital will lead to an increase in other amounts of capital. For example, as people become educated (increase in human capital), they may get better jobs

which earn more money (increase in financial capital). This, in turn, means that they are able to upgrade their home and facilities (increase in physical capital). Sometimes, however, one form of capital decreases as another increase. This could be true, for example, where a person or household sells their land to migrate to a city.

# CHAPTER THREE

# EMPIRICAL ISSUES

## Introduction

This chapter deals with the empirical issues on the impact of floods on crop production. The livelihood coping and adaptation strategies to flood disaster are also reviewed. Finally, the chapter reviewed empirical evidence on the challenges associated with the adaptation strategies and the lessons learned.

## Impact of Flooding on Crop Production and Livelihoods

In 2015, Mirza, Tanvir, Shofiul and Syed conducted a study on coping with flood and riverbank erosion caused by climate change, using livelihood resources in Sirajganj district of the Rajshahi Division in Bangladesh. The study was to identify which coping strategies and which livelihood resources were used in response to flood and erosion and to judge how effective these strategies were. Participatory Rapid Appraisal tools were used to collect data through a structured questionnaire survey. Key Informants Interview (KII) and Focus Group Discussion (FGD) were the two Participatory Rapid Appraisal (PRA) tools that were used to collect the field data. The data were processed by CRiSTAL software and analysed by Rep IV software.

The results of the study indicate that floods have a very high potential to turn into a disaster. The following major impacts of floods were identified: crop damage, spread of water-borne diseases, loss of land (including agricultural and non-agricultural land), loss of settlement and loss of income. Due to these impacts, people were subjected to both material and social difficulties. The

scarcity of employment opportunities was the single most important impact in the post-disaster period in the study area (Mirza et al., 2015). Moreover, in general, there were reductions in assets, savings and income, and in worst cases, people lost their family members. Other impacts include the paucity of safe sanitation facilities as well as access to drinking water. It was also found that a proportional relationship existed between economic conditions and social status; thus, the economic situation of rich families worsened, leading to some family members losing their social value in the community.

The results further supported the fact that people left their homes, and often, this displacement brought a major change in the structure of the low-income families. It was also reported that violence increased within the family and although this seldom led to divorce, in some cases, men abandoned their families and ran away to cities for their own betterment. Other important negative ramifications in the study area include loss of privacy that results in insecurity for women and children (Mirza et al., 2015).

However, the study revealed immediate coping strategies households adapted to survive the impact of the floods. Family members first tried to build a safe shelter and manage food and drinking water. Then the income-generating members of the family explored the availability of small-scale income-generating activities (IGAs). It was found that low-income-generating families involved their women and children in IGAs, which was not seen in high-income-generating families. One main type of IGA was daily labour to cope with the disasters, followed by other IGAs such as small-scale fishing, small-scale businesses and

rearing of domestic animals. The number of daily labourers increased and the wage of labor decreased in the post disaster period. Therefore, it was very common for the affected people during the post-disaster situation to be engaged in more than one IGA on a part-time basis since a single IGA could not provide enough revenue to support the whole family (Mirza et al., 2015).

In another study, Kabba, Kenneth and James (2013) focused on coping with the impacts of weather changes in five rural settlements in Kambia and Kono Districts of Sierra Leone. The study examined the perceptions of rural dwellers to the impacts of weather changes and the local strategies used in response to these weather changes in rural settlements in Sierra Leone. The study design was exploratory and involved the following steps: determination of study sites, site visits prior to data collection, determination of the most appropriate language to use for the research, the use of facilitated group discussions during data collection and recording of relevant responses from respondents on flip charts during the group discussions. The data collected for this study were analysed using a simple qualitative technique to reveal an understanding of rural dwellers' perceptions of the impacts of weather changes.

Informal discussions with people during field-based survey indicated that the farmers in rural areas did not have a scientific understanding of the causes of weather changes affecting their communities. However, they were well aware of the consequences which these changes had on their lives and their attempts at adapting to these changes (Magrath, 2010).

The study also indicated that a change in the pattern of rainfall was realised over the years; rains suddenly started in March or April instead of the normal time in May. Farmers could not burn their rice farms as usual and were, sometimes, forced to abandon their brushed upland rice farms because of earlier and heavy rains. It was, also, revealed that most inland valley swamps (IVS) were usually flooded and could not be cultivated due to early rains, and this adversely affected food production and well-being. Even the crops that grew were often prone to attack by insects and pests whose population was seen to be flourishing under high temperature conditions (Kabba et al., 2013).

Additionally, the study results indicated that declines in crop yields were reported to correlate closely with rural peoples' earnings. Farmers in the study maintained that the higher their annual crop yields, the higher their incomes and purchasing power. Good crop yields also lead to greater income security which assured them of being able to afford their basic needs, and they could also hire labour or engage in any economic activity that benefited their households. With higher yields, farmers were more able to increase their productive power. The study revealed that since 2000, farmers experienced a decline in rice yields in years characterised by erratic floods. For example, field data revealed that about 70 percent of participants in Kono District were affected by low crop yields.

Although it may seem unbelievable respondents observed an increased in immorality during times of insecure rural livelihoods. For example, the field study revealed a close relationship between prostitution or unfaithful marriage relationships and rural livelihood insecurity. About 48 percent of participants,

especially household heads and females, made claims that were similar to the following: Young girls and wives apparently engage in secret love relationships for money with relatively wealthy community people. Most times, such clandestine relationships were a recipe for domestic violence, broken relationships and suffering for women and children. More cases of crime and prostitution were reported, especially during years when the store of food for domestic use was either insufficient or threatened because of less rain and prolonged dry periods (Kabba et al., 2013).

Similarly, Fabusoro, Omotayo, Apantaku and Okuneye (2010) conducted a study on forms and determinants of rural livelihood diversification in Ogun State, Nigeria. The simple random and purposive sampling techniques were employed in the study to sample 320 people. Data were collected using a semi-structured interview guide and a focus group discussion guide. The data generated were subjected to hierarchical regression, which ascertained the independent contribution of socioeconomic factors. The result from the study indicated that households would never leave farming even if they made very high income from other sources.

The study also revealed that women in all the study locations dominated trading in different forms. Local trade provided employment opportunities for about 22 percent of the sample, of which 14 percent were involved in it all year round. Like other livelihood activities, it provided daily income as the respondents took advantage of nearby market opportunities such as commodity

markets, nearby schools or institutions, motor parks, major roads and construction sites among others (Faburoso et al., 2010).

Local formal employment involved wage employment within the community. This accounted for livelihoods among 11 percent of the sample. Of these, 10 percent were employed all year round on a permanent basis while the remaining (0.62%) were employed during the off-season. This employment provided regular monthly income for participants and assisted in meeting basic household needs. Some of the respondents' view was that local formal employment gave them assurance of income "rain or shine" even if there was crop failure (Faburoso et al., 2010).

Ijigah and Akinyemi (2015), also, did an empirical study on flood disaster in Kaduna, Nigeria. The objective of their study was to examine the causative factors and preventive measures of floods. The research design was both quantitative and qualitative. The study area was stratified into twenty-three local government areas, out of which five were randomly selected for the study. The relative index, significant index, frequency and percentages were used to rank the descriptive data. Coded broad sheets were, thereafter, used for extracting data from the returned questionnaires. The data collected were analysed using SPSS 19 (Statistical Product for Service Solutions) with the mean score used to achieve the stated objectives.

The result of the study showed that floods damaged the roots of crops which were ranked first, having Relative Index (RI) of 4.53. The reason for this is attributed to the fact that roots of crops are usually not more than 3cm deep. This

could be easily washed away by flooding. Farmland was ranked second among the extent of flood damage, having RII of 4.40. Controlling flooding on a farmland is not an easy task, but excess run off water can be slowed down and stored on the land to improve absorption by loosening the soil and creating a rough soil surface after harvest. This is left for as long as possible to allow water to soak in rather than run off. Residential buildings were ranked third under the extent of flood damage, having RII of 4.23. Whether the flood resulted from a storm surge, is a riverine flooding or an urban flooding, the physical forces of the flood water which acts on the structure were classified into three load cases. These load cases are hydrostatics, hydrodynamic and impact loads (Ijigah & Akinyemi, 2015).

The study further indicated that poor drainage with RII of 4.70 was ranked first among the factors that caused flood on crops, farmland and residential buildings. The effect of poor drainage was cracking of concrete, retaining walls, fences and foundation (Ijigah & Ainyemi, 2015). Next in rank among the factors that caused flooding was heavy rainfall with RII of 4.60. Rainfall in Kaduna metropolis is seasonal, with August and September having the highest frequency of occurrence. Heavy downpour usually affected crops, farmland and residential buildings during this period. The third in the rank is improper waste disposal, having an RI of 4.40. Improper waste disposal leads to wearing off of the soil and flooding. Erosion was ranked forth having an RI of 3.95 among these factors (Ijigah & Ainyemi, 2015).

**Lessons Learnt from the Review of Related Literature**

The number of flood disasters is growing (Parker et al., 2007: 3), driven by: changes to catchments (such as deforestation or urbanisation) that lead to increased run-off; population growth in areas at risk of flooding and climate change which increases the variability and severity of the weather, such as record-breaking rainfall and possibly more severe tropical cyclones. All of these factors suggest that the number of flood disasters is likely to keep increasing.

Irrespective of the type of flood, there are two key considerations: speed and duration. Storm surges and tsunamis arise almost instantaneously but generally have a short duration. Flash floods rise quickly but also fall quickly. Drainage-line floods can rise slowly but last for a long time. All types of floods can cause sustained damage to livelihoods, either through the immediate damage and loss of life or through the damage caused by prolonged inundation (Parker et al., 2007).

Of the lessons identified during this review, the following were identified as the most important, relevant to flooding and broadly applicable. Some more general lessons (regarding cash transfers, for example) have been included to reflect their importance in current humanitarian debates. Many lessons that apply to other types of humanitarian response, whether it is the need for coordination or consultation with the affected population, also apply to floods. What makes floods different is that their impact may be long term, either through sustained waterlogging or through the impact that they have on livelihoods.

A World Bank review of lessons learned on flood disasters states that "the most immediate needs following a flood are for a safe water supply, food, shelter, and medical care" (IEG, 2010: 3). Even though the basic pattern of needs is clear, a great deal of effort often goes into overly detailed and poorly coordinated needs assessment (ACAPS, 2012; Darcy et al., 2013) that yields little new information. Needs assessment is often given a great deal of prominence in the early stages of a disaster response even though the results of formal assessments are often marginal to the decisions taken (Darcy & Hofmann, 2003). Poole and Primrose (2010) found that the most powerful influence on donor ability to fund in accordance with needs is not necessarily ultimately the availability of evidence.

An ALNAP study on the quality and use of evidence in humanitarian action found that the evidence from needs assessments is often only one of the several factors that influence decisions (Knox & Darcy, 2014). An evaluation of the role of needs assessment in the 2004 Indian Ocean tsunami response (de Ville de Goyet & Moriniere, 2006) found that initial needs assessments were effectively based on international satellite coverage, and that "humanitarian assessments intending to influence decisions widely were largely too late" (ibid.: 25).

If an agency is already familiar with the capacities of a flood-affected community, with the likely impacts of flooding, a needs assessment can be limited to identifying (1) the affected areas and the extent to which they are affected and (2) the scale of the response by other actors (Cosgrave, 2009). This was what happened in Sri Lanka after the 2004 Indian Ocean tsunami, where organisations

familiar with the context launched response activities rather than making formal assessments (De Goyet & Moriniere, 2006).

Moreover, when deciding whether to intervene, agencies should consider how long their engagement is likely to last. The impact of a flood can last for a considerable time. Even when a flood is of short duration, such as a storm surge or tsunami, its impact – the consequences of the loss of assets, shelter and livelihoods and the deaths of economically active household members – can endure for many years. This makes floods a significant disruption to the development narrative of any group. In some types of natural disasters such as drought, floods affect urban as well as rural livelihoods. Floods (in all their forms) are growing more frequent (Parker et al., 2007) and, in some cases, reaching unprecedented size and impact, such as the Thai floods of 2011 (Komori et al., 2012).

Additionally, while the engagement of the community and of local authorities is often identified as a critical factor in humanitarian action, it is of particular relevance in flood relief operations. That is because of the long-term nature of many flood impacts and because many of the measures required for effective risk reduction require intervention by the local authorities. In Sri Lanka, for example, a Red Cross community-based health project was very thorough in its approach to working with the local authority and was regarded by local officials as being more sustainable (Bang et al., 2008). One challenge for local engagement is the turnover of aid personnel. An evaluation by MedAir considered that staff turnover may have affected working relations with local authorities

among others (Lee, 2005). It also noted the tension arising from the NGO's desire for independence and the local authority's desire for control of the project (ibid.: 19). Given the long-term nature of flood impacts, agencies need to engage closely with local authorities to be able to advocate for the most vulnerable and for sustainable policies. Agencies need to be aware that local authorities have their own agenda and may be pulled in different directions by different stakeholders.

Equally, there is a natural tension between speed and sustainability in humanitarian response. This is particularly relevant in flooding due to the sustained nature of the flooding itself, where waterlogging or the impact of the flooding lasts several months. Responses need to avoid two traps: delaying action while seeking a perfect solution (Bhattacharjee et al., 2005) and committing to action that is later revealed to be unsustainable. This tension between speed and sustainability applies not only to humanitarian responses, but also to the broader aspects of planning in urban environments, where there is a need to balance day-to-day demands against long-term strategy (Jha, Bloch et al., 2012). The lesson here is that agencies should engage in effective consultation to ensure that their actions are as sustainable as possible. As a Red Cross review of recovery operations noted, taking adequate time at the beginning to consult with the affected population and other stakeholders can make things go faster later and can improve the quality of the outcomes (IFRC, 2006).

Community-level disaster preparedness planning that begins immediately after the relief phase reduces post-disaster anxiety (SCF, 2005). The most important precondition to ensure that DP activities are sustainable is to improve

linkages between the activities and local government planning processes (DipECHO, 2004). Support for mitigation activities is required but the focus should be broadened to include nonstructural measures; for example, supporting livelihood-related endeavors as a means of mitigating future disasters. Even the best performing communities will require a minimum level of follow-up support and guidance.

# CHAPTER FOUR

# RESEARCH METHODS

## Introduction

Research methodology provides the philosophical framework and the fundamental assumptions that relate to the entire process of research and equips the researcher with the necessary procedures and tools needed to evaluate theories and propositions and review the work of others (van Manen, 1990). In addition, it describes the gaps and how the entire research is to be conducted and then structures the most appropriate strategy for data collection and analysis and drawing logical and valid conclusions (Kumekpor, 2003; Panneerselvam, 2010).

This chapter describes the methodology that was used in conducting the study. It covers the study area, research design, study design, target population, data sources, data collection methods, sampling procedure, research instruments, pre-testing and data analysis. It also outlines the ethical considerations of research.

## Study Area

The study was conducted in the Upper East Region of Ghana. The Upper East Region, historically, is part of what used to be the Upper Region (Upper East and Upper West), which was itself carved out of the Northern Region on 1st July 1960. The Upper Region was later divided into Upper East and Upper West in 1983, during the regime of the Provisional National Defence Council (PNDC). The Upper East Region is located in the north-eastern corner of the country, between longitude $0^0$ and $1^0$ West and latitudes $10^0$ 30"N and $11^0$ N. It is

bordered to the north by Burkina Faso, the east by the Republic of Togo and the west and south by the Upper West and Northern Regions of Ghana respectively as shown in figure 5. The land is relatively flat with a few hills to the East and southeast. The total land area is about 8,842 sq km, which translates into 2.7 percent of the total land area of the country (GSS, 2013).

About eighty percent of the economically active population engages in agriculture. The main foodstuffs produced are millet, guinea-corn, maize, groundnut, beans, sorghum, tomatoes and onions. Livestock and poultry production are also prominent. There are two main irrigation projects, the Vea Project in Bolgatanga covering 850 hectares and the Tono Project in Navrongo covering 2,490 hectares. Altogether, the two irrigation projects provide employment to about 6,000 small-scale farmers. Other water-retaining structures (dams and dugouts) provide water for both domestic and agricultural purposes. The study was conducted in two districts (Talensi and Builsa South) of the Upper East Region because these districts are more prone to annual flood disasters in the region (NADMO, 2008).

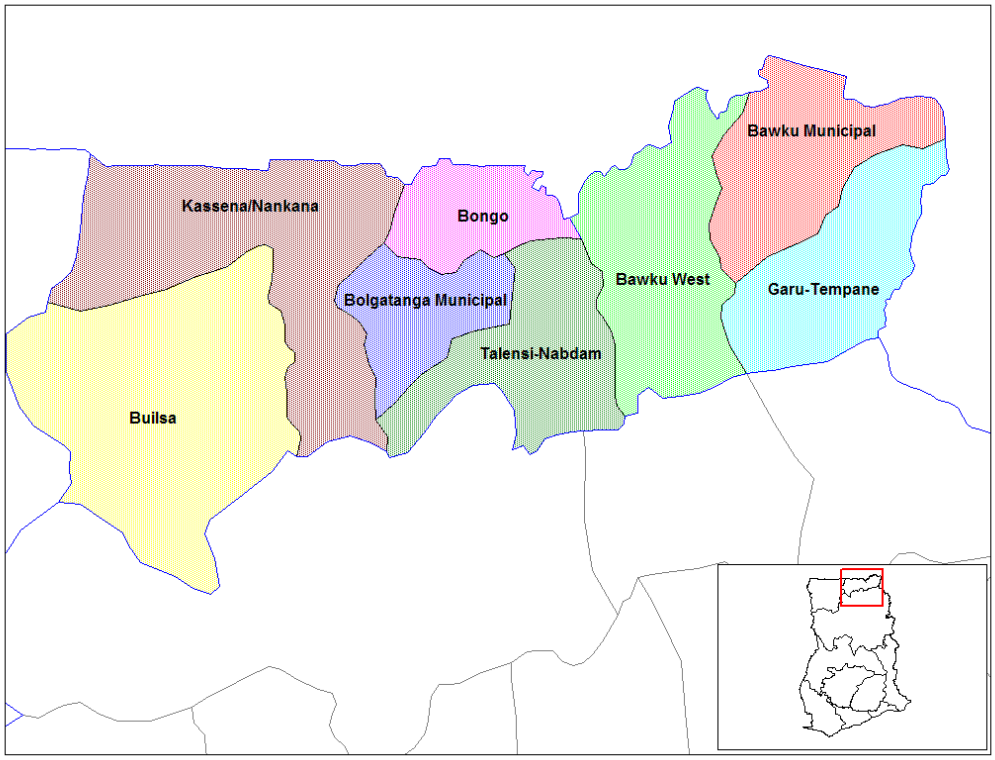


**Figure 5: Map of Upper East Region**

Source: Ghana Statistical Service, GIS (2014)

**Builsa South District**

The Builsa South District was created on 7th June 2012, and was carved out of the then Builsa District. The district is one of the four that were created in the region in 2012 that brought the total number of districts in the region to thirteen. It has Fumbisi as its administrative capital. The Legislative Instrument that mandated its establishment is the Local Government Act, 1993 (Act 462) of 2012 is (LI 2104). Builsa South District lies between longitudes $1^0$ 05' West and 10 35' West and latitudes $10^0$ 20' North and$10^0$ 50' North of the equator. The district shares boundaries with the Builsa North district to the north, Mamprugu Moagduri District in the Northern Region to the South, West Mamprusi District to

the west and the Sisala East District in the Upper West Region to the east (GSS, 2010).

The population of Builsa South District, according to the 2010 Population and Housing Census, is 36,514 representing 3.5 per cent of the region's total population. Males constitute 49.6 per cent and females represent 50.4 per cent. 100 per cent of the population lives in rural localities. The district has a sex ratio of 98.3. The population of the district is youthful (under 15 years) (40.7%) depicting a broad base population pyramid which tapers off with a small number of elderly persons 60 years and above (9.0%). The total age dependency ratio for the District is 88.6. Of the employed population, about 81.0 percent are engaged in agricultural, forestry and fishery work; 7.0 percent in craft and related trade and 6.5 percent in service and sales. About 3.0 percent are engaged as managers, professionals and technicians.

**Socioeconomic Activities**

The people are predominantly small holders growing a range of rain-fed food crops. The main food crops are cereals (maize, rice, sorghum, millet) and pulses (cowpea and groundnuts). The people are also engaged in livestock and poultry production. Livestock reared in the district include cattle, sheep, goats, guinea fowls and fowls, turkeys, ducks, pigs and donkeys. The agricultural sector employs about 96.0 percent of the population. It is well noted as the food basket of the region. The main farming systems are mixed farming and mixed cropping. Farming households have an average of 1ha around the dwelling places and with 2ha of bush farms which can be up to 6km from dwelling house. Though there is

only one rainy season in a year, most of the farmers also engage in dry season farming. The methods of cultivation are the hand hoe, animal traction and tractor tillage. The most predominant is the hand hoe.

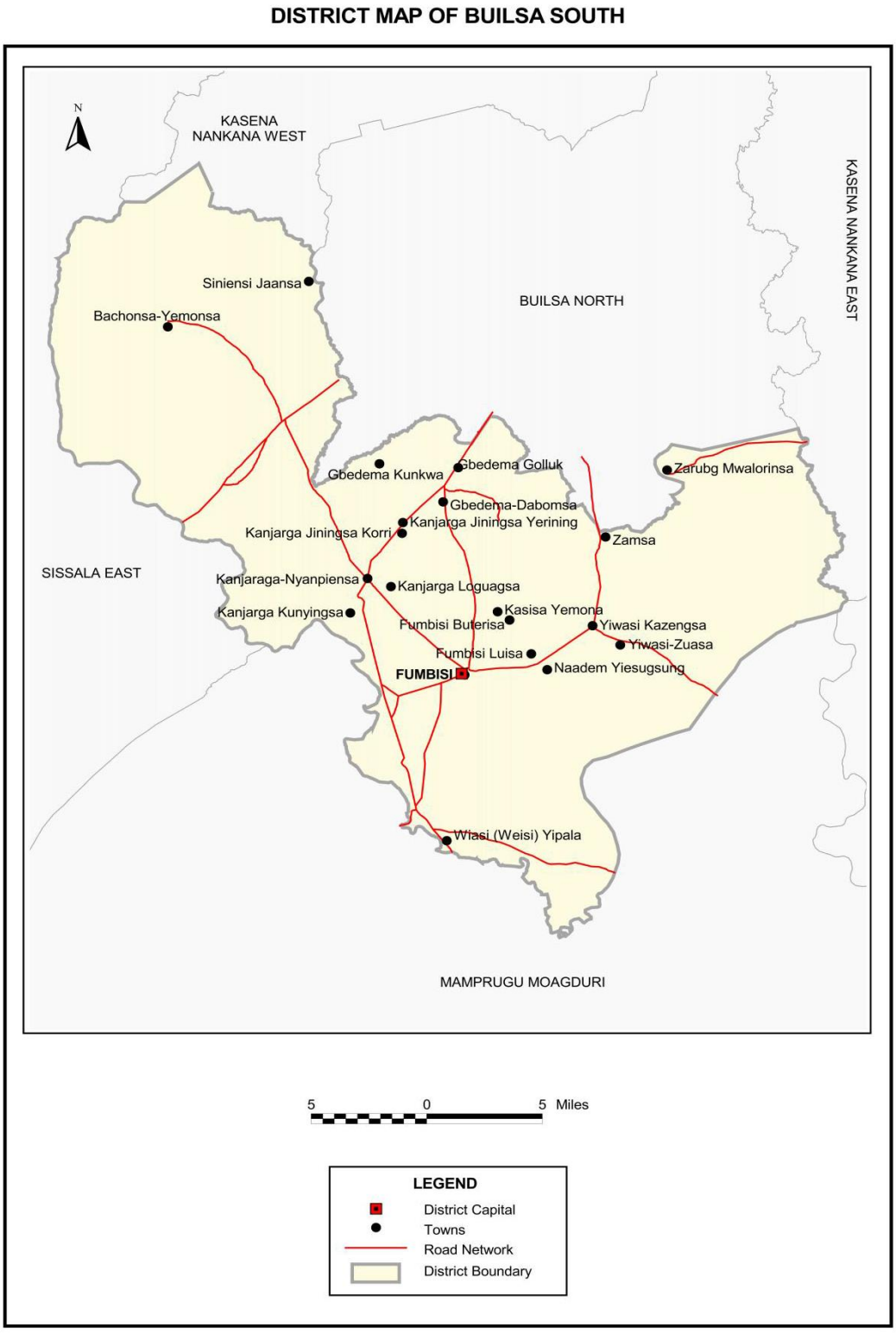


**Figure 6: Map of Builsa South District**

Source: Ghana Statistical Service, GIS (2014)

**Talensi District**

The Talensi District Assembly came into existence after the Nabdam District was created out of the then Talensi Nabdam District in 2012. Talensi District Assembly was established by Local Government Establishment instrument 2012 (L.I.2110). It has its capital at Tongo. The district is bordered to the North by the Bolgatanga Municipality, to the south by the West and East Mamprusi Districts (both in the Northern Region), Kassena-Nankana District to the West and Nabdam District to the East. The district lies between latitude$10^0$ 15" and $10^0$'60" north of the equator and longitude $0^0$' 31" and $1^0$' 0.5" and west of the Greenwich meridian. It has a total land area of 912 km (GSS, 2010).

The population of Talensi District, according to the 2010 Population and Housing Census, is 81,194 representing 7.8 percent of the region's total population. Males constitute 49.7 percent and females represent 50.3 percent. Eighty-four percent of the population is rural. The district has a sex ratio of 101.2. The population of the district is youthful (41.2%) depicting a broad base population pyramid which tapers off with a small number of elderly persons (7.0%). The total age dependency ratio for the District is 99.0 percent with the age dependency ratio for males being higher (96.7%) than that of females (89.5%).

The main source of employment is crop production in which about 90 percent of the population attain their livelihood. Other activities undertaken by the people are livestock rearing, poultry production, fuel wood extraction, food processing, mining and tourism. The secondary sector, on the other hand, is dormant; this includes a tomato factory, cotton ginnery and two quarries.

**Socioeconomic Activities**

A total of 90.7 percent of the people in the district are engaged in agriculture. In the rural localities, eight out of ten households (83.7%) are agricultural households while in the urban localities, 15.5 percent of households are into agriculture. Most households in the district (96.5%) are involved in crop farming. Poultry (chicken) is the dominant animal reared in the district.

Crop farming, animal rearing and hunting are the main economic activities in the district. Agriculture is mainly rain fed and little irrigation, and serves as the main source of employment and account for 90.0 percent of local Gross Domestic Products (GDP). The main agricultural produce are groundnuts, sorghum, millet, rice and maize.

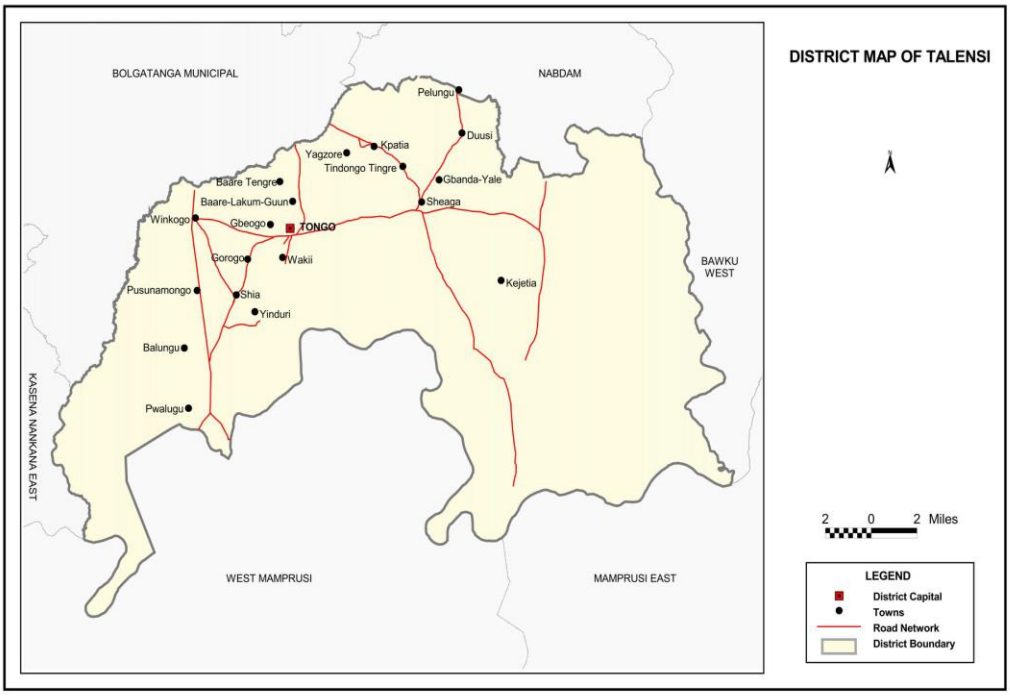


**Figure 7: Map of Talensi District**
Source: Ghana Statistical Service, 2010

## Research Design

Researchers are influenced by the epistemological position they hold which affects the way they examine issues and the methodologies they adopt to tackle those issues (Laughlin, 1995). This is because the underlying assumptions of each position have important implications for the way in which one attempts to investigate and obtain knowledge about the social world. Thus, different underlying assumptions are likely to incline researchers towards different methodologies (Crotty, 1998).

Research design is the programme that guides the investigator as he or she collects, analyses and interprets observations (Yin, 2011). It is a logical model of proof that allows the researcher to draw inferences concerning causal relations among the variables under investigation. In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. As such, the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. In their guidelines on research choices, M'cNeil and Chapman (2005) posit that there are no perfect solutions to any research approach, only a series of compromises. Panneerselvam (2010) observes that each design is governed by specific paradigms, and depending on the type of reality, the best-fitted method should be selected.

There are different theoretical perspectives that influence the structure, process and direction of social science research. This study adopted the concurrent mixed methods approach which is an approach to enquiry that

combines both qualitative and quantitative research assumptions (Creswell, 2003; Johnson & Onwuegbuzie, 2004; Zohrabi, 2013). This strategy permits the use of many approaches in answering research questions rather than limiting researchers' choices (Johnson & Onwuegbuzie, 2004).

In addition, investigators take a varied approach to method selection when conducting studies. Within this approach, the collection of both quantitative and qualitative data is simultaneous. Johnson and Onwuegbuzie (2004) hoped that the mixed method approach to research provided researchers with an alternative to believing that the quantitative and qualitative research approaches are incompatible and, in turn, their associated methods "cannot and should not be mixed" (p. 14).

One of the most advantageous characteristics of conducting mixed methods research is the possibility of triangulation; i.e., the use of several means (methods, data sources and probability sampling) to examine the same phenomenon. Triangulation allows one to identify aspects of a phenomenon more accurately by approaching it from different vantage points using different methods and techniques. Successful triangulation requires careful analysis of the type of information provided by each method, including its strengths and weaknesses (Babbie, 2005).

This gives a good reason for the study's attempt to use the multi-purpose strategy approach (triangulation), whereby a combination of focus group discussions, in-depth interviews and questionnaire administration methods were employed (Campbell & Fisk, 1959; Denzin, 1978). As has already been alluded

to, the study area (Talensi and Builsa South Districts in the Upper East Region) reveals the actions of multiple actors or stakeholders in the livelihood adaptation strategies of farmers to floods. Farmers, NADMO officials, agricultural extension officers and opinion leaders (Assemble members) are all operating within a milieu where they interact. Moreover, the various actors or stakeholders' attitude and perceptions in interpreting their social reality are critical in assessing their support for livelihood adaptation to floods initiatives.

This study also adopted the mixed methods because all the objectives primarily involved the collection of some kind of quantitative and qualitative data. In addition, this approach was utilised because it allows for mixing of methods that improved the validity and reliability of the data and their explanation (Zohrabi, 2013). Finally, this approach was proper for this study because it permitted the use of both statistical and non-statistical methods of analysis concurrently.

Although the use of mixed methods is generally thought to produce more valid and reliable results than the use of single methods, there are researchers who disagree. They argue that generalisations of this kind are unfounded and point to the fact that expanding the spectrum of methods employed to collect the data does not necessarily guarantee better results (Sarantakos, 1997). However, it is generally accepted that the number of methods that are most appropriated in each research design must be evaluated in the context of the project in question.

**Study Design**

The study employed a cross-sectional study design. A cross-sectional study is a design in which a group of subjects are selected from a defined population and contacted at a single point in time. On the basis of the information obtained from the subjects at that point in time, they are then classified as having or not having the attribute of interest. It, also, aimed at determining the frequency of a particular attribute, such as a specific exposure, disaster or any other risk-related event, in a defined population at a particular point in time (Bryman & Bell, 2007). In some instances, cross-sectional surveys attempt to go further than just providing information on the frequency of the attribute of interest in the study population by collecting information on both the attribute of interest and potential risk factors (Creswell, 2007).

The study adopted this design because it was useful in assessing practices, attitudes, knowledge and beliefs of a population (farmers) in relation to a particular problem such as livelihood adaptation strategies of farmers to flood disaster. The results from the cross-sectional design will not only give an indication of the magnitude of the problem in a particular population at a particular point in time, but also provide a basis for designing appropriate interventions to mitigate the problem. Cross-sectional surveys are relatively easy and economical to conduct and are particularly useful for investigating exposures that are fixed characteristics of individuals, such as households and families. No follow-up is required in cross-sectional studies; it provides a good picture of the

needs of the population at a particular point in time and can be used to investigate multiple exposures and multiple outcomes at a particular point in time.

On the other hand, the term descriptive study design refers to the type of research question, design, and data analysis that will be applied to a given topic. Descriptive designs, primarily concerned with finding out "what is", might be applied to investigate the question, what have been the reactions of farmers to floods? (Glass & Hopkins, 1984). The descriptive design was used because it involves gathering data that describe events and then organise, tabulate, depict, and describe the data collected (Glass & Hopkins, 1984).

**Data and Sources**

Both primary and secondary data sources were used for the study. Primary data was obtained from farmers, agricultural extension officers and NADMO officials. The administration of questionnaires, in-depth interviews and focus group discussions formed the basis of methods for collecting primary data for the study. Findings from the focus group discussions were used to complement or authenticate the findings of the farmer's survey.

The secondary sources constituted textbooks, published and unpublished articles in dailies, journals, magazines, official documents from the NADMO office and the agricultural departments of the districts selected for the study. Information was also obtained from libraries and internet search, government publications and other related literature. Data collected for this study consisted of livelihood adaptation strategies of farmers to flood, household assets that influence livelihoods, farmers' perception of vulnerability to flood, the challenges

associated with the adaptation strategies to floods and institutional arrangements for livelihood adaptation to floods.

**Study Population**

Jennings (2001:136) defines study population as "all the study subjects or units that are the focus of the research project". The target population for the study includes farmers, agricultural extension officers, NADMO officials and farmer groups of the various districts selected for the study. These categories of respondents were selected because they have an in-depth knowledge of issues, as far as this study was concerned.

**Sampling Size and Sampling Procedures**

The main purpose of sampling is to achieve representativeness; therefore, the sample should be assembled in such a way as to be representative of the population from which it was taken (Jennings, 2001). Sampling is also necessary because in dealing with a large number of respondents (especially the farmers in this particular research), there is the need to get a reasonable representation of the people since everybody in the population cannot be included. However, the question about the right sample size in quantitative research is one that concerns not only the beginner but any social investigator. In simple terms, it refers to basic questions such as how large or small the sample must be for it to be representative (Sarantakos, 1997).

Fowler (1993) admits that the size of a sample is one of the most common questions posed to survey methodologists. One familiar misconception people have is that the adequacy of a sample size depends heavily on the fraction of the

population included in that sample. For example, those who hold such a view would say 1 percent or 5 percent or some other percentage of a population will make a sample credible. In spite of this argument, Fowler (1993) reports that the vast majority of survey samples involve a small fraction of populations. In such instances, it is contended that small increments in the fraction of the population included in a sample will have no effect on the ability of the researcher to generalise from a sample to a population.

To Fowler (1993), the first requirement for determining a sample size is an "analysis plan". The key component of this analysis plan is not an estimation of confidence intervals for the overall sample but rather an outline of subgroups within the total population for which separate estimates may be made. The key is that most sample size decisions do not focus on estimates for the total population; rather, they are concentrated on the minimum sample sizes that can be tolerated for the smallest subgroups of importance (Tuffuor, 1996). To achieve this, a multi-stage sampling technique was applied to generate the sample size. The two districts (Talensi and, Builsa South) were selected purposively because of the fact that they were more prone to flood disaster every year in the region (NADMO, 2008).

The study districts have been politically demarcated into area and town councils based on the geographical positioning of the districts and were represented in the Assembly by an Assembly Member. The Town Councils were further sub-grouped into communities which were used for the study because it was through these communities that the problems of the people could be

channelled directly to the District Assembly. The Talensi District has 96 communities out of which five were prone to severe flooding annually. Builsa South, on the other hand, has 43 communities out of which five were severe flood prone areas, making a total of 10 severe flood prone communities in the two districts which were purposively selected for the study (NADMO, 2008) (see Table, 1).

The sample size for the respondents (farmers) was, however, determined using Yamane's (1967) statistical method. The formula is:

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

Where: n = the sample size; N = the population size; and e = the acceptable sampling error (.05).

Thus, with a total farmer population of 2,419 for the two districts (NADMO, 2015), a margin of error of 5% and 95% confidence level,

$$n = \frac{2419}{1+2419(0.05)^2}$$

$$n = \frac{2419}{1+2419(0.0025)}$$

$$n = \frac{2419}{1+6.0475}$$

$$n = \frac{2419}{7.0475} = 343.242284$$

$$\boldsymbol{n = 343}$$

**Table 1: Categories of the Population, Selection Procedure and Sample Size.**

| Name of district | Names of sampled communities | Total number of farmers | Sampled farmers per community |
|---|---|---|---|
| Talensi | | | |
| | Pwologu | 187 | 26 |
| | Yindure | 269 | 39 |
| | Vuvu-kawale | 193 | 27 |
| | Sangteg | 265 | 38 |
| | Yamiriga | 199 | 28 |
| Builsa South | | | |
| | Chaansa | 191 | 27 |
| | Fumbisi | 226 | 32 |
| | Kanjarga | 174 | 25 |
| | Uwesi | 502 | 71 |
| | Doniga | 213 | 30 |
| Total | 10 | 2,419 | 343 |

Source: NADMO, (2016)

The simple random sampling was used to select the study units from each of the community selected. Here, arbitrary numbers were assigned to farmers and picked at random till the required number was reached. To ensure fairness, a proportional representation of farmers of the communities within each district was selected. These methods ensured proportional selection of respondents from the communities and reduced biases.

Purposive sampling was also used to select the agricultural extension officers and officials of NADMO in the various districts. This was because the researcher targeted particular individuals in the study (Greenstein, 2003). Those categories of individuals were selected because they were believed to possess in-depth knowledge of the topic being studied. This technique was adopted because

the study units from these categories were relevant for the study and may be left out if probability sampling was used.

**Instruments for Data Collection**

Since both qualitative and quantitative methods were used in this study, the instrument for data collection incorporated both methods. The methods that were used to collect data include:

- Questionnaire
- Focus group discussions guide
- In-depth interview guide
- Observation

**Questionnaire administration**

Questionnaires were chosen for varied reasons; one, because they are very effective for securing factual information about practices and conditions of which the respondents were presumed to have knowledge and for enquiring into opinions and attitudes of the subjects. Another reason for choosing questionnaires was that they were easy to fill and take little time as compared to other instruments like the interview. Finally, when dealing with a large number of respondents, using questionnaires is the best and appropriate technique.

The questionnaires comprised of both closed and open-ended questions. In the case of open-ended questions, the respondents were free to formulate their own answers the way they deemed most appropriate, in their own way and in their own words. The closed-ended questions were used because the responses were fixed and the respondents were expected to choose the option to which they

agreed most. The questionnaire was divided into 5 sections (A-E). Section A considered the background information of respondents while sections B to E were based on the objectives of the study. The questionnaires were administered to respondents who cannot read as an interview schedule.

**In-depth interview**

The NADMO officials and agricultural extension officers who were part of the study were interviewed using the in-depth interview guide to document their informed opinion on the adaptation to flood and the impact of floods on crop production in their respective communities as well as their suggestions on how best to mitigate and adapt to floods in the region. A total of four in-depth interviews were conducted. An interview guide was prepared to cover adaptation strategies to floods and the impacts of flooding on crop production and other issues that were deemed important to providing answers to the research questions. This helped achieve the objectives of the study.

The in-depth interview guide was open and allowed for more changes during the actual data collection on the field. This, when compared to a questionnaire, makes the latter look rigid. As such, it was possible, with the interview, to obtain more detailed information on the topic where necessary. According to Bernstein (2004), people will always provide much more information in a one-on-one discussion than they will in a public forum. Although interviews cannot substitute for more public forms of participation, they often provide information that cannot be obtained any other way.

**Focus group discussions**

A focus group discussion was organised for two farmer groups (Males and Females) from the two districts (Talensi and Builsa South). A moderator's guide was developed to cover livelihood adaptation strategies to floods, the impact of flood on crop production and how to prevent or reduce floods in the region from their individual houses to the community level. There were 11 participants in each group with two facilitators, one as the moderator and the other, as a note taker of responses from participants. In addition to the note taker, a digital voice recorder was used with the permission of the participants. The FGDs were conducted to complement the responses of the main respondents in the survey and it was also to allow great flexibility in the questioning process. It also allowed the interviewer to clarify terms that were unclear, control the order in which questions were asked and probe for additional information.

**Observation**

Study visits were made to the flood-prone communities in the two districts. The damaged structures, roads and farmlands in the study area were also observed. The researcher together with the NADMO officials visited some of the constructed drain sites in order to observe how they were constructed. Observation was the major data collection technique in this regard because it offered first-hand knowledge of the status of the flood-prone sites.

**Pre-testing of Research Instruments**

Pilot testing helps in making an instrument reliable and increases the degree of consistency that the instrument or procedure demonstrates. The term

pilot testing refers to mini versions of a full-scale study (also called feasibility studies), as well as the specific pre-testing of a particular research instrument such as questionnaire or interview schedule (Baker, 1994). The pilot test was conducted in the Zebila district which was also regarded as a disaster prone district in the region. Forty (40) farmers were selected for the pilot study.

**Fieldwork**

Before the actual field work began, a reconnaissance survey took place a month earlier to identify the houses to enter, which household within the house to interview and the routing of field assistants. The collection of data for this study was from the 5th of November to the 10th of December 2016 (see Table 2). This suggests that the data collection process lasted for a month and five days. The collection of the data for the Talensi District was from the 6th of November to the 23rd of November 2016 while that of the Builsa South District was from the 24th of November to the 10th of December 2016.

**Table 2: Summary of Actual Data Collection Details**

| No. | Activity | Duration of activity | Date | Implementer(s) | Location |
|---|---|---|---|---|---|
| 1. | Training of enumerators on interview schedule administration and ethical responsibility | 1 day | 05/11/2016 | Researcher | Talensi |
| 2. | Administration of interview schedule | 18 days | 06/11/2016 to 23/11/2016 | Five enumerators | Talensi District |
| 3. | Key informant interview | 3 days | 17/11/2016 to 19/11/2016 | Researcher | Talensi District |
| 4. | Administration of interview schedule | 18 days | 24/11/2016 to 10/12/2016 | Five enumerators | Builsa District |
| 5. | Key informant interview | 2 days | 08/12/2016 to 09/12/2016 | Researcher | Builsa District |

Source: Author's Construct (2016)

The researcher contracted 10 enumerators. The chosen research assistants were natives of the district. This was to address any language barrier issues. Each of the selected study districts had five enumerators. These five enumerators administered the interview schedules in each of the districts. The researcher educated them on the items on the interview schedule and on ethical behaviours in research. They were given a one-day training to equip and place them in a position to interpret the items on the instruments uniformly and appropriately to ensure ease in the collection of the data as well as prevent unethical behaviours.

After the training, the enumerators were moved to the various districts for the data collection. The responsibility of the researcher was to monitor the progress of work of the enumerators on the field every day. In the case of the key informant interviews, the researcher personally conducted them. This took five days: 17th to 19th November 2016 in the Talensi District while the field enumerators collected data there and the remaining two days (8th and 9th of December 2016) at the Builsa South District for data collection and the key informant interviews.

**Ethical Consideration**

The study methodology was subjected to official ethical considerations. The researcher ensured that the methodological approach of the study did not violate research ethics. Respondents who participated in the study were briefed on the objectives of the study and their consent, sought. Under no situation was any respondent coerced to participate in the study. Strict confidentiality of the

information the respondents provided was adhered to. In addition, all protocols, with respect to community entry, were observed.

**Data Processing and Analysis**

The collected data contained both quantitative and qualitative data. This, therefore, required both quantitative and qualitative analysis. The quantitative data was edited, coded, imputed into the Statistical Product and Service Solution (SPSS) version 21 and cleaned before analysis was undertaken. Quantitative data analysis involved the use of statistical techniques such as descriptive statistics. The chi-square ($\chi^2$) statistic was also employed to measure the difference between farmers' socio-demographic and economic variables and their perception of vulnerability to floods. The presentations of the quantitative results were in tables and charts.

The analysis of the data from the in-depth interview involved a qualitative approach by a manual process using thematic analysis. A qualitative research is based on the theoretical and methodological principles of the interpretive perspective. As a result, a qualitative analysis contains a minimum of quantitative measurements, standardisations and mathematical techniques. In most cases, its processes bring together collection and analysis of data in such a way that identifying data automatically leads to their analysis, which in turn directs the researcher to the area in which new data should be sought and identified, in order to be analysed again (Carspecken & Apple, 1992 cited in Sarantakos, 1997). The results from the IDIs and the FGDs were categorised into appropriate themes and analysed. The presentations of the qualitative results were in the form of matrices

and texts. There was an integration of both the quantitative and qualitative analysis under each of the objectives to give a clearer and general picture of issues being analysed.

# CHAPTER FIVE

# LIVELIHOOD ASSETS AVAILABLE TO FARMERS

## Introduction

Farmers need a variety of assets to realise positive livelihood outcomes; no single asset on its own is sufficient to yield all the many and diverse livelihood outcomes that farmers seek. This is mainly true for poor farmers whose access to any given asset tends to be very limited. Poor farmers, therefore, seek ways of nurturing and combining the assets they have in innovative ways to ensure survival (Scoones, 1998). This chapter begins with a presentation of the background characteristics of respondents as well as findings related to the first objective of the study: livelihood assets available to the farmers.

## Background Characteristics of Respondents

In order to appreciate, understand and contextualise the respondents' perspectives regarding the objectives of the study, background characteristics such as the sex, education, age, marital status, religion, occupation, and family size of farmers were analysed. These variables were considered to be important because they influenced peoples' perspectives on needs, participation and responsiveness and held people to account (Gyimah-Boadi, 2009). The background characteristics of respondents also reflect social structure and influence the attitudes and lifestyles of farmers. An insight into the background characteristics of respondents would, therefore, play an important role in appreciating the culture of farmers and how they adapt to flood disaster.

**Sex of Respondents**

The influence of gender on the choice of an adaptation strategy to flooding is not straight forward. Whiles some studies (for example, Hassan & Nhemachena, 2008; Mandleni & Anim, 2011) have concluded that males are more likely to adopt an adaptation strategy because they have more access and control of resources, Nhemachena and Hassan (2007) reported that females are more likely to take up adaptation options to climate change and variability since much of the agricultural work is done by women. Table 3 presents the sex distribution of respondents in the study.

**Table 3: Sex Distribution of Respondents**

| Sex | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No | % |
| Males | 97 | 56.7 | 101 | 58.7 | 198 | 57.7 |
| Females | 74 | 43.3 | 71 | 41.3 | 145 | 42.3 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

Table 3 indicates that out of the three hundred and forty-three (343) farmers, about 58 percent were males. There is virtually no variation in the proportion of males and females between the two selected districts.

**Education of Respondents**

Access to education is important in livelihood and food security programmes. Education is essential to reduce poverty and increase human capital and can be considered the most basic building block of development (UNICEF,

1995). The influence of education on the choice of adaption strategy by farmers for adjusting to climate related disaster (flooding) is ambiguous. To some researchers the educational level of the farmers played a role in determining the quality of the decisions made by farmers to select flood adaptation strategies. Mandleni and Anim (2011), however, reported that education appears not to have an influence on adaptation. Table 4 summarises the educational level of the farmers.

**Table 4: Educational Distribution of Respondents**

| Education | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No | % |
| Never attended school | 63 | 36.8 | 45 | 26.2 | 108 | 31.5 |
| Primary | 34 | 19.9 | 26 | 15.1 | 60 | 17.5 |
| JHS | 22 | 12.9 | 24 | 14.0 | 46 | 13.4 |
| SHS | 41 | 24.0 | 58 | 33.7 | 99 | 28.9 |
| Tertiary | 11 | 6.4 | 19 | 11.0 | 30 | 8.7 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

The educational level of the farmers played a role in determining the quality of the decisions made by farmers to select flood adaptation strategies. Almost a third of the respondents (31.5%) never attended school while 30.9 percent have had basic education (primary and JHS). Having a basic education indicates that they are literate and open to new ideas that may be made accessible

to them by state agencies such as agricultural extension officers, but they may not certainly appreciate the more intricate scientific concepts such as meteorological data (Jordan, 2012). Respondents with senior high education (28.9%) may have the prospective for more scientific knowledge that may improve agricultural productivity. Only 8.7% of the farmers have had tertiary education, and this is consistent with the findings of Akyeampong, Roleston and Ampiah (2010) that most rural residents in Ghana had education only to the basic level.

**Age of Respondents**

The effect of age on the decision to choose an adaptation strategy is varied in the literature. While Deressa et al. (2010) reported that age has a positive influence on the choice of livestock sale as an adaptation strategy by farmers during extreme climatic events, Hassan and Nhemachena (2008) have found age to have no significance in influencing the choice of an adaptation strategy to climate change. The age of the respondents is presented in Table 5.

**Table 5: Age Distribution of Respondents in the Talensi and Builsa Districts**

| Age | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| group | No. | % | No. | % | No | % |
| 18 – 30 | 46 | 26.9 | 30 | 17.4 | 76 | 22.2 |
| 31 – 40 | 49 | 28.7 | 43 | 25.0 | 92 | 26.8 |
| 41 – 50 | 42 | 24.6 | 46 | 26.7 | 88 | 25.7 |
| 51 – 60 | 22 | 12.9 | 37 | 21.5 | 59 | 17.2 |
| 61 + | 12 | 7.0 | 16 | 9.3 | 28 | 8.2 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

Generally, most of the farmers were adults, with about 27 percent of them being between the ages of 31 to 40 years. Only 8.2 percent of the respondents were more than 61 years old. The age of the respondents, which is a proxy for experience in farming, is important in the process of making choices, especially agriculture based decisions.

**Marital Status of Respondents**

Marriage is the basis of farmer household production. It has also been the means through which both women and men gain access to land and labour (Ingrid, 2002). In this study, about two-thirds of the respondents (65.9%) were married. Such composition of marital status helps to obtain a broader perspective on the disproportional impact of flood and differences in coping and adaptation strategies in the study area. This finding shows a slight increase in the marriage population in the sample as compared to the Population and Housing Census (2010) reports which indicated that 60.7 percent of the Upper East population aged 12 and older were married. In terms of the district divide, a marginal difference was observed in the percentage of married respondents as the two districts recorded 66.3 percent and 65.5 percent respectively for the Builsa South and Talensi Districts.

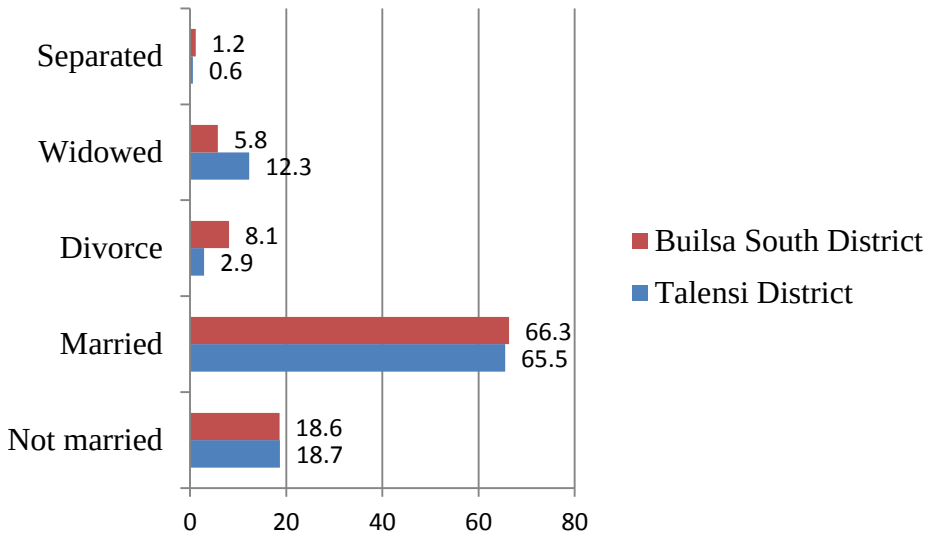


**Figure 8: Marital status of respondents in the study**

Source: Fieldwork, 2017

**Religion of Respondents**

Religion is a very effective vehicle for change in attitudes and behaviour because it shows people's beliefs and general perspectives of life. Farmers' attitude towards customary beliefs about floods could be influenced by their religious practices. For Mbitti (1990), religion has the greatest influence on the thinking and living of the people concerned. As religion defines cultural outlook, so does the culture shape the peoples' relationship with the land (Mbitti, 1990).

As far as religion is concerned, most of the respondents (40.2%) were Catholics, followed by traditionalists (23.9%) and Muslims (17.5%), as presented in Table 6. This finding is consistent with that of GSS (2015) which indicates that 59 percent of the people of the Upper East Region are Catholics (GSS, 2015). However, almost (50%) of the respondents in the Talensi District were Catholics while the Builsa South District had 40 percent. Islam, which was the least popular

religion in the study, was practised by more respondents in the Builsa South District (20.9%) than the Talensi District (14.1%).

**Table 6: Religious Distribution of Respondents in the Talensi and Builsa South Districts**

| Religion | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Catholic | 70 | 40.9 | 68 | 39.5 | 138 | 40.2 |
| Muslim | 24 | 14.1 | 36 | 20.9 | 60 | 17.5 |
| Traditionalist | 43 | 25.1 | 39 | 22.7 | 82 | 23.9 |
| Protestant | 34 | 19.9 | 29 | 16.9 | 63 | 18.4 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

**Occupation of Respondents**

According to Watts (2001), occupation is the individual's lifelong progression in learning and in work. The scope for crafts and agriculture to be part of a long-term progression in a person's life is a key theme in this study. The sustainable livelihoods framework developed by Chambers and Conway (1991) refers to livelihoods as a system comprising people's capabilities; natural resources; material and social assets which they draw upon; the strategies they adopt for subsistence; the social and cultural contexts in which they make a living and the risk factors that determine vulnerability.

With regard to this study, crop farming 84.3 percent was the predominant occupation of respondents as presented in Table 7. This was slightly higher than the national average of 83 percent for rural areas in Ghana (GSS, 2015). In

northern Ghana, it is normal that many of the people in the rural areas practised subsistence farming as a source of livelihood because of inadequate formal employment opportunities. Furthermore, the region lacks manufacturing and industrial facilities that could engage the youth. However, because the region experiences one farming season, majority of the youth usually migrate to the southern part of Ghana to seek improved opportunities.

**Table 7: Occupation of Respondents in the Talensi and Builsa South Districts**

| Occupation | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Crop production | 164 | 95.9 | 125 | 72.7 | 289 | 84.3 |
| Petty trading | 3 | 1.8 | 6 | 3.5 | 9 | 2.6 |
| Craftsmanship | 1 | .6 | 5 | 2.9 | 6 | 1.7 |
| Salary worker | 3 | 1.8 | 36 | 20.9 | 39 | 11.4 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

Because majority of the respondents were crop farmers, land was considered as an important asset for every household in the Upper East Region. It must, therefore, be protected against the destructive agents of floods. According to the Ghana Poverty Reduction Strategy (GPRS, 2016), crop farmers have the highest incidence of poverty, which is often attributed to disasters such as floods. Only 11.4 percent of the respondents were salaried workers with 2.6 percent and 1.7 percent engaged in craftsmanship and petty trading respectively.

The occupational background of the respondents as presented above shows that they might be vulnerable and more likely to be affected when floods occur. Flood water that covers community land lowers the land's productivity and increases the chances of losing harvest and property. Ultimately, farmers stand to lose their livelihood resources.

**Family Size of Farmers**

Family size in Ghana is still based on the extended system in spite of modernisation and the gradual erosion of the extended family household composition (Bogale, 2009). Traditionally, family sizes have been large, reflecting status and prestige as well as serving as a source of labour on farmlands. Large family sizes of farmers have been economic assets in a labour intensive subsistence economy like Ghana (Bogale, 2009). Similarly, family size in a rural setting plays a critical role in floods preparedness and adaptation as it determines the number of people who are vulnerable to floods. In this study, the majority of farmer families had an average family size of 6.

This family size was above the national average for rural areas which is 4.4 (GSS, 2014). The family size can be considered large, hence, a possible contributor to vulnerability. The family size as presented here is, however, consistent with the PHC (2010) report which indicates that the average family size for the Upper East Region is 5.9 percent. The large family size in the study area implies that their sensitivity to floods was very high because there were more members to take care of in times of shocks, and often, with limited resources. The family size can be an advantage if the majority of the family members are able to

provide labour. Crop production is normally labour intensive in farming areas and its success hinges on energetic people.

**Availability of Livelihoods Assets to Farmers**

Livelihood assets owned by farmers represent the basic building blocks with which they undertake production, engage in labour markets and participate in reciprocal exchange with other households (Ellis, 2000). These include skills and experience of household members (human capital), their relations within wider communities (social capital), their natural environment (natural capital) and physical and financial resources (Gebrehiwot & Fekadu, 2012). Assets are stocks which may depreciate over time or be expanded through investment. But the assets used to repel poverty and cope with floods encompass a broader range of tangible and non-tangible resources.

In the study area, possession of these assets varied among farmers. This reflects the fact that different geographic locations provide different resource endowments. Hence, people face different constraints and employ different strategies to achieve livelihood outcomes (Barrett & Webb, 2001).

Natural assets

Natural assets in a broad sense include everything that is derivable for use of humans from any part of the universe. In the physical form, they include energy from sunshine and gravity as well as mineral deposits and the rain. In the biological sphere, they include domesticated as well as wild plants and animals (UNESCO, 2014). For the purpose of this study, the natural assets that were analysed included farmlands, size of farmlands, crops grown and access to water.

These assets were selected based on the fact that they were more affected by floods in the study area.

The study revealed a considerable variety of assets available to farmers. However, farmland was considered by the respondents as the most important natural capital. Availability of water, grazing land and fuel wood were also mentioned by respondents as important natural assets. It was found that majority of respondents (95.3%) have access to land for crop farming purposes. Landholdings were generally small and varied among the farmers, though they did not have absolute control over the ownership of the land. That majority of respondents have access to farm lands corroborates the illustration in the conceptual framework that farmers who have access to land as an asset are in a better position to have sustainable livelihoods. It also supports Aryeetey's (2004) findings that over 50 percent of all Ghanaian rural households have a member who owns or have access to land.

**Determinants of Land Acquisition**

Generally, in Ghana, though customary authorities still retain their role in customary land acquisition, the state land sector agencies are required by statutory provision to supervise land development in the country. The Lands Commission, for example, is required to control any disposition and development of Stool

Lands. This is contained in Article 267 (3) of the 1992 constitution. Accordingly, land administration in this regard includes both the statutory regulation of the state as well as the traditional norms governing land use, land control and access.

In the study area, however, it emerged from the focus group discussion in the Builsa South District that acquiring land for farming is not difficult as compared to acquiring land for infrastructure development. Discussants indicated that land can easily be released to a friend for farming activities without much family consultation. One discussant who had ever worked with the Town and Country Planning explained that:

> *"Land acquisition hardly entailed the collaboration of the statutory and customary institutions in charge of lands. Except in the urban areas of the study area where the activities of the state land sector agencies (Lands Commission, the Town and Country Planning Department and the Survey Department) had an influence on customary land tenure by determining land boundaries and acquisition" (23rd November 2016) .*

In response to a question on how farm lands were acquired, it was revealed that clans and families owned the land and the family heads were responsible for allocations to members. It suffices that the Tindana (the custodian of the community land) owned the land traditionally, but with the support of the chief and elders manage the land on behalf of the people and determines who should use the land.

The study also established that more than half (55.7%) of the respondents had access to family lands; 39.9 percent of the respondents

inherited their farmlands with only 4.4 percent of the respondents purchasing their farmlands (Table 8). Members of the land owning group (family heads, clan or village) in principle had user rights that allowed them to freely access land, subject to the availability of unused land. Inheritance still served as an important medium of land transfers among land owning groups. This finding was in line with the illustration in the sustainable livelihood approach that livelihood strategies depend upon access to assets of some kind or other, whether such an access involves private ownership or other forms of access. In terms of the Talensi/Builsa District divide, there was virtually no variation in the mode of land acquisition.

**Table 8: Acquisition of Farmlands in the Talensi and Builsa South Districts**

| Acquisition | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Purchase | 5 | 2.9 | 10 | 5.8 | 15 | 4.4 |
| Inherited | 65 | 38.0 | 72 | 41.9 | 137 | 39.9 |
| Family land | 101 | 59.1 | 90 | 52.3 | 191 | 55.7 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

The findings were consistent with that of Rowton (2010) who indicated that one of the main characteristics of customary land acquisition is the reciprocal relationship between members of the land owing group (family head, tribe or clan and the village chief). In general, any member of the family can return to his or her village and is entitled to use a piece of land, independent of the period of absence.

It was also revealed during the focus group discussion in the Talensi District that migrants were allowed to access farmland through the allodial title holders. One elderly discussant explained that:

> *"Under customary norms, allocations to strangers were sealed with a token of gifts such as tobacco, kola and drinks which are presented as a sign of respect to greet the family head of the land owners and were not to be regarded as outright alienations of land or sales" (8th November 2016).*

The discussants indicated that it was not mandatory, but as courtesy demands, it was expected that after every good harvest some foodstuff was given to the family head and elders of the community. This was to help promote a good relationship and the continuous use of the land for farming and to demonstrate that their ownership of the land was acknowledged.

The above discussion demonstrates that access to farm lands in the study area was not only the preserved right of the indigenes or limited to only land owners and their family members. Any other person who exhibited good will to the land owners could access farm land for agricultural activities. However, having access to the farm land did not suggest that you have absolute control over

the land. Thus, the land could not be transferred to a third person without the consent of the original land owner. It was, therefore, important for non-indigene farmers to pay yearly homage to the land owners for their continuous use of a farm land. This finding corroborates that of Yildirim (2014) that holds that settlers in Northern Burikina Faso had access to their farm lands through a traditional arrangement with land owners.

**Farm size**

According to Deressa (2010), farmers with larger farm sizes are also wealthier farmers who can depend on savings and are, therefore, less likely to adopt strategies such as livestock sale and borrowing from relatives as adaptation options to floods and climate variability. Gbetibouo (2009) also holds the same view but indicated that large scale farmers are rather more likely to adopt adaptation strategies since they have the capital and resources to easily invest in strategies that demand a high investment cost.

The average farm size of the sample studied was about five hectares. Farming was proficient basically on a subsistence level and not as a large scale commercial activity. Every household visited therefore engaged in farming with or without a second source of income. Even though crop production in the study area was in the hands of subsistence smallholder farmers, it was not uncommon for households to engage in the cultivation of a few annual cash crops such as potatoes, maize and rice or engage in the sale of harvested produce to meet a financial need.

Results in Table 9 revealed that most respondents (38.8%) had eight years of experience in farming while a little over 30 percent of the respondents had 16 years or more experience in farming. These suggests that respondents, with these years of experience in farming in the study area, would have witnessed the destruction of farms and property by floods and are able to speak to the issues as far as floods' impacts are concerned.

**Table 9: Respondents Years of Farming Experience**

| Years of farming experienced | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 1 – 8 | 53 | 31.0 | 80 | 46.5 | 133 | 38.8 |
| 9 – 16 | 39 | 22.8 | 60 | 34.9 | 99 | 28.9 |
| 17 + | 79 | 46.2 | 32 | 18.6 | 111 | 32.4 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

**Types of Crops Cultivated in the Study Area**

Crop production is a challenge in the study area because of inadequate rains (late rains and short rainy seasons). The study found that 40 percent of the respondents cultivated maize because it was a staple food despite the prevailing unfavourable climatic condition for its production. One of the key informants (Agricultural Extension Officer) from Builsa South District stated in the interview that:

*"Farmers were advised in the study area to cultivate two months duration of maize and grains like sorghum, but the majority of the farmers did not take the advice".*

The fact that rainfall did not come early and stopped early in the study area means that the chances of maize producing better yields were limited but the farmers stuck to maize production. Though millet/sorghum was cultivated by 30 percent of the farmers, respondents stated that they cultivated maize because millet/sorghum required spending more time in the fields to scare away birds; yet, they still had low yields. Some respondents 14 percent cultivated rice because rice had been noted to be a commercial crop. One of the reasons for growing a variety of crops by some respondents was because of an advice given them by agricultural extension officers that if one crop failed the other could survive since rainfall was unpredictable, a sort of not "putting all eggs in one basket".

**Farmers' Access to Water**

Water is at the core of sustainable development. Water resources and the range of services they provide underpin poverty reduction, economic growth and environmental sustainability. From food and energy security to human and environmental health, water contributes to improvements in social well-being and inclusive growth, affecting the livelihoods of billions (UNDP, 2005).

According to UNDP (2008), on average, in developing countries, the proportion of people without access to safe water is 30 percent in urban areas but 40 percent in rural areas. Safe drinking water is a human right and a basic requirement for good health. Specifically, from the study, it emerged that about

42 percent of the respondents had access to pipe water which was above the national figure of 28.9 percent (GSS, 2015) but lower than the regional figure of 51 percent (PHC, 2010). While 28.9 percent accessed water from boreholes, 17.5 percent accessed water from wells as shown in Table 10. This finding was consistent with that of Bazezew (2013) that in Lay Gaint District in Ethiopia, about 57 percent of respondents had access to pipe-borne water while 26 percent used unprotected springs. The rest obtained their water from nearby rivers and streams. In terms of the Talensi/Builsa South District divide, Talensi District had higher access to pipe-borne water (70.2%) than the Builsa South District 13.4 percent, an indication that the Builsa South District had water challenges.

**Table 10: Source of Water in the Talensi and Builsa South Districts**

| Source of | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| water | No. | % | No. | % | No. | % |
| Pipe water | 120 | 70.2 | 23 | 13.4 | 142 | 41.7 |
| Dam | 5 | 2.9 | 19 | 11.0 | 24 | 2.0 |
| River | 2 | 1.2 | 15 | 8.7 | 17 | 5.0 |
| Wells | 13 | 7.6 | 47 | 27.3 | 60 | 17.5 |
| Borehole | 31 | 18.1 | 68 | 39.5 | 99 | 28.9 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

Water was usually sourced by women and young girls; hence, the distance of water sources increased the time burden of household chores and affected the time for care in the case of women and going to school in the case of the girl child. The time taken to reach a water source was found to be higher in the Builsa South District than the Talensi District. Builsa South District reported the highest

percentage 56.6 percent of farmers who did not have a consistent water supply as indicated in Table 11. These households become even more vulnerable during the dry season when most natural water sources tend to dry up. This confirms Bazezew's (2013) findings that the availability of water in the Kolla zone was a serious problem and, on average, women in this zone travelled a round-trip of about four hours a day to fetch water.

**Table 11: Time taken to Access Aater in the Talensi and Builsa South Districts**

| Average time water | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Within 30 minutes | 116 | 67.8 | 57 | 33.1 | 173 | 50.4 |
| 30 mins - 1 hr | 46 | 26.9 | 100 | 58.1 | 146 | 42.6 |
| >1hr 30mits | 9 | 5.3 | 15 | 8.7 | 24 | 7.0 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

A follow up question was asked to determine whether there was any water problem. The results revealed that 50.7 percent of the respondents had water problems whereas 49.3 percent had no water problem. Looking at it from the district perspective, 59.3 percent of the respondents from the Builsa South District

reported on problems with accessing water as against 42.1 percent for the Talensi District (Figure 9).

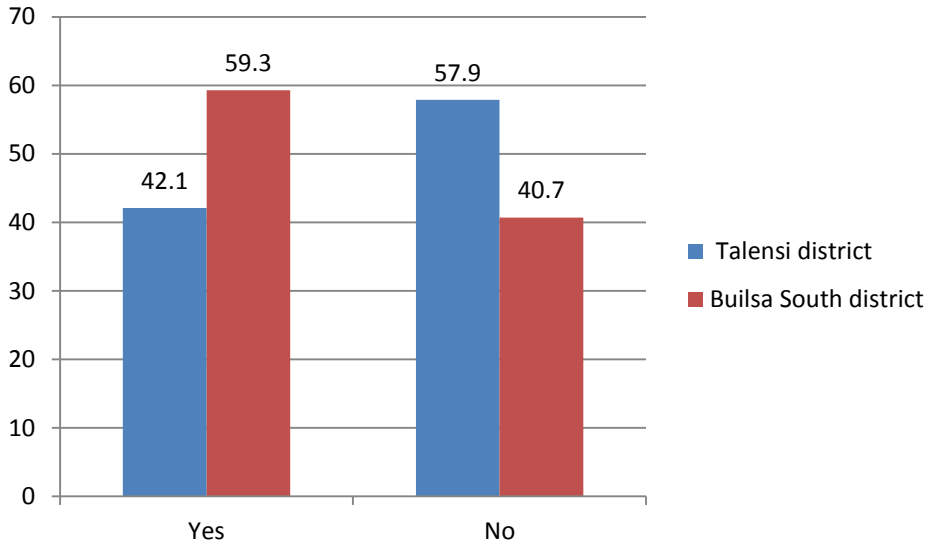


**Figure 9: Water problems in the Talensi and Builsa South Districts**

Source: Field survey (2017)

**Financial assets**

Any investment decision with the view of generating income requires financial injection. Financial assets comprised cash at hand, savings and loans. Financial assets can be acquired from either formal or informal sources. Their role is to facilitate for the short and long term investments for fixed capital needs. Financial assets are important for the poor who usually do not have enough funds if not for the little collateralised assets that could be used as insurance against their risks and shocks. Therefore, access to cash at hand, savings and loans help the poor in building on their financial assets that enable them to increase their investments and lead to increased household income (SEN, 2003). To appreciate the role of financial assets in responding to shocks, this section focused on the

amount of income earned by farmers, the source of income, savings and the livestock of respondents in the study area.

**Amount of Income Earned by Farmers**

Some researchers (Deaton, 2000; Coulombe 1997) have tried to explain why Ghanaian survey data always indicate a shortfall in income over expenditure. This may be because respondents find it difficult to recall all their income as many income sources may be informal or transient. This is less likely to be a problem with expenditure, the bulk of which may be more frequent and regular. Secondly, respondents may have a motivation to understate or not declare certain sources of income if they fear that the information may be used for taxation purposes. Thirdly, respondents may have difficulty in calculating profits from household enterprises for which no formal accounts exist (Aryeetey, 2004).

In order to determine the readiness of farmers in their quest to withstand pressure from floods, it was important to establish the monthly income of the households. It emerged from the study that majority of the respondents (83%) earned between 100 to 300 Ghana Cedis a month, while 57 percent of the respondents earned 501 Ghana Cedis and above (Table 12). Looking at it from the districts perspective, 27 percent of the respondents from the Builsa District earned 501 Ghana cedis and above as against 29.8 percent for the Talensi District. This result suggests that the monthly income of the respondents was marginal.

It was, however, important to note that irrespective of this negligible income, respondents were able to survive and managed to address some of the challenges they face as a result of the floods. The resilience theory of the study

attests to the fact that farmers, no matter the adversity they face, have to demonstrate their perseverance and ability to absorb the change and disturbance and still maintain the same statoscope. In short, the theory defines resilience as "the ability of a household to absorb disturbances and still retain its basic function and structure" (Walker & Salt, 2006, p.1).

**Table 12: Amount of Income Earned by Farmers In A Month**

| Income | Talensi District | | Builsa District | | Total | |
|---|---|---|---|---|---|---|
| earned | N | % | N | % | N | % |
| 100 – 300 | 70 | 40.9 | 73 | 42.4 | 143 | 83.3 |
| 301 – 500 | 50 | 29.2 | 52 | 30.2 | 102 | 59.4 |
| 501 + | 51 | 29.8 | 47 | 27.3 | 98 | 57.1 |
| Total | 171 | 99.9 | 173 | 99.9 | 343 | 199.8 |

Source: Field survey (2017)

The key informants pointed out that it will be very difficult to determine the exact amount farmers earned in a month because they engaged in many activities for their income. The key informant for the Builsa South indicated that:

> "*In as much as I may not be able to quantify the monthly income of the farmers, based on my observation and having lived in this community for some time now, except for very few farmers, no farmer earns less than 500 Ghana Cedis in a month"*.

If one were to go by this narrative, it presupposes that the average monthly income of households in the study area could be 500 Ghana Cedis, which could still be considered as very low to sustain a household during floods.

There was a mixed reaction among female discussants in Builsa South District as they indicated that quantifying households' monthly income was a challenge. This was attributed to the fact that they did not keep records of their source of income and their expenditure. One of the discussants attested to this fact by saying:

> *"In this community we live from hand to mouth and I must confess that telling you our monthly income will be a very difficult thing for us. We depend on several sources for our income which is nothing to write home about".*

The above quotation indicates that farmers in the study area did not rely on one source for their income. Because they lived from hand to mouth, it was extremely difficult for respondents to quantify their monthly income. This suggests that the possibility of farmers living in a cycle of poverty was very high, and their ability to adapt to floods' destruction, affected.

**Sources of Income**

In order to be able to attribute changes in farmers' adaptation strategies to floods, it was critical to determine farmers' sources of income. The study identified the following sources of income for farmers: (a) income from formal employment, (b) agricultural income, (c) income from petty trading and (d) income from remittances. The results indicate that income from petty trading was 11.4 percent whereas agriculture turned out to be the largest source of income, reported by 84.3 percent (Figure 10). This result reinforces the subsistence nature of farming by the respondents in the study area.

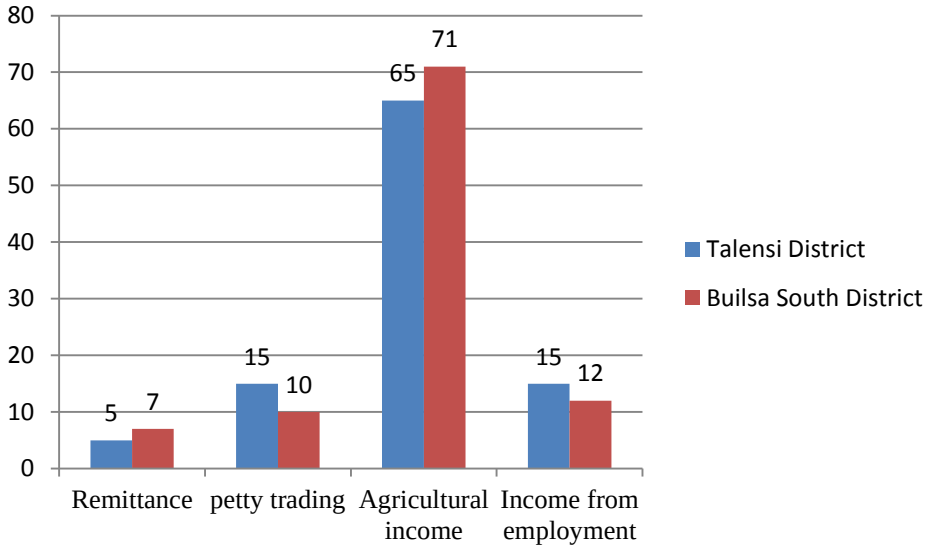


**Figure 10: Source of income**

Source: Field survey (2017)

**Savings of respondents**

Savings have been primarily defined as the portion of income that is not consumed. Generally, it includes not only money but also assets and other landed property (Carney et al., 1999). However, for the purpose of this study, the amount of money people have in their savings account or susu as captured by the GLSS 5 is what was considered because it can easily be measured. Savings is the basis of an investment, and such money helps in financing consumption during periods of hardships (Carney et al., 1999) without the need to rely on others (Onyango-Ouma & Samuels, 2012). This is imperative because the ability to save is a sign that people will be able to get out of their poverty situation (Handa, 2013).

As far as this study is concerned, a majority of the respondents (66.8%) did not have savings. Only 33.2 percent of respondents did have some savings. This concurs with the findings of Gordon (2011) that in Sudan, majority of the

rural farmers did not operate savings as a backup when a disaster happens. It, also, suggests that respondents may not be well informed about the importance of savings, or that what they earn as compared to their expenditure may not create room for them to save part for future use. Respondents, therefore, need to be educated on the importance of savings; for example, saving to pay school fees, to purchase livestock, to purchase food for the family, to pay health expenses, to pay unforeseen expenses, to cover basic household needs and to pay agriculture-related expenses.

**Livestock ownership**

Livestock rearing was the second most important agricultural activity after crop farming in the study area. A hierarchy of livestock keeping was observed, with the poor keeping mainly poultry while relatively wealthier farmers keep more small and large ruminants. The occurrence of this phenomenon is essentially an empirical question, as factors other than wealth may drive the reliance of farmers on different types of livestock. Livestock is also a substitutable asset that can be sold in order to invest in small businesses or serve as a means of adapting to floods when they occur.

Non-farm income can be used to build up herds; the ordering of these sequences depends on the personal and market opportunities that prevail in different time periods (Ellis & Freeman, 2004).

It emerged from the study that the majority of the respondents (87.5%) owned livestock. Owning livestock in the study area reduced people's vulnerability to the impacts of floods as they could sell them and buy food during

floods. The most common livestock owned, as shown in Table 13, was chicken, which constituted 81.3 percent of the livestock, an indication that almost every household in the study area had chicken. However, its commercial value to alleviate the plight of respondents in times of floods was low. In addition, 72.6 percent rear goats. Aziz (2010) observed that goats are believed to be independent, agile and tolerant to many diseases and can look after themselves much better than other livestock species.

Interviews with key informants revealed that the wealth of a person in the study area was also determined by the number of livestock he or she owned, especially cattle ownership. Cattle were owned, though in small numbers, by 26.1 percent of the respondents. It was revealed that the very few farmers who had cattle inherited them from generation to generation. Also, some of the cattle in the rural areas were owned by people residing in urban areas, confirming the observation by Shankland (2000) that in Ethiopia, young men migrate to work in towns for a few seasons to invest in cattle which are kept in family smallholdings before they return to start their own households.

The study further disaggregated the data by Districts to determine the variation in the livestock holdings. In terms of cattle and horses, the two Districts had 19.3 percent and 32.6 percent respectively for Talensi and Builsa South. On the other hand, goats constituted 70.8 percent and 74.4 percent of the livestock holdings for both the Talensi and Builsa South Districts. However, it was poultry that constituted the bulk of livestock holdings with 84.2 percent and 78.5 percent for the respective Districts as seen in Figure 11. This finding supports that of

Katia, Longin and Alberto (2009) that for the average livestock keeping of rural households, it is normally poultry that constitutes the bulk of livestock holdings.

The higher holdings of the poultry among households could be attributed to the following reasons: local breeds are commonly available; women, children, and old folks can easily take care of chickens; feeds are available from natural sources as well as household and farm wastes and by-products; chickens are good scavengers and free-range birds and that they are more disease resistant than cattle, goats and sheep. Other reasons are that the investment required to produce chicken was very low; they are naturally most adaptable to climatic and ecological conditions and that brooding, hatching and rearing of the chicks are naturally done by the hens, with relatively high percentages of chick survival (Alberto, 2009).

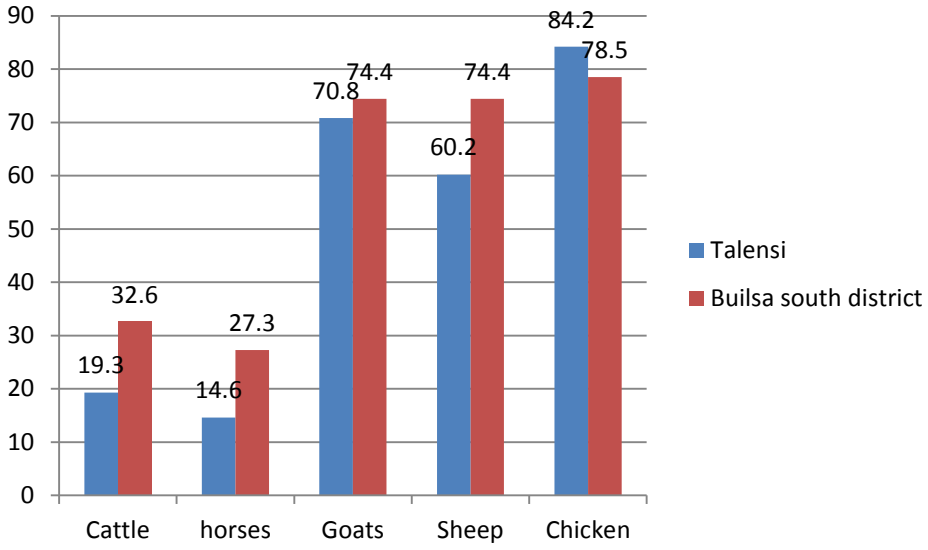


**Figure 11: Livestock/poultry ownership by districts**

Source: Field survey (2017)

On the issue of livestock ownership, an elderly male discussant in the male focus group discussion in the Talensi District explained that:

"*Livestock were owned by compounds, households and individuals. At these various levels of ownership, the livestock were given marks and labels for easy identification. Ownership of livestock is a measure of household wealth and could be sold to solve family problems".*

He, however, indicated that floods affect the feeding of the livestock because after the floods recede, fodder that was needed to feed the livestock was rotten and insufficient to sustain the livestock herd. It was a good practice to sell livestock during floods, save the money and buy livestock at normal times without losing wealth (Jordaan, 2012). However, the cultural practice of observing one's wealth and social status in the number of herds one has was a major drawback to this adaptive strategy in the study area. Another discussant also said:

*"Most of the livestock (chicken and goats) were owned by women and not men".*

In a response to a follow up question to determine whether most of the livestock were owned by women in the community, a 47 year old male discussant responded that:

*"The women had theirs, and they controlled the livestock of their children".*

In a quick interjection by a 50 year old discussant, he argued that:

> *"These livestock were owned by households and individuals; they could be used to solve other family members' and friends' problems, specifically, when it comes to marriage issues in order not to embarrass the family or the person concerned. These livestock could also be lent to friends and family members in times of problems or difficulties".*

This suggests that in every household, there is individual and collective ownership of livestock which were used to alleviate the suffering of household members when in need. Thus, it was the responsibility of every individual member to protect and cater for the livestock as it could be used to support any person at any given time. It also reemphasised the claim that most of these livestock, especially the cattle, were inherited from generation to generation. Social cohesion and solidarity were maintained as people supported one another with their livestock in order to prevent one from being exposed to public ridicule.

**Number of livestock owned**

Livestock figures from the study Districts showed that there were variations in livestock population among the two Districts. With respect to cattle, 33 farmers in Talensi District owned 158 cattle as against 56 farmers in Builsa South District who owned the same number (158). There were, however, a relatively higher number of goats and sheep in the two districts. While Talensi District had a total of 497 goats and 545 sheep for the selected farmers, Builsa South District had 520 goats and 590 sheep. The most significant number was in

poultry, probably due to its nature of production and cost, as compared to the cattle, goats and sheep.

**Table 13: Livestock figures between Talensi and Builsa South Districts**

| Livestock figures | Talensi District | Builsa South District |
|---|---|---|
| Cattle | 158 | 158 |
| Horses | 56 | 108 |
| Goats | 497 | 520 |
| Sheep | 545 | 590 |
| Chicken | 1481 | 1133 |
| Total | 2737 | 2509 |

Source: Field survey (2017)

**Physical assets of respondents**

Interventions designed to improve the wellbeing of rural farmers often focus on expanding physical assets ownership and access based on the view that it is a farmer's low asset position that limits his or her ability to take advantage of opportunities. Historically, farming has been considered the principal economic activity of rural households, particularly poor rural households. Hence, the dominant view of development has been the small-farm first paradigm which emphasised access to physical assets and promoting agriculture among smallholders and their ability to withstand disaster when they occur (Ellis & Biggs, 2001).

A report by the International Fund for Agricultural Development (IFAD) (2001) states that increasing access to physical assets is crucial for broad–based growth and poverty reduction among rural farmers or households. Physical assets comprise the basic infrastructure and producer goods required to support livelihoods. This infrastructure consists of changes to the physical environment

that helps people to meet their basic needs and become more productive (Jonathan, 2000). Producer goods are the tools and equipment that people use to function more productively.

It emerged from the study that almost every farmer had, at least, one or more physical asset to support in their farming and other daily activities. There was a segregation of results on the percentage of ownership of physical assets between the two districts (Talensi and Builsa South Districts). It was established from the study that the two Districts had almost the same percentage of ownership of physical assets such as beds, TVs, radios, bicycles and mobile phones as indicated on Table 14. It was further revealed that though these assets were important, their contribution to livelihood adaptation and withstanding of floods was very low because their financial value for floods adaptation was very minimal.

**Table 14: Physical Assets ownership by Talensi and Builsa South Districts**

| Assets | Talensi | Builsa South |
|---|---|---|
| Beds | 73.7 | 87.8 |
| TV | 77.8 | 82.6 |
| Radios | 66.7 | 90.1 |
| Machetes | 69.6 | 84.3 |
| Knapsack | 40.9 | 64 |
| Tractors | 5.3 | 11 |
| Bicycles | 71.9 | 77.9 |
| Harrows | 10.5 | 12.2 |
| Ploughs | 8.8 | 15.1 |
| Sewing machines | 41.5 | 44.8 |
| Motorbikes | 50,9 | 58.7 |
| Mobile phones | 83.0 | 70.9 |
| Stoves | 39.2 | 50 |
| Fridges | 37.4 | 41.9 |

Source: Field survey (2017)

The radio set was an important source of information, entertainment and most importantly education for most households in the study area. Civic education, health and agricultural programs were usually aired in the local dialects on both community and regional radio stations. It was not uncommon to find farmers listening to the radio since these radio sets usually run on dry cells and were very portable; thus, it could be carried to the farm and even moved within and around the community. The radio set also serves as a medium through which information on floods and adaptation strategies to floods are transmitted to the farmers. Table 14 shows that physical assets such as tractors, harrows and ploughs which were more essential to agricultural activities recorded the lowest percentage for the two Districts. This is an indication of the fact that floods adaptation was a challenge to farmers because these assets were needed for land preparation after floods recede.

**Human Capital**

Human capital represents the skills, knowledge, ability to work and good health that together enable people to pursue different livelihood strategies and achieve livelihood objectives (Roberts & Yang, 2003). At the household level, human capital is a factor of the amount and quality of labour available, and this varies according to household size, skill level, leadership potential and health status (Kollmair & Gamper, 2002). Household size, education, health status and experience in farming activities are important human capital for households' livelihoods. Among these, the skilled work force is considered a vital human resource to bring about development. Education is expected generally to be linked

to a shift to non-agricultural activities since this is where the returns to education are most likely to be highest (Taylor & Yunez- Naude, 2000). This does not necessarily imply that there are no returns on education in agriculture, but rather that on average, increased education appears to be likely to lead to a shift away from agricultural activities.

As already mentioned in this study, 31.5 percent of the respondents have had no formal education; approximately 30 percent had Senior High/Secondary (SHS) education and only 8.7 percent had tertiary education. In small scale agricultural entrepreneurship, education in entrepreneurship, knowledge, family health and experiences have been considered as a human capital.

Evidence from the study suggests that a higher share of income was from non-agricultural sources. The aforementioned farmers' access to livelihood assets is in line with the conceptual framework that looks at the complexity of people's livelihoods, especially the livelihoods of the poor farmers, whether they are in rural or urban areas. The framework explains the various dimensions of a person's livelihood assets, the strategies and objectives pursued and the associated opportunities and constraints. Improved access to livelihood assets and the outcome of greater livelihood security (especially higher incomes, more stable incomes and reduced risk) are usually important objectives in rural livelihood strategies. That is why in the livelihoods framework, access to livelihoods assets is the major determinant of sustainable rural livelihoods (Ellis, 2000).

**Determinants of Household Assets Choice**

It is usually well known that Ghanaian households have been generally low savers (Aryeetey, 1996). This increases considerable interest in the issue of what regulates or influences how households distribute their collection of assets. A diverse collection of assets is not only critical for households to cope with unexpected shocks such as floods but can offer free access to a choice of consumption levelling options that are important for them to maximize value over time.

One would expect households dominated by young income earners to allocate more to productive assets, while older persons look more at stable assets. Although farm assets may differ across the different age groups, there is certainly more variation for non-farm enterprise assets which matter more to younger household heads. Elderly people concentrate their fortunes on their house and land. Younger people are surely more mindful of rates of return on different assets and have the physical capability to engage in other economic activities; hence, their greater involvement in non-farm enterprise activities (Aryeetey, 2004).

During the male focus group discussion in the Talensi District on household asset choices and their contributions to livelihoods, it surfaced that a good job influenced a household asset choice. That is, if one is jobless, it is difficult to feed oneself and the family not to even talk of owning or deciding on the kind of assets to own. One of the discussants, however, disagrees and professed that:

"O*ne could also farm and buy any household assets of his/her choice and not necessarily work in the formal sector, but the setback in farming was the annual floods that could wash away everything or the rains that might not even be enough for the crops to do well, and that could limit the choice of individual assets*".

Based on the above quotation, it was obvious that respondents had the conviction that the main driver of household asset choice was money. This presupposes that if someone did not have money, he or she might not have an option as to which assets to acquire. However, this is not always the case because other factors such as age, education and sex could also determine household asset choices. Nonetheless, respondents acknowledged the importance and the benefits they could derive from farming since obtaining assets was not depended only on formal employment.

The informal sector, which includes farming, was equally a competing area that could facilitate farmers' ability to obtain their needed household assets. This notwithstanding, respondents admit that farming could not be considered the surest way of obtaining assets because of its unpredicted nature in terms of output. The argument was that farming could easily be affected by floods or delayed rainfall.

On the contribution of assets to household livelihoods, discussants said assets such as livestock contributed significantly to the livelihood of farmers. They sell some of the livestock to offset medical bills and buy foodstuff for the household in times of adversity. The narratives also suggested that these assets

served as insurance to farmers in times of need. For example, during sickness, these assets were sold to offset medical bills. They also acknowledged the fact that the assets were vulnerable to floods which perpetuate their poverty and suffering. This finding coincides with the conceptual framework's illustration of assets that are needed to help households adapt to floods when they occur. The finding, as well, agrees with the resilience theory's assertion that households must employ all available means to keep household assets in order to be able to cope with adversities such as floods.

The in-depth interviews with the NADMO and agricultural extension officers on household assets recorded the following narratives. The NADMO officer in the Builsa South District had this to say:

> *"The main household assets to farmers in this community were livestock (sheep, cattle and goats) and poultry (local fowls and guinea fowls). Majority of the farmers got these assets from their farming activities. Farmlands and commercial lands for building and other assets such as tractors and tricycles (motor kings) are within the reach of the affluent in the community. These assets contribute greatly to their livelihoods because they sustain them, help them to undertake daily activities and also serve as security for them in times of adversity. If I were to group the assets, I will put them into physical assets like the bullocks, the plough, the tricycle (motor king), the donkeys and the other animals. They could also be classified as social assets and economic*

*assets because some of them are used for marriages and other social purposes".*

An analysis of the NADMO officer understanding of the determinants of household assets corroborated the responses of the farmers on livestock and natural assets. He, however, did not classify the assets into the natural, physical, social and human assets. All the assets identified were valuable to households and could be of support to them in times of any adversity. However, some of the assets identified such as the livestock were vulnerable to floods because they could easily be washed away by the floods. Social assets or capital which was also vital in adapting to floods had been wrongly placed or not mentioned, an indication that its existence may not be more pronounced during floods.

**Chapter Summary**

The chapter first addressed the background characteristics of the respondents in the study area (the Talensi and Builsa South Districts of the Upper East Region). Among the issues discussed under the background are sex, education, age, marital status, religion and occupation of the respondents. The chapter, then, dealt with the first objective of the study which looked at the availability of livelihood assets to farmers in the study area.

Among the issues discussed under the objective is natural resource capital which specifically dealt with land acquisition, farm size, types of crops cultivated and household access to water. Financial assets which composed of the amount of income earned by households, source of income, savings, and the livestock of

respondents in the study area were also discussed. The chapter concludes with the physical and human capital of the respondents in the study area.

# CHAPTER SIX

# FARMERS' PERCEPTION OF VULNERABILITY TO FLOODS

## Introduction

The second part of the analysis deals with farmers' perception and level of vulnerability to floods and the effects of floods on livelihood resources. This covers the third and fourth objectives. The chapter discussed the objectives, taking into consideration farmer's perception and vulnerability, causes of floods, knowledge of floods, frequency of floods, changes in rainfall patterns and temperature, vulnerability to floods and household assets vulnerable to floods. The chapter also discusses the effects of floods on livelihood resources with emphasis on crops, infrastructure, livestock, water and diseases. The discussion brings out the similarities, contrasts and differences contained in the literature and theory as well as empirical studies. Theoretically, the chapter is situated within the tenets of the resilient theory as well as the conceptual framework of the study.

Farmers' Perception of Vulnerability to Floods

The study of perception involves the examination of people's awareness, emotions and behaviour with regard to a phenomenon, in this case, hazards such as floods. The knowledge of perceptions on a hazard is promoted as a prerequisite to achieving effective risk communication (Keller, Siegrist & Gutscher, 2006). Terpstra, Gutteling, Geldof and Kappe (2006), for example, indicated that limited knowledge about risk perception of flood hazards may lead to difficulties in communicating these risks and unsatisfactory knowledge about risk-reducing measures.

It has become increasingly important to understand people's perception of floods and other natural hazards because the knowledge of the public risk perception is considered a crucial aspect in modern flood risk management as it steers the development of effective flood mitigation strategies (Kellens, Zaalberg, Neutens & Maeyer, 2011). Specifically, understanding people's perception of natural hazards may provide information about the causes of floods and farmers' willingness or unwillingness to prepare for future occurrences (Prelog &Miller, 2013).

**Causes of Floods**

Many countries and communities are vulnerable to natural disasters which are related to their location and geophysical context. While the risk of technological disasters exists everywhere, technically, according to Nelson (2003), floods may occur when a stream discharge increases and oversteps its banks. The stream increases in its depth and width to accommodate the water that flows into it from rainfall, tributary, streams and underground water seeping into it. The discharge rate of a stream is the amount of water passing any point at a given time. As the amount of water in the stream increases, the stream adjusts its velocity and cross-sectional area in order to form a balance, thereby going beyond its normal channel boundaries (Nelson, 2003).

Opinions are divided on the causes of floods. While some link it to human interventions which appear varied depending on the locality, others believe it is a natural incident (Zhang et al., 2008). Floods are attributable to several causes which include natural ones like the geophysical location, the topography of

floodplain, prolonged and torrential rains and human-induced ones such as space use and location of economic activities (Zhang et al., 2008). The views of the respondents on the causes of floods in the study area are showed in Table 15.

**Table 15: Causes of Floods in the Talensi and Builsa South Districts**

| Causes | Percentage scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Talensi District | | | | Builsa South District | | | |
| | SA | A | D | SD | SA | A | D | SD |
| Nature | 14 | 21.1 | 29.2 | 35.7 | 37.2 | 37.2 | 14 | 11.6 |
| God | 12.9 | 17.5 | 27.5 | 42.1 | 20.9 | 34.3 | 26.7 | 18.0 |
| Bursting of dams | 32.2 | 18.1 | 12.3 | 37.4 | 36.6 | 33.1 | 23.3 | 7.0 |
| Deforestation | 30.4 | 19.3 | 12.3 | 38 | 32.6 | 37.2 | 18 | 12.2 |
| Bad waste disposal | 23.4 | 17 | 11.1 | 48.5 | 30.8 | 27.3 | 20.9 | 20.9 |
| Building on water ways | 15.2 | 12.9 | 18.1 | 53.8 | 34.3 | 28.5 | 27.3 | 9.9 |
| Dams spilled over | 83 | 10.5 | 4.1 | 2.3 | 35.5 | 33.1 | 19.2 | 12.2 |
| Increase heavy rains | 38.6 | 15.8 | 28.1 | 17.5 | 37.2 | 27.9 | 22.1 | 12.8 |
| Punishment by ancestors | 4.7 | 6.4 | 15.2 | 73.7 | 11 | 32 | 25 | 32 |

SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree
Source: Field survey (2017)

Floods in the study area were influenced by a number of factors, with 83 percent of the respondents from the Talensi district strongly agreeing that a dam spill over was the key factor of flooding in the study area as against 35.5 percent for the Builsa South District. The study area receives extract water from the Bagre

Dam in Burkina Faso any time it is spilled. Excess water from the dam has adverse impacts on the crops as well as livestock. This has been observed annually in the study area.

Heavy rains in the months of August and September was the second factor which was raised by 38.6 percent of the respondents in the Talensi District as the cause of floods against 37.2 percent of respondents in the Builsa South District. This finding was consistent with that of UNDP/NADMO (2009) that from both the technical and ordinary citizen's viewpoints, what accounts for the floods in the study area was the natural incidence of heavy down pours, annual spillage of water from Burkina Faso and human activities. Torrential rains which are concentrated within a two months period (August and September) in the savannah belt caused high discharges and large-scale sudden flows above the carriage capacity of the drainage. Whether there are rains or not, the annual spillage of the Bagre Dam in neighbouring Burkina Faso also places the region in a danger of flooding and the consequences are dire. This result also supported Agrawala, Raksakulthai, Aalst, Larsen, Smith and Reynolds' (2003) assertion that in India, accelerated increased intensity of monsoon precipitation observed during recent years has contributed to increased frequency of floods.

The in-depth interviews with the key informants in the two Districts corroborated the farmers' responses on the causes of floods in the study area. One of the key informants in the Talensi District had this to say:

"*Floods in this community could be as a result of the farming activities. Some farmers farm close to the river banks, which leads to soil erosion.*

*The sand is carried into the river and silts it so in the event of any slight rainfall, the whole place gets flooded. Some too had built houses at flood prone areas so when it rains; the water has no place to pass than to spread to other places. Excess water that comes from Burkina Faso also contributes to major flooding. They have a Dam that can be compared to Akomsobo and when they release the water, communities along the river are swept away, not to even talk about life and property".*

This submission suggests that farmers in the study area engaged in bad farming practices which contributed to flooding. However, the farmers must acknowledge that there is climate change and, thus, desist from actions that would deteriorate the situation and affect sustainable livelihoods. The finding regarding bad farming practices supports the Zhang (2008) and ActionAid (2005) position that human activities driven by socio-economic factors should be considered responsible for the recent increased level of flood risk. Although humans have been victims of natural flooding, their presence and interventions near rivers and flood plains contribute to the problem. Flood disasters are created by countless locational decisions of individuals that encourage settlement and unregulated expansion into flood zones and the intrinsic land use and economic development of flood plains (Smith & Ward, 1998).

**Knowledge of the Nature of Floods**

The study sought to establish the nature of the floods problem in the study area. The results of the study indicated that majority of the respondents 93.6 percent agreed to the fact that flooding was the major problem confronting the

people in the study area. This suggests that respondents may have suffered severely from floods in the study area. This finding confirms the global perspective on the problematic nature of floods which have been reported to have destroyed properties worth fortunes in different countries of the world (Aljazeera, 2010).

The farmers' knowledge of a particular hazard determines their understanding and interpretation of it thereof. Respondents highlighted varied interpretations of floods to include natural hazard and acts of God (See Table 16). Of all the respondents, 58.3 percent noted that floods were a natural hazard which causes much destruction, such that crops that were planted or cultivated struggle to survive during the floods. About a quarter (24.5%) of the farmers were of the view that floods mean a high flow of water oversteps the natural channel provided for run off, whiles 2.6 percent simply understood flooding to be an act of God. The results revealed that more than 95 percent of the answers given for floods were correct indicating that farmers were not ignorant of floods in the study area. These findings were also in accordance with those of Amir Faisal et al. (2014), who ascertained that farmers are not ignorant of flood issues.

**Table 16: Respondent's Knowledge of Floods**

| Knowledge | Talensi District | | Builsa District | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Natural response of a river | 14 | 8.2 | 17 | 9.9 | 31 | 18.1 |
| Excess water found on dry land | 32 | 18.7 | 24 | 14 | 56 | 32.7 |
| High flow of water which oversteps the natural channel provided for runoff | 87 | 50.9 | 121 | 70.3 | 208 | 121 |
| Natural hazard which causes a lot of destruction | 27 | 15.8 | 7 | 4.1 | 34 | 19.9 |
| An act of God | 11 | 6.4 | 3 | 1.7 | 14 | 8.1 |
| Total | 171 | 100 | 172 | 100 | 343 | 200 |

Source: Field survey (2017)

The study also sought to find out the number of years respondents witnessed floods in the study area. From Figure 12, the results revealed that 43.7 percent of respondents in the Talensi District and 17.4 percent in the Builsa South District had 11 years of flood experience. In the Builsa South District, however, 43 percent had 6 to 10 years of flood observation as against 28.7 percent for Talensi. This indicates that majority of the respondents had ever witnessed flooding and had a higher perception of risk to flooding. This finding is consistent with that of Weinsten, and Aboagye (2012), Dari and Koomson (2013) who indicated that farmer' years of experience with regards to flooding is an important factor that influences their understanding and perception of floods.

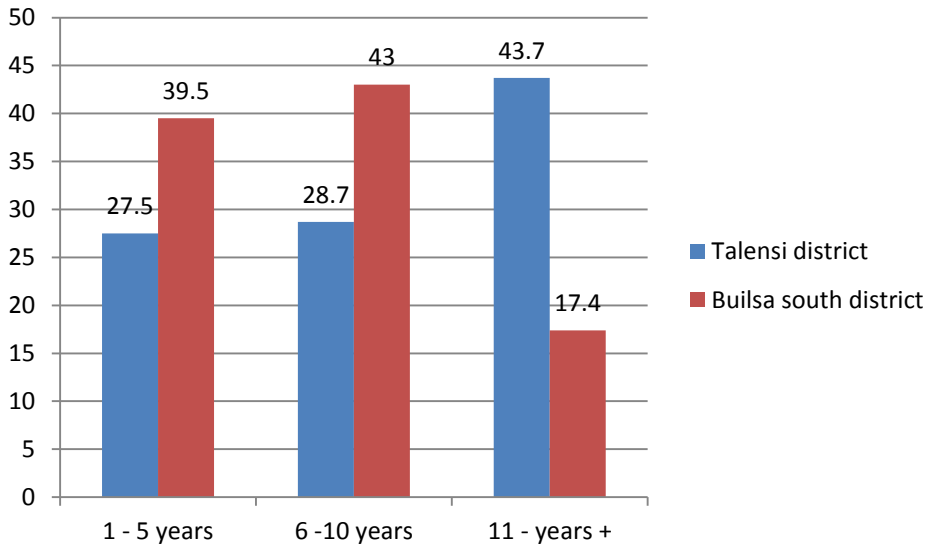


**Figure 12: Years of flood experience**

Source: Field survey (2017)

The study sought to establish the nature of the flood problem in the study area. The results of the study indicated that majority of the respondents 93.6 percent agreed to the fact that flooding is the major problem confronting the people in the study area. This result indicated that respondents may have suffered severely any time the study area was flooded. This confirmed the global perspective of the problematic nature of flooding which has been reported to have destroyed properties worth fortunes in different countries of the world (Aljazeera, 2010).

**Frequency of Floods**

Knowing the magnitude and probable frequency of recurrence of floods is necessary for proper preparation such as sowing flood resistant crops, sowing early, drainage designing and location of structures such as dams, bridges, culverts, levees, highways and waterworks (Dalrymple, 2007). In response to a

question on the frequency of floods in the study area within the past ten years, it was revealed that out of the total number respondents, 69.1 percent believe floods in the study area occur more often now while 11.7 percent considered the frequency of the floods in the study area now as the same as ten years ago (Table 17).

It was obvious from the study results that there has not been any decrease in the occurrence of floods in the study area for the past ten years. This implies that respondents have no choice but to always put in place preparatory measures to mitigate the effects of the floods in the study area. The observations made by majority of the respondents were consistent with findings from the studies carried out by Udosen (2012) who indicated that floods were globally becoming more frequent because of climate change. Looking at it from the Districts perspective, 91.2 percent of the respondents from the Talensi District and 47.1 percent from Builsa South District indicated that flood events occur more often now.

**Table 17: Frequency of Floods in the Talensi and Builsa South Districts**

| Frequency | Talensi | | Builsa South | | Total | |
|---|---|---|---|---|---|---|
| of floods | No. | % | No. | % | No. | % |
| More often | 156 | 91.2 | 81 | 47.1 | 237 | 69.1 |
| Less often | 10 | 5.8 | 56 | 32.6 | 66 | 19.2 |
| Same as always | 5 | 2.9 | 35 | 20.3 | 40 | 11.7 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

**Changes in Rainfall and Temperature**

Observing changes in the rainfall and temperature of an area helps people to plan for either positive or negative outcomes of the changes. This study, therefore, sought to find out respondents' observation of the changes in the rainfall and temperature patterns in the study area. The results (Table 18) hold that on the whole, almost 40 percent of the respondents were of the view that rainfall in the study area had decreased as 43.7 percent think the nature of temperature is unpredictable.

These results were further disaggregated by Districts and it was found that 45 percent of the respondents in the Talensi District observed that there was an increase in the temperature as against 19.2 percent in the Builsa South District. In Talensi and Builsa South Districts 43.9 percent and 36 percent of the respondents respectively were of the view that rainfall had decreased. Based on these results, one would expect that there should be a corresponding decrease in floods in the study area. This was, however, not the case because most of the respondents admitted that the major cause of floods in the study area was the annual spill over from Bagre dam in neighbouring Burkina Faso.

**Table 18: Changes in the Rainfall and Temperature**

| Responses | Talensi district | | Builsa south district | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| *Rainfall* | | | | | | |
| Unpredictable | 36 | 21 | 62 | 36.0 | 98 | 28.6 |
| No changes | 7 | 4.1 | 23 | 13.4 | 30 | 8.7 |
| Decreased | 75 | 43.9 | 62 | 36.0 | 137 | 39.9 |
| Increased | 53 | 31.0 | 25 | 14.5 | 78 | 22.7 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |
| *Temperature* | | | | | | |
| Unpredictable | 64 | 37.4 | 86 | 50.0 | 150 | 43.7 |
| No changes | 11 | 6.4 | 23 | 13.4 | 34 | 9.9 |
| Decreased | 19 | 11.1 | 30 | 17.4 | 49 | 14.3 |
| Increased | 77 | 45 | 33 | 19.2 | 110 | 32.1 |
| Total | 171 | 100 | 172 | 100 | 343 | 100 |

Source: Field survey (2017)

The female participants in the focus group discussions (FGDs) explained that temperatures were very high because the duration of the rainy season was decreasing, leading to more dry months and higher temperatures. They also linked less tree cover to the rising temperatures. An elderly woman stated that:

> "*When I was young, there were trees around that provided shade where most households sat during the hot day, but most of these trees are dead. As you can see, we now create stalls like this and these do not blow air, so the air is still hot".*

A key informant in another interview at the Talensi District stated that:

> "*Temperatures are so high that when you walk in the sun for long, you fall sick".*

In fact, all the statements regarding temperature indicated an increase. Observations during the study demonstrated the fact that there was a serious

depletion of the tree cover in the study area. Felling of trees was very common, as many used trees for fuel wood and charcoal burning as a source of income for their livelihoods. Additionally, it was unanimously agreed in all FGDs (Males and females in Talensi and Builsa South) that it was very hot when there was no rain or when the air was dry, particularly in the dry season or during dry spells/droughts.

The study also sought to determine why respondents were still living in flood prone areas despite knowing that such areas are at risk and liable to flooding. Different reasons were given as presented in Table 19.

**Table 19: Reasons for Continued stay in Flood-prone Areas**

| Reasons | Frequency | Percentage (%) |
|---|---|---|
| No alternative | 13 | 3.8 |
| To maintain ties with family | 19 | 5.5 |
| High cost of relocation | 31 | 9.0 |
| Low cost of farmlands | 64 | 18.7 |
| Fertility of the soil | 216 | 63.0 |
| Total | 343 | 100 |

Source: Field survey (2017)

It emerged from the study that 3.8 percent of the respondents said it was because they did not have an alternative. This was because the property they occupied belonged to them and they were not willing to move into rented apartments elsewhere. Almost a fifth (18.7%) indicated that the low cost of farm land was responsible for their continued stay while the majority of the

respondents (63%) said it was the fertility of the soil that prevented them from moving away.

The varied reasons respondents advanced were an attempt to make people appreciate why they continued to live in the area although they endured the phenomenon of flooding each year. All these go to validate the proposition that "socioeconomic constraints were the motivation of inhabitants' continual stay in flood prone areas". While some residents could not afford to move out of their communities, others continued to stay because of social ties such as the need to stay in a family house to take care of it and not pay any rent.

**Vulnerability to Floods**

Vulnerability is the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt (Adger, 2006). Vulnerability consistently focuses on socio-ecological systems. The concept of a socio-ecological system reflects the idea that human action and social structures are integral to nature and hence any distinction between social and natural systems is arbitrary. It is the multi-level interactions between system components (livelihoods, social structures and agricultural policy) that determine system vulnerability. In all formulations, the key parameters of vulnerability are the stress to which a system is exposed, its sensitivity and its adaptive capacity ( Ahile, & Ityavyar, 2014).

A number of disciplines and studies have proposed numerous ways of measuring or quantifying the vulnerability of rural households to different phenomena. Despite their differences in defining vulnerability and hence the

variables selected and methodologies (Luers et al, 2003), the development of measures of vulnerability is complicated by the lack of consensus on the exact meaning of the term (Luers, 2003; Mani, 2001; Pritchett et al, 2000; Downing et al., 2001).

This study, however, adopted the social protection perspective of measuring household vulnerability to floods in rural areas, where vulnerability measures are categorised into three levels: low level vulnerability – coping or resilient to floods; moderate level vulnerability – can cope after receiving assistance and high level vulnerability – point of no return that require special attention to recover from damage. With respect to this study, respondents were asked to rate their vulnerability level based on the three levels regarding their ability to recover with or without assistance. Findings from my study revealed that majority of the respondents (79.6%) indicated that they were highly vulnerable to floods in the study area. This is an indication of the fact that they required special support to recover from their flood damage.

Disaggregation of the results by Districts indicated that the majority of respondents in the Talensi District (60%) were highly vulnerable to floods as compared to 55% for Builsa South District. Many factors may contribute to the respondents' vulnerability to floods (see Figure 13).

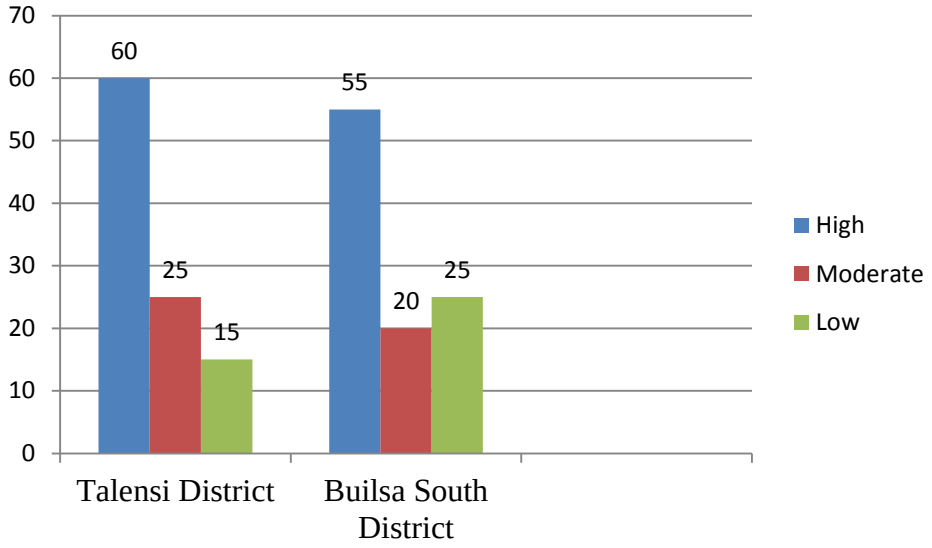


**Figure 13: Level of vulnerability to floods**

Source: Field survey (2017)

From the in-depth interviews in the Talensi and Builsa South Districts, it emerged that Farmers were vulnerable to floods because they did not have the resources needed to withstand the impact of the floods. For instance, farmers who did not have the needed resources, lacked basic things and are not physically strong were more vulnerable to floods compared to other people who had the resources, do not lack basic things and were strong. Specifically, the key informant in the Builsa South District summarised the farmers' vulnerability as:

> *"Farmers' vulnerability to floods was due to their lack of knowledge and poverty. The residents used mud to construct their structures and were easily affected by small rainfall. Others also built their houses in water logged areas. Because of the poverty, some built weak houses which can easily be washed away, and all these make them more vulnerable to floods. In view of this, if I were to rate their vulnerability level, it would be*

*high because the community is a low land area and flood prone. So as soon as it rains successively, the whole place becomes flooded".*

In a related development, the NADMO officer in the Builsa South District indicated that:

*"The environment, for instance, is water logged and has poor drainage systems. Residents who stayed in this area were vulnerable to floods because they lived and farm there and there was nothing they could do. Some people also want to live in towns and enjoy city facilities and make their money, irrespective of the place being water logged or not. Economically, they are interested in making money so they sited their animal's pen or stores close to flood prone areas".*

The above quotation demonstrates the fact that the vulnerability of residents to floods in the study area can be traced to their own actions and inactions. For example, for residents' personal comfort and economic gains, they are prepared to live in flood prone areas irrespective of the dangers they are exposed too. The findings also supported NADMO's (2015) position that the ecology of the study area is Sudan savannah, thereby, increasing the susceptibility of the area to floods and desertification. Thus, the Upper East Region experienced the highest number of flood events (NADMO, 2015).

Also, because the Bagre Dam in Burkina Faso tributaries flows through the region, the impact of the spillage of the Bagre dam on farmers in the region is severe. However, farmers in the region do not receive adequate information or warning about imminent natural disasters such as floods (NADMO, 2015).

**Education of Respondents and Vulnerability to Floods**

In order to examine whether differences exist with respect to education and vulnerability level of respondents, a chi-square test of independence was conducted. The test was statistically significant at the 0.05 alpha level ($\chi^2$ = 28.317; df = 8; *p*-value = 0.000), meaning there were variations in the educational level of respondents and their vulnerability level. The results showed that respondents with no formal education had higher levels vulnerability than those who had tertiary education.

This implies that respondents who have had no formal education have fewer opportunities to rely on when floods occur. On the contrary, those with tertiary education were more likely to be engaged in more than one livelihood activity so when floods occur they could rely on other alternative means of survival. The conceptual framework of the study attests to the fact that households with higher human resources as assets have alternative livelihood strategies which are vital to breaking out of poverty. This further supports the findings made by Deressa, Ringler and Hassan (2010) that households who experienced floods in Bangladesh with human resources are more likely to recover faster than those without human resources.

**Table 20: Education of Respondents and Vulnerability to Floods**

| Educational Level | Vulnerability to floods | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | High | | Moderate | | Low | | |
| | No. | % | No. | % | No. | % | |
| Never attended | 96 | 88.9 | 12 | 11.1 | 0 | 0.0 | 108 |
| Primary | 47 | 78.3 | 12 | 20.0 | 1 | 1.7 | 60 |
| JHS | 39 | 84.8 | 7 | 15.2 | 0 | 0.0 | 46 |
| SHS | 73 | 73.7 | 16 | 16.2 | 10 | 10.1 | 99 |
| Tertiary | 2 | 6.7 | 10 | 33.3 | 18 | 60.0 | 30 |
| Total | 257 | 332.4 | 57 | 95.8 | 29 | 71.8 | 343 |

($\chi^2$ = 28.317; df = 8; *p*-value = 0.000)

Source: Field survey (2017)

**Sex of Respondents and Vulnerability to Floods**

In order to examine whether the sex of respondents influences their vulnerability levels, a chi-square test of independence was conducted. The test was not statistically significant at the 0.05 alpha level ($\chi^2$ = 1.711; df =2; *p*-value = 0.425), meaning, there were no variations in respondents' sex and their vulnerability level. The results showed that the majority of respondents, both males and females, had high vulnerability levels to floods as shown in Table 21. This means that sex did not influence household vulnerability to floods. The implication was that being male or female does not necessarily determine one's vulnerability to floods. In this regard, the ability of an individual to recover from the effects of floods is not influenced by the person's sex.

**Table 21: Sex of Respondents and Vulnerability to Floods**

| Sex | Vulnerability to floods | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | High | | Moderate | | Low | | |
| | No. | % | No. | % | No. | % | |
| Males | 153 | 77.3 | 36 | 18.2 | 9 | 4.5 | 198 |
| Females | 120 | 82.8 | 21 | 14.5 | 4 | 2.8 | 145 |
| Total | 273 | 160.1 | 57 | 32.7 | 13 | 7.3 | 343 |

($\chi^2$ = 1.711; df =2; *p*-value = 0.425)

Source: Field survey (2017)

**Farmers' Assets Vulnerable to Floods**

The actual amount of damage by a specific flood event depends on the vulnerability of the affected socio-economic and ecological systems that are broadly defined on their potential to be harmed by a hazardous event (Cutter 1996; Mitchell 1989). Generally, an element at risk of being harmed is more vulnerable when exposed to a hazard and more susceptible to its forces and impacts. Vulnerability is determined by a household's resource characteristics (economic, political, social, demographic, psychological and environmental) and, in this case, their appropriateness in reducing the likelihood of living in a space being flooded and the scale and distribution of impacts should flooding occur. The views on household assets which are more vulnerable to floods are shown in Table 22.

**Table 22: Farmer's Assets Vulnerable to Floods**

| Dimensions | Percentage scores | | | Total |
|---|---|---|---|---|
| | High | Moderate | Low | |
| Land | 72.6 | 17.2 | 10.2 | 100.0 |
| Water | 47.2 | 31.2 | 21.6 | 100.0 |
| Equipment | 20.4 | 36.7 | 42.9 | 100.0 |
| Livestock | 24.5 | 33.2 | 42.3 | 100.0 |
| Remittance | 16.9 | 29.4 | 53.6 | 100.0 |
| Saving | 39.9 | 35.9 | 24.2 | 100.0 |
| Farm labour | 44.9 | 34.1 | 21.0 | 100.0 |
| Dependency ratio | 35.9 | 37.0 | 27.1 | 100.0 |
| Information | 16.3 | 33.2 | 50.4 | 100.0 |
| Social network | 20.1 | 32.1 | 47.8 | 100.0 |
| Community support | 18.1 | 41.7 | 40.2 | 100.0 |
| External families | 15.2 | 40.5 | 44.3 | 100.0 |

Source: Field survey (2017)

From Table 22, it can be seen that majority of the respondents (72.6%) were of the view that land was the most vulnerable to floods as compared to other household assets. The Region's land is relatively flat with a few hills to the East and Southeast. The "upland soil" mainly developed from granite rocks. It is shallow and low in soil fertility, weak with low organic matter content and predominantly coarse textured. Erosion is a problem. Valley areas have soils ranging from sandy loams to silty clays. They have higher natural fertility but are more difficult to till and are prone to seasonal water logging and floods (Regional Coordinating Unit, 2003).

**The Effects of Flooding on Livelihood Resources**

The frequency of flood disasters around the world is rising (Douben 2006) and the hypotheses for the causes of this phenomenon are numerous. Increased climatic variability, the expansion of human settlement in flood plains and land cover and land use changes, all together, are believed to be increasing human exposure and sensitivity to flood impacts (Kundzewicz & Kaczmarek, 2000). The persistence of loss in face of increased knowledge about the dynamics, drivers, and outcomes of hazards may well signal a significant lack of sustainability in social-environmental relations, as well as a need to reconsider the underlying principles of flood management. Nevertheless, the meaning of harm and loss has a significant subjective component and thus varies among individuals from place to place (Hewitt, 1997). Understanding this subjective experience is not only necessary to ensure that policy effectively addresses the needs of vulnerable populations, but also, it is necessary to enable more effective and flexible policy solutions to evolving risk.

**Effects of Floods on Farmers**

The effect of flooding on individual farmers varies. Views from respondents were drawn regarding the effect of flooding. The study investigated how individual farmers had been affected by the floods. Majority of the respondents (58.3%) indicated that they had been directly and severely affected by the floods. This was followed by 35.6 percent who had been affected by the floods, but not severely (Table 23). This finding was consistent with that of

Scoones (2009) who argued that flood impact on farmers in Zimbabwe varied in magnitude.

**Table 23: Effects of Floods on Farmers**

| Responses | Frequency | Percentage |
|---|---|---|
| Yes, but not severe | 122 | 35.6 |
| Yes, severely | 200 | 58.3 |
| No | 21 | 6.1 |
| Total | 343 | 100 |

Source: Field survey (2017)

From the women in the focus group discussions in the Builsa South District, it was disclosed that flooding had been one of the major problems in the community. According to them they suffered dearly because of the floods. Almost all roads to the market were cut off. One of the discussants had this to say:

> *"I suffered greatly last year because of the floods; where to go with my children was a problem. We were left to our fate and wandering like strangers in our own land. We sat under a shed in the rain; it was just too much for me and my children".*

Another discussant supported the statement and pointed to a river and said:

> *"Almost every year, this river usually gets full and overflowed to houses, making buildings collapse; we had no place to sit. Everybody ran for his or life, some climbed trees and it was like only the strong could survive. It has been raining but last year's, for instance, was too serious. It affected our children's education*".

Discussants further revealed that people normally swim, climbed roofs of houses or move from precarious areas to safe areas to rescue lives during a flood. These measures were used as they did not require modern tools like boats for evacuating people during floods from dangerous areas to safer places. In practice, the efficiency of these techniques depended on the flexibility of the people.

The focus group discussions also disclosed that gender, age and body fitness of a person were among the key factors for effective swimming and climbing of trees and roofs of the houses. As a discussant had put it:

> *"Men were flexible and fast to run, swim and climb trees and roofs of houses compared to women, especially those who were carrying babies. They were often restricted from running fast by their clothing and their role as caretakers of children".*

It also emerged from the discussion that children and elders were perceived to lag behind in terms of running, swimming, and climbing trees and roofs of houses due to age and body fitness factors. Briggs (2005) argues that both men and women are sentient to respond to hazard risks; however, socio-economic, political, biological and environmental settings set apart their response measures. These views were also cemented by URT (2004) that when a disaster strikes, it is mainly women, children, the disabled, elderly and confined persons who bear the brunt of the tragedy due to their family roles and confinement from easy movement. In instances of displacement, women and children were often subjected to human rights violations.

**Effects of Floods on Livelihood Resources**

The effects of floods on livelihood resources in the study area were complex, but they were summarised and presented in Table 24. Majority of the people directly depended on crops for their livelihoods, but floods in the study area generally affect crops. As far as this study was concerned, most of the respondents were of the view that crops, food supplies, physical structures as well as livestock were the frequently affected resources during a flood; the magnitude of the effects are, however, varied (see Table 24).

**Table 24: Effects of Floods on Socioeconomic Resources**

| Livelihood resources | Percentage Scores | | | | | Total |
|---|---|---|---|---|---|---|
| | VMS | VS | S | FS | NS | |
| Structures | 27.7 | 21.9 | 19.2 | 9.0 | 22.2 | 100.0 |
| Crops | 66.5 | 18.1 | 11.4 | 2.6 | 1.5 | 100.0 |
| Food supplies | 51.0 | 22.4 | 14.3 | 7.9 | 4.4 | 100.0 |
| Water contamination | 20.4 | 16.9 | 20.4 | 26.5 | 15.7 | 100.0 |
| Loss of lives | 16.9 | 16.3 | 24.8 | 28.9 | 13.1 | 100.0 |
| Epidemics | 16.9 | 25.9 | 28.0 | 16.9 | 12.2 | 100.0 |
| Disrupting schools | 11.4 | 16.9 | 22.2 | 26.8 | 22.7 | 100.0 |
| Transportation | 13.4 | 14.3 | 20.7 | 29.4 | 22.2 | 100.0 |
| Communication | 13.4 | 15.5 | 16.0 | 20.1 | 35.0 | 100.0 |
| Famine | 21.6 | 28.3 | 16.0 | 14.9 | 19.2 | 100.0 |
| Traumatise | 12.2 | 28.3 | 25.4 | 16.3 | 17.8 | 100.0 |
| Stress | 15.2 | 23.9 | 27.7 | 17.2 | 16.0 | 100.0 |
| Reduce investment | 20.7 | 17.5 | 24.2 | 28.3 | 9.3 | 100.0 |
| Proliferation of snakes | 19.5 | 22.7 | 25.4 | 21.9 | 10.5 | 100.0 |
| Water diseases | 25.9 | 22.7 | 30.0 | 12.8 | 8.5 | 100.0 |
| Migration | 27.4 | 28.9 | 23.0 | 9.3 | 11.4 | 100.0 |
| Reduce soil nutrient | 18.7 | 18.1 | 25.9 | 23.3 | 14.0 | 100.0 |
| Internal displacement | 13.4 | 19.5 | 24.5 | 23.9 | 18.7 | 100.0 |
| Livestock | 16.3 | 18.7 | 22.4 | 26.8 | 15.7 | 100.0 |

Very much severe = VMS Very severe = VS Severe = S Fairly severe = FS Not severe = NS

Source: Field survey (2017)

From Table 24, it is evident that majority of the respondents (66.5%) identified crops as the most severely affected livelihood resource during floods in the study area. This was followed by the food supply system (51 percent). There was also a spread of waterborne diseases, mentioned by 25.9 percent. The results further indicate that with the exception of social ties, transportation and communication which were not severely affected by floods, all other resources were severely affected as presented in Table 24.

These results confirmed the fact that the study area is made, principally, of agricultural producers and demonstrated the severity of the floods. The main consequence of flooding has been the obliteration of food crops on farms as well as seeds stores, ultimately culminating in a decline in food production. A decline in food production could lead to food insecurity and hunger which may, in some cases, last for several months after each episode of flooding.

In an interview with a key informant, he professed that:

> "*Hunger, together with a decline in environmental quality resulting from flood associated impairment, fuels the desire for migrating out of the study area. The reduction in food production resulting from floods also means loss of income for many in these communities which further reduce their ability to purchase food and thereby contribute to increasing the problem of food shortages and starvation among farmers. The floods also contributed to the disruption of children's schooling and the spread of waterborne diseases".*

This finding was consistent with that of Mirza, Tanvir, Shofiul and Syed (2015) whose findings concluded that floods damaged crops; spread waterborne diseases and led to a loss of land, including agricultural and non-agricultural land; loss of settlement and loss of income. Reports from the Ministry of Food and Agriculture estimated that an area of 24,300 hectares was affected by flooding and resulted in an estimated production loss of 75,000 Metric Tonnes (MTs) of food crops (including maize, sorghum, millet, ground nuts and rice) in the region for the year 2014 alone, and the study area was part of this disaster.

In an in-depth interview with a key informant (Agricultural extension officer) in Talensi District, he pointed out that:

> *"Many farmers safe-guard the most viable portions of their produce as seed for the next planting season. In the 2015/2016 floods, the significant damage of food crops just approaching harvest meant that the farmers' seed supply for the coming agricultural year was endangered".*

Floods, therefore, affected seed supply either through affecting crop production (on farms) or destroying seed stores (in homes). Whichever way, the lack of seeds for successive planting could create a reinforcing effect of lower food production and food insecurity.

**Plate 1: Crops submerged in Talensi District**

The agricultural extension officer in the Talensi District further stressed that farmers might be able to complement their seeds by purchasing some from the markets either to make up for a deficit or introduce products with better qualities into their stock. However, by reducing food production, floods may diminish household income and reduce farmers' ability to buy seeds which also creates another effect of lower production and even lower ability to increase household income enough to afford seed purchases.

Farmers who could not harvest their own seeds or buy them because of flood damage turned to family and friends for support which often proved to be very productive. This highlights the vital role played by social networks as important tools for the mitigation of flood-induced vulnerability. With higher yields, farmers were more able to increase their productive power. The study also revealed that since 2000, farmers experienced a decline in rice yields in years characterised by erratic floods.

In a related development, the agricultural extension officer for Builsa South added that:

> *"Floods also render farms uncultivable for the time it was inundated and even deposit residues on farms that make farming expensive and difficult for some time".*

Floods, therefore, have a huge potential of reducing food production, which could reduce access to food, lower nutrition standards; encourage rural exodus and the loss of agricultural labour which further reduces food crop production in a vicious cycle. Hunger was another important product of floods in the study area. Another submission by the key informant of the Builsa South was that

> *"Floods created an enabling environment for the proliferation of diseases and destroy produce on farms, which drives the cycle of limited food production. Floods also directly limit access to food resources either distributed as aid, sold in distant markets or available from relatives in areas not affected by floods, thereby, reinforcing the starvation that may be created by the destruction of crops by floods".*

This might mean that the flood-induced declined in crop production and restraint in access to food both contribute to triggering the hunger that has been common among natural resource dependent populations in flood-prone areas. Given that the economies of these areas were profoundly dependent on agriculture, flood damage of food production systems may lead to a reduction in

household income and the ability to buy food; hence, the starvation that follows periods of floods.

It emerged from the females' focus group discussion in the Builsa South District that paddy fields were damaged. It was not uncommon for some families to entirely lose their rice harvest for the year. Of those families who were categorised as "affluent" or "having enough", the average land area for paddy fields was 5 hectares. Discussants argued that losing the rice crop following a flood, previously landed families take time to find new land. The new land may be less fertile, leading to a decreased rice production from already low quantities, and additional help is required to clear the new land. In respect of this, one discussant concluded that:

> *"If only one indicator was used to assess vulnerability from the perspective of farmers, it would be whether a family has a sufficient amount of rice throughout the year".*

**Infrastructure Damaging**

Flood loss in the districts was not limited to human lives, crops and animals, but also public and private infrastructure. Several places were cut off and made inaccessible during floods. Businesses were also affected. The results of the study as presented in Table 24 revealed that 27.7 percent of the respondents indicated that physical structures, both government and private owned, were affected by the floods.

This result was an indication of the fact that flood disasters led to the destruction of housing and feeder roads and the collapse of schools. The poor

quality of materials used and the structural problems coupled with heavy rains led to the total collapse of several buildings across the study area. Poverty in technology, locational decisions and finance made it difficult for individuals to acquire improved building materials for the construction of flood resistant structures. While it was not a common problem within the study area, loss of infrastructure greatly impacts a few farmers very significantly. It takes considerable resources in time and effort to rebuild the lost shelters. It is a cost that takes away from other recovery efforts in farming or supporting the family.

This finding corroborated that of Bariweni, Tawari, and Abowei (2012) in their study on some environmental effects of flooding in the Niger Delta Region of Nigeria. Their study revealed that the floods of 2012 had major effects on socioeconomic life for days, weeks and even months in some areas. Roads and buildings were submerged and victims were trapped due to the blockage of roads and the damage to bridges. Fast flowing floodwaters are also capable of washing away entire buildings and communities. In January 2011, floods in South-Eastern Brazil rendered about 100,000 people homeless and destroyed key infrastructures (Jha, 2012).

*Plate 2: Damaged road in the Builsa South District*

**Livestock losses**

Although crop losses and paddy field damage were a common and immediate impact on the household, losing livestock was the most serious blow to

long-term livelihood and family food security (Jha, 2012). In rural areas, the family's cows were used as a savings mechanism.

The flood also caused losses to livestock like goats, sheep, chicken and cattle. About 57 percent of the respondents revealed that floods affected livestock considerably. Considering the fact that animal husbandry is the second largest source of income and livelihood in the study area after food crops, the death of some of the livestock as a result of the flood had effects on the livelihood of the people. While the chicken suffered maximum health related problems, the cattle suffered food crisis during periods of floods, which was one of the major problems during any floods in the study area. This was supported by a key informant who indicated that:

> *"Wetlands of the study area were under the water during the flood period and for this reason, food for livestock as well as shelter becomes a great problem especially for the poor farmers".*

He added that during floods, the livestock suffered from different types of health related problems very frequently, and it was very difficult to manage the medical service for sick livestock.

Based on the above quotation and narratives, the average family that lost a considerable number of livestock during major floods in the study area were more likely to be food insecure considering that in rural households, some livestock could be sold and used to buy enough rice to feed four or five people for an entire year, this was a terrible setback in a family's savings. Cows also played a key role in livelihood as draught animals in the paddy fields.

The finding also supports the finding by FAO (2010) that the floods in Pakistan caused the deaths of between 11 million and 20 million animals and monetary damages were estimated at over US$287 million. The loss of livestock did not only represent a loss of income for families, but also family savings and investment over many years. Livestock represents a safety net for many families and the loss of such productive assets will impact significantly on lives and livelihoods.

**Water-related diseases**

About 30 percent of the respondents pointed out that the floods led to the spread of waterborne diseases in the study area. It emerged from the female focus group discussion in Builsa South District that during the flood periods, water related problems increase. One discussant had this to say:

> *"During floods, different waterborne diseases like diarrhoea, cholera, jaundice and skin related health problems were more commonly seen. Children and aged people were most commonly affected by these types of health related problems".*

Discussants further indicated that treatment sometimes might not be easy due to the lack of accessibility to basic health facilities. Accessing these facilities becomes a difficult task during floods because the flood water covers the entire area and the water is contaminated by different bacteria and poisonous substances. Thus, contact with this water could be harmful to human health, but people were bound to use this water in different daily activities because of the lack of safe water. This finding supports Kunii's (2002) argument that floods release

contaminants which pose serious public health risks for survivors. Flood waters can mix with raw sewage and thus dramatically increase the incidence of water-borne diseases. Such contaminated flood waters eventually contaminate the affected community's drinking water sources, causing death from water related diseases such as diarrhoea and cholera.

An unhealthy person might not be able to contribute meaningfully to the development of a society and sometimes he or she becomes a liability to those around him/her. Additional money was spent on treatment of water related diseases, particularly malaria, due to the breeding of mosquitoes from motionless dirty or muddy water which remains after the floods for a while before drying up. The environment subsequently becomes predisposed to the epidemic of diseases such as malaria and cholera.

A key informant from the Talensi District explained that during flood periods, crime surges since thieves take advantage of the situation to steal properties belonging to victims of the floods. He indicated that this often aggravates the plight of flood victims, making it very difficult to recover from the adversity.

# CHAPTER SEVEN

# FLOOD PREPAREDNESS AND ADAPTATION STRATEGIES

This chapter deals with farmers' preparedness and adaptation strategies for floods. The chapter is presented under the following headings: households' preparedness for floods, early warning information on floods, source of information on floods, the local means of forecasting floods, information on flood magnitude, knowledge on what farmers do before floods, factors influencing flood preparedness and effective ways of preparing for floods. The chapter also discusses resilience mechanism and adaptation strategies for floods and the farmers' challenges to adaptation strategies for floods.

## Farmers' Preparedness for Floods

Social scientists, emergency managers, and public policy makers generally organise both research and guidance around four phases of disaster loss reduction: mitigation, preparedness, response and recovery. According to a report by the National Research Council (NRC) (2006), the core topics of hazards and disaster research include hazard research, which focuses on pre-disaster hazards, vulnerability analysis and mitigation and disaster research which focuses on post-disaster emergency response and recovery. Preparedness is typically understood as consisting of measures that enable different units of analysis such as individuals, households, organisations, communities and societies to respond effectively and recover more quickly when disaster strikes. Preparedness efforts also aim at ensuring that the resources necessary for responding effectively in the event of a disaster are in place and that those faced with having to respond know

how to use those resources. Preparedness, however, begins with early warning information, main source of information, indigenous means of forecasting floods and knowledge on what to do before flood events.

**Early Warning Information on Floods**

Early warning and the provision of timely and reliable climate and seasonal forecast are critical components of flood planning and preparedness; they enhance the farmers' decision making process (UISDR, 2015). As far as this study majority of the respondents (82%) had early warning information with regard to flood issues in the study area. This high percentage could be attributed to the source through which they access the early warning information. This implies that farmers in the study area were more likely to be informed about pending occurrences of floods and the need for them to take measures and action to prepare for the floods. Information on pending floods reduces the impact of the flood on farmers if acted on.

The study indicated that about half of respondents (51.9%) relied on community announcement while 29.2 percent relied on radio as a source of early warning information (see Table 25). Community announcement procedures were increasingly viewed as an important element of flood disaster risk reduction (UNISDR, 2015). One possible explanation could be that it was readily available, precise and easy to disseminate.

**Table 25: Main Source of Information on Floods issues**

| Source | Frequency | Percentage |
|---|---|---|
| TV | 11 | 3.2 |
| Don't know | 54 | 15.7 |
| Radio | 100 | 29.2 |
| Community announcement | 178 | 51.9 |
| Total | 343 | 100 |

Source: Field survey (2017)

The different sources had diverse ways of conveying flood preparedness information to the farmers. According to ASFPM (2003), early warning information is to make people more aware of the flood hazards and protection alternatives; moreover, they are now going one step further to impart knowledge that could change attitudes and behaviour. As explained by a key informant in the Builsa South District:

> *"Available early warning information on floods increases households' level of urgency and appropriateness of their preparedness for floods. Inadequate or lack of early warning information on floods could be a barrier to farmers' preparedness level for floods. If farmers had prior knowledge or warning on the occurrence of floods, they will psyche themselves up to the floods. Unexpected floods occurrence could weaken their potential to withstand the impact of the floods".*

It was obvious from the narrative that one of the best ways farmers could prepare for floods was to have information on pending floods. This presupposes that farmers who had early information on the occurrences of floods would be in a

better position to prepare for floods compared to those who do not have access to early warning information on floods occurrence. This finding supports UN-ISDR's (2011) position that farmers who will receive early warning information on floods occurrence increase their participation in the flood response initiatives.

Similarly, from the male focus group discussion in the Talensi District, it emerged that farmers received information or early warning about floods through the use of information delivery vans or radio announcements indicating the onset of floods and dangers associated with the floods. Additionally, disaster committees in the villages, with the support of the chief, announced pending floods events to the general public. One of the discussants supported the narrative by saying that:

> "*There were community-based institutions known as the flood disaster committees whose duty was to educate farmers on flood disasters and to ensure that early warning, danger signs and announcement about the floods were done to safeguard human lives and farm produce".*

He was, however, quick to add that these committees did not execute their mandate effectively and that this was only possible if members of the committee were motivated to work effectively. He asserted that this strategy of disseminating information require extra funding which is not available.

Another male discussant in the Talensi District said:

> *"Farmers' preparedness for floods in this community is very low because it was always beyond them since it involves money and was nature. Thus,*

*the time the floods will come, the crops might not be ready for harvesting hence they had no control over the floods".*

**Indigenous means of forecasting floods**

Respondents were asked to indicate known indigenous means of forecasting floods in the study area. Most (77.6%) of the respondents specified the various indigenous means of forecasting floods. Results further pointed out that of the total 77.6 percent, about 39 percent were of the view that when they see a lot of snakes and ants moving out of rivers, it was an indication that floods were going to happen. Another 27.4 percent of the respondents used the months in the year to predict the onset of floods (Table: 26).

**Table 26: Indigenous Means of Forecasting Floods**

| Means | Frequency | Percentage |
|---|---|---|
| The way it rains | 14 | 4.1 |
| Direction of the wind | 25 | 7.3 |
| Consulting soothsayers | 77 | 22.4 |
| Using the months in a year | 94 | 27.4 |
| When snakes & ants come out of rivers | 133 | 38.8 |
| Total | 343 | 100 |

Source: Field survey (2017)

One key informant indicated that indigenous knowledge was based on observing nature and monitoring the natural environment such as observing the intensity of dew formation, croaking of frogs, spotting of certain types of river snakes, a flock of certain birds near the river or swarm of butterflies near crop

fields. Old people knew how the natural environment including weather had changed over the time. On these grounds, it was easily passed from one generation to another.

These views on floods prediction corroborate a study by Oageng (2012) in the Taung community in South Africa that the older people in the community have developed an indigenous knowledge system that was used to read and interpret weather patterns. According to the researcher, this was done through observing seasonal patterns, changing seasons, the lunar cycle and the stars. For example, the position of the moon was used to determine if it was going to rain or not. The position of the Sun may predict the onset of the rainy season. The direction of the wind was also used to determine whether it was going to be cold or not. This assists them in preparing for disasters such as drought and floods.

The study also investigated whether respondents were annually informed on flood forecasts and its magnitude. A little above half (51.9%) indicated that they received such forecasts. Unless the farmers were consistently informed of the flood levels, it was likely that they would be oblivious of the flood risks; thus, increasing their vulnerability. Flood forecasts initialised actions or pre-emptive and preventive measures for future events. The National Weather Service of United States of America (NWS) categorised the magnitude of floods into minor, moderate or major flooding for effective communication of flood forecasts (NOAA, 2005).

**Knowledge of what farmers do before a flood event**

Investigating what farmers do before the flood occurrence is an important way of assessing their level of preparedness. Surprisingly, over three-quarters of the respondents (77.8%) indicated that they did not do anything before a flood occurrence (Table 27). It was, however, not immediately established during the study why they did not do anything before a flood occurrence. But, this could likely be attributed to respondents being fed up with the floods in the area and having resigned to their fate, leaving everything in the hands of God.

Ideally, if your area has any history of flooding, you should prepare a flood action plan and check list. This action plan would include where you will evacuate to should the need arise. The finding of not doing anything was contrary to the assertion of Sutton and Tierney (2006) who argued that the activities that are commonly associated with disaster preparedness among households include developing planning processes to ensure readiness, formulating disaster plans, stockpiling resources necessary for effective response and developing skills and competencies to ensure effective performance of disaster-related tasks.

**Table 27: Knowledge on what to do before a Flood Event**

| Responses | Frequency | Percentage |
|---|---|---|
| Buying medical kits | 28 | 8.2 |
| Move to high areas | 29 | 8.5 |
| Have separate account | 19 | 5.5 |
| Don’t do anything | 267 | 77.8 |
| Total | 343 | 100 |

Source: Field survey (2017)

**Factors influencing preparedness for floods**

Ordinary citizens can be the first to respond to natural disasters such as flood, and preparatory action could be the most cost efficient and sustainable response (WMO, 2008). Fore casting and taking of precautionary measures and necessary actions before a disaster ensures individuals' effective response and speedy recovery (Frieman, 2011; Austin, 2010; Perry & Lindell, 2003; Kent, 2004). As disaster preparedness is simply the state of readiness to deal with a disaster if and when it occurs (Frieman, 2011), one may simply say that flood preparedness is the extent to which individuals are ready to act and take preparatory defensive action in advance or immediately prior to a flood threat (Frieman, 2011).

It emerged from the study that a number of indicators have been identified as factors that influenced preparedness for floods in the study area. From figure 15, education, income, past experience, age and sex have been identified as the factors that influenced preparedness for floods. While (3.5%) of the respondents identified sex as the least factor that influences preparedness for floods, most of the respondents (49%) were of the view that income was the main and important factor that influenced preparedness for floods in the study area. This was followed by past experience with 29.4 percent.

This implies that the inability of respondents to prepare for the floods was associated with poverty. Preparing for floods, eventually, will mean having money to buy necessary resources such as medical kits, blankets, foodstuff and other valuables to mitigate the floods. It is obvious from the above that farmers in

the study area did not have the needed capital to secure what is needed to prepare for the floods.

This finding was consistent with that of Digian (2005) who stated that income is one of the most important factors which shares a relationship with disaster preparedness. Many studies also found that high income populations seem to be more prepared and less vulnerable before, during and even after natural disasters than low income populations (Baker, 2011; Rowel et al., 2011; King, 2000). Similarly, a study by Kim and Kang (2010) also expressed the importance of income in a more complicated way: disaster resources could be one of the key elements in disaster preparedness which itself is highly depended on income level.

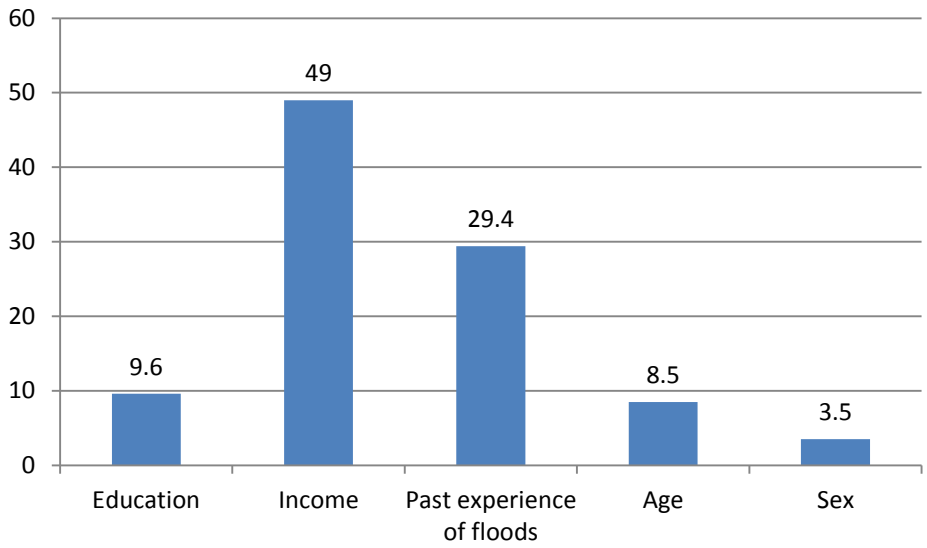


**Figure 14: Main factors that influence preparedness for floods**

Source: Field survey (2017)

**Effective ways of preparing for floods**

The study again, sought to find out the types of measures that respondents considered being effective when preparing for floods in the study area. From Table 28, majority of the respondents (84%) pointed out that an awareness campaign was the most effective measure for preparing for floods. This was followed by building on raised platforms (68.2%) and relocating of residents (54.5%). It was, also, established by respondents that appealing to the water god (58.6%) and the use of concrete embankment (58.3%) were not effective measures to take when preparing for floods in the study area. These findings demonstrated that awareness campaigns could easily play an effective role in providing knowledge to the farmers which could minimise the loss and damages caused by devastating flood events.

Knowledge is based on an appreciation that floods occur and pre-disaster activities (that is, flood preparedness) were intended to equip the community with what to do before, during and after floods. Studies have shown that families that move back after floods subside remain a concern due to their exposure to future events of flooding in the same areas (UN-ISDR, 2011). In study area, respondents had limited knowledge about flood insurance and did not even consider it as a good measure to guard against floods.

**Table 28: Effective ways of Preparing for Foods**

| Effective ways of preparing for floods | Percentage scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Talensi District | | | | Builsa South District | | | |
| | VME | VE | E | FE | VME | VE | E | FE |
| Awareness campaign | 43.9 | 31 | 14 | 11.1 | 33.1 | 30.8 | 15.1 | 20.9 |
| Construction of water | 4.7 | 7 | 8.8 | 79.5 | 26.2 | 27.3 | 19.8 | 26.7 |
| Concrete embankment | 2.3 | 6.4 | 10.5 | 80.7 | 20.9 | 16.9 | 26.2 | 36 |
| Relocation | 15.8 | 8.8 | 15.2 | 60.2 | 15.7 | 25 | 28.5 | 30.8 |
| Use of sand bags | 2.9 | 7.6 | 11.1 | 78.4 | 21.5 | 24.4 | 20.3 | 33.7 |
| Temporary accommodation | 7.6 | 3.5 | 7 | 81.9 | 21.5 | 23.8 | 26.7 | 27.9 |
| Construction of | 6.4 | 6.4 | 10.5 | 76.6 | 22.7 | 18.6 | 27.9 | 30.8 |
| Building on raise platforms | 38 | 18.7 | 9.4 | 33.9 | 15.7 | 30.8 | 23.8 | 29.7 |
| Appeal to water gods | 5.8 | 8.2 | 15.8 | 70.2 | 12.2 | 21.5 | 19.2 | 47.1 |
| Flood insurance | 5.3 | 5.8 | 11.1 | 77.8 | 12.8 | 22.1 | 20.3 | 44.8 |

VME = Very much effective VE = Very effective E = Effective FE = Fairly effective
Source: Field survey (2017)

The results indicate that response to floods alone was not enough to mitigate the growing damages caused by floods on farmers. It bears the commitment to share knowledge that could help with identifying hazards and risks, taking action to build safety and resilience, and reducing future flood impacts. Communities and individuals usually could and want to become partners in this. Public awareness and public education for disaster risk reduction could empower normal people everywhere to participate in reducing future suffering.

However, awareness campaigns must target the right audiences for public education. Here, the core audience were those who were living in the flood prone areas and were already acting consistently to make themselves and those around them safer and more resilient. Immediately outside that core were people who were receptive and thinking about acting, but needed supportive information and more confidence in order to act. Public education and awareness efforts need to reach each of these layers and draw them towards the centre.

**Access to Agricultural Extension Services**

Several authors noted that access to agricultural extension services have a positive influence on flood preparedness (example, Hassan & Nhemachena, 2008; Gbetibouo, 2009; Deressa. et al., 2010; Mandleni & Anim, 2011). According to Nhemachena and Hassan (2007), access to extension services increases the probability of taking up flood preparedness options. Extension services provide an important source of information on climate change as well as agricultural production and management practices. Farmers who had extension contacts had better chances of being aware of the changing climatic conditions and the various management practices that they could use to adapt to the changes in climate.

The study results revealed that majority of the respondents (80.2%) did not have access to agricultural extension services in the study area. Nevertheless, Agricultural Extension in the current scenario of a rapidly changing world has been recognised as an essential mechanism for delivering knowledge (information) and advice as an input into modern farming (Jones, 1997).

On the contrary, in-depth interviews with the agricultural extension officers in the Talensi and Builsa South Districts proved otherwise. They revealed that as part of their roles as agricultural extension agents, they facilitated farmers' group formation and trained farmers on improved technologies, especially good agricultural practices like the way they should plant their crops, the way they should use chemicals and other things. They also impacted cross-cutting issues, some of which were advanced by an informant as:

> *"HIV/AIDS, gender sensitivity and a whole lot, in terms of floods, we have field extension officers. Once there was information, they quickly go to inform the chiefs, the sub-chiefs and the group leaders and they, in turn, spread the information and when the event was too close, we use the radio station to inform the whole district not only those communities. Every field extension officer visits his/her operational area four times a week and we have been doing that. Any time there is a meeting with them they come out and we pass the information to them".*

The discussion in this narrative presupposes that if you were an individual farmer you were not likely to have access to an agricultural extension officer as the extension officers brought farmers together to form groups even though they dealt with them individually on their farmers. It was, also, acknowledged that if you were an individual farmer or you belong to a group which was outside the operational area of the extension officer, you were also not likely to have access to the extension officer because the officer may not know about you.

Agricultural extension has to reorient itself beyond the narrow mind set of transfer of technology packages. Instead, it has to rejuvenate its vigour for transferring knowledge or information packages as the input for modern farming and protecting all farmers against any disaster. In such cases, extension will become more diversified, knowledge intensive and demand driven.

**Resilience Mechanism and Livelihood Adaptive Strategies of Farmers to Floods**

At all times, people have to adapt to processes of ecological change. But the strategies and mechanisms of the adaptation of livelihoods to those processes have certainly gained more and more global attention since the effects of climate change are said to be one of the most crucial topics (not only) in the field of development studies and development practice in the 21st century. Nonetheless, there always has been critique on the accuracy and the underlying methodological approaches of the estimated dramatic consequences of global warming and its alleged implications for adaptation measures (Dessai et al., 2009) or its interference with certain political agenda (Lomborg, 2007).

People have always found ingenious ways to overcome adverse conditions like floods, earthquakes and tsunamis among others, but because of lack of wider dissemination, these initiatives have remained localised to limited areas (Adger, 2006). Government and development organizations the world over have tried to deal with flood situations in their countries, but their initiatives have been more of settling victims after the occurrence of the said floods (relief oriented) and targeted at short periods as it is always within a short time frame. As a result,

there have been no long-term solutions to the people's problems nor have such initiatives had a positive impact on the people's coping mechanisms and capacities (Brahmi & Poumphone, 2002).

**Initiatives put up by Government and Non-Governmental Organisations to Address Climate-Related Disaster in the Study Area**

This study first identified the initiatives put up by the government of Ghana and Non-governmental Organisations as a way of addressing climate change related disasters (floods) especially in the study area between 2000 and 2011. These initiatives have been implemented by both private and public institutions. The implementation period and the challenges faced during implementation are also presented.

The Ministry of Food and Agriculture (MoFA) implemented the land conservation and smallholder rehabilitation project (LACOSREP II) in the Upper East Region with funding from the International Fund for Agricultural Development (IFAD) and the Government of Ghana (GoG). Capacity building through demonstration of technologies such as improved varieties and promotion of irrigation were the main activities promoted by the project in order to help build the resilience of smallholder farmers in the Upper East Region to climate change and variability. Whereas bushfires were the major challenge faced at the demonstration plots, mortality of seedlings was the major challenge faced at the banks of the irrigation sites.

Also, the Government of Ghana, with a loan facility from the African Development Bank (AfDB), initiated the livestock development project (LDP)

which was implemented by MoFA between 2003 – 2010 as a way of increasing smallholder farmers' options in adapting to the effects of climate change and variability. The key activities of the project include the promotion of improved breeds and capacity building of smallholder farmers to improve upon their husbandry practices such as provision of good quality feed, water and health care. The key challenge of this project was that most smallholder farmers were comfortable with the extensive system of animal production and therefore did not readily adopt the intensive and semi intensive systems proposed by the project.

The International Maize and Wheat Improvement Centre (CIMMYT), in collaboration with the International Institute for Tropical Agriculture (IITA) with funding principally from the Bill and Melinda Gates Foundation, partnered the Savannah Agricultural Research Institute (SARI) of the Council for Scientific and Industrial Research (CSIR) to develop drought-tolerant maize varieties (DTMA I and II) between 2006 and 2011. The drought-tolerant maize varieties were developed through participatory approaches with selected smallholder farmers in all the three regions of northern Ghana. The drought-tolerant varieties were developed with the aim of helping smallholder farmers to adapt to climate change and variability. The major challenge of DTMA I and II is that the project concentrated more on varietal development to the detriment of varietal dissemination. The varieties developed, therefore, seem not to be very popular with smallholder farmers. Collaborators during the implementation included MoFA, seed producers and smallholder farmers.

The Ghana Environmental Management Project (GEMP) is being implemented by the Environmental Protection Agency (EPA) with funding from the Canadian International Development Agency (CIDA). The aim of the project is to reverse desertification and land degradation as a result of climate change and variability in Ghana and especially in northern Ghana. Some of the activities being undertaken by the project include sensitisation on the causes and effects of both desertification and land degradation, as well as the promotion of tree planting. A major challenge being faced by this project is bush fires, especially during the dry season.

Two projects, namely conservation agriculture (CAP) and community land use responses to climate change were implemented by the Tamale Sub Office of Care International. Implementing partners include smallholder farmers, CSIR-SARI, MoFA and other projects such as the Presbyterian Agricultural Station and Nandom Agricultural Project. Both projects commenced in 2007 and ended in 2011. Some of the activities implemented during the conservation agriculture project include promotion of the minimum use of external inputs, minimum tillage and cover cropping and land rotation among others. A major challenge was low adoption due to low immediate returns of the conservation agricultural practices. Some of the activities implemented during the community land use responses to climate change include tree planting and soil fertilisation among others. A major challenge faced during the implementation was the taking over of land (mostly from women) by land owners (mostly men) after the marginalised land had been reclaimed.

Largely, it was observed that even though several climate-related initiatives have been executed in northern Ghana, there seems to be little or no harmonisation among these projects at both the implementation and donor level. All the interventions identified were found to be implementing activities that were geared towards enhancing food security and boosting income levels of project beneficiaries. The implementation method, however, varied from project to project. Capacity building in the form of demonstration of technologies and training were cross-cutting approaches among different projects. All the initiatives identified had a monitoring and evaluation system of some sort even though it was not well structured for many projects. Generally, the duration of project implementation was found to be adequate. Specific projects that required an extension of duration were most of the time granted or given a second phase.

The difficulties faced by the various interventions during implementation, however, had negative consequences on the overall success and impacts of the projects. Achievements in soil fertility and vegetative growth were easily eroded by wild fires and intermittent droughts. Bush fire was a major concern not only to developmental projects but also to farmers. Low credit recovery rates, as well, negatively affected the sustainability of innovative credit systems introduced. Low promotional activities also limited the impacts of projects to only project beneficiaries. Another interesting thing realised was that none of the above mentioned initiated projects sought to help farmers cope or address the annual flood problems.

**Livelihood Adaptation Strategies**

This part looked at the different types of livelihood coping mechanisms or adaptation strategies employed by the respondents (farmers) in the study area after a flood disaster. Adaptation strategies by persons affected by floods have been put into two levels, the individual level and the social level. This has further been divided into two: short term and long-term as shown in Figure 16 and Table 29. "Short term" refers to actions that were undertaken during and immediately after a flood and “long-term”, a period more than one month after the floods.

Food security was imperative in the face of floods; therefore, understanding where farmers get their food was critical to effective adaptation. This study, thus, segregated the results by districts. The most common source of food for the respondents in the two districts was from reserved food with Talensi and Builsa South having 30.4 percent and 31.4 percent respectively. With regard to food aid, there was a slight difference; 24.4 percent of the respondents in the Talensi District and 22.2 percent for the Builsa South District depended on food aid for their livelihood. Additionally, 32.6 percent of the respondents in Builsa South District obtained food assistance from their neighbours and friends as compared to 27.5 percent of respondents from the Talensi District. The least among the identified sources was buying food from the shops which was 19.9 percent for Talensi and 11.6 percent for Builsa South District. This is not surprising as farmers were always devastated during floods to the extent of losing everything. This could limit their ability to buy food from shops.

It also appears that the spirit of social networking was relatively invisible in the study area. One would have expected that during flood situations, victims would get social support from their immediate families, friends and neighbours, but this has not been the case. This was probably due to the fact that vast majorities did not even have the cash to lend to each other. The social capital was not enough to pull the rural folks out of poverty, but the counterfactual would have been worse. The information gathered only pointed to the fact that it was used to balance the equitable distribution of hardships and disasters such as floods.

Another phenomenon that could not be left out was low food aid to victims. It appears that majority of flood victims did not have access to food aid from government institutions responsible for disaster relief.

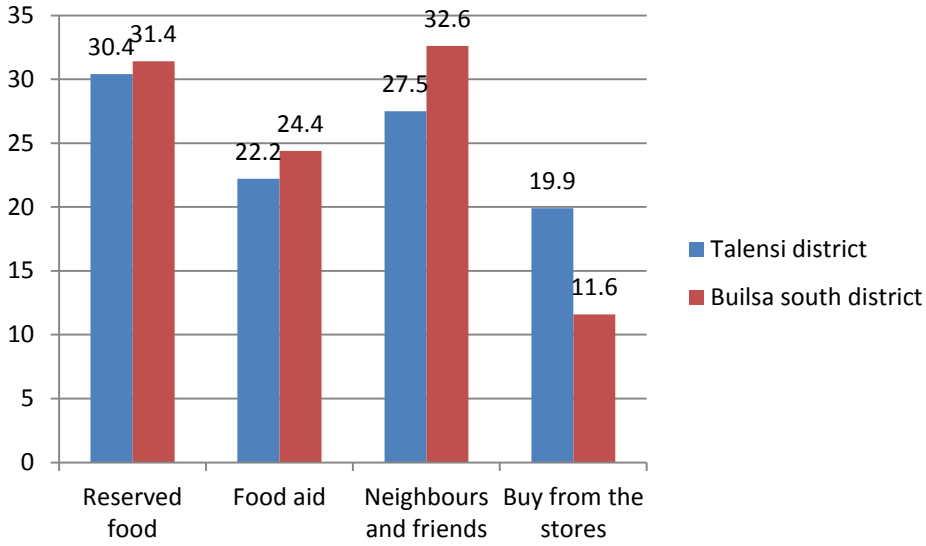


**Figure 15: Source of farmer's food immediately after floods**
Source: Field survey (2017)

Irrespective of the above, the result of the study was in line with the resilience theory of the study which stresses the need for perseverance. In this perspective, striving for a management approach based on resilience would accentuate the need to keep choices open, the need to view events in a local rather than a regional context and the need to emphasise heterogeneity; thereby, requiring a qualitative capacity to develop systems that can absorb and accommodate future events in whatever unforeseen form they may take (Holling, 1973).

As regards the long-term adaptation measures, majority of the respondents, represented by 90.3 percent, used crop diversification practices such as mixed cropping and crop rotation. About 86 percent of the respondents planted improved crop varieties (i.e., flood-tolerant and early maturing varieties), while 85 percent work over time. Other identified adaptation practices being implemented were selling of household possessions (79.3%) longer seasonal migration (84%), selling of agricultural tools (75%) and selling of family lands (64.7%) as shown in Table 29.

This result revealed that respondents employed different adaptation practices. The finding also corroborated the findings of Nelson (2010) which hold that in Ghana, for example, farmers who experienced flooding have been adapting to it in their own diverse ways. Examples of some of the measures adopted are diversification of crops and livestock as well as the management practices, planting and conservation of trees, application of chemical fertilizers and outmigration of people.

**Table 29: Adaptation Strategies by Respondents**

| Adaptation strategies | Percentage scores | | | | Total |
|---|---|---|---|---|---|
| | VME | VE | E | NE | |
| Reduce size or number of meals a day | 45.2 | 29.4 | 18.7 | 6.7 | 100.0 |
| Days without food | 22.2 | 38.2 | 26.2 | 13.4 | 100.0 |
| Change to cheaper diet | 16.3 | 34.1 | 27.1 | 22.4 | 100.0 |
| Longer seasonal migration | 15.7 | 30.9 | 37.9 | 15.5 | 100.0 |
| farmers work overtime | 39.9 | 22.2 | 23.0 | 14.9 | 100.0 |
| Table 29 continued | 14.0 | 19.5 | 33.2 | 33.2 | 100.0 |
| Consume small livestock | 17.8 | 25.1 | 22.4 | 34.7 | 100.0 |
| Spend money meant for investment | 20.7 | 34.1 | 32.1 | 13.1 | 100.0 |
| Sell farmer's possession | 20.7 | 30.9 | 27.7 | 20.7 | 100.0 |
| Crop diversification | 34.1 | 33.8 | 22.4 | 9.6 | 100.0 |
| Sell agricultural tools | 25.4 | 26.2 | 23.9 | 24.5 | 100.0 |
| Plant improved short duration crops | 25.0 | 35.6 | 25.7 | 13.7 | 100.0 |
| Sell family land | 14.0 | 23.9 | 26.8 | 35.3 | 100.0 |
| Access to micro finance loan | 14.3 | 16.9 | 18.4 | 50.0 | 100.0 |

Very much effective (VME) Very effective (VE) Effective (E) Not effective (NE)

Source: Field survey (2017)

During the focus group discussion in the Talensi District, it emerged that people in the community engaged in cutting and selling of firewood, stone quarrying or selling of some livestock if there are any to buy some foodstuffs for the family. Another discussant added that some of them engaged in other businesses such as petty trading and illegal mining activities besides the farming.

Others also did casual work to support their families. One discussant who also agreed with his comrades added that:

> *"There is so much money in galamsey, but it is very dangerous to work there. Many of our young men die almost every day, but what could we do? At the community level, there are no organised responses as to how families coped with the floods. As we sit here, some flood victims go into dry season farming right after the floods, by planting calabashes, tobacco, pepper and tomatoes among others to survive and undertake other obligations such as paying school fees, buying ingredients and paying medical bills".*

The narrative presented above demonstrates local perceptions and intuitions about what respondents considered to be livelihoods that could cope with the impacts of floods both under the present conditions and in the future. Livelihoods in the study area are largely natural resource-based, which, according to Agrawal and Perrin (2008), means that these communities may be disproportionately impacted by floods because their livelihoods were highly dependent on rainfall and water availability for both farming (Gentle & Maraseni, 2012) and livestock keeping (Nardone et al., 2010).

The finding was consistent with that of Rahmato (2009) that the elements of famine survival as a result of a flood disaster may be grouped into sequential series of activities. In the first stage of this sequence, households would cope with a risk to their livelihood by austerity and reduced food consumption. At the same time, there would be increased reliance on loans and transfers of food and assets

within and between families. Temporary migration in search of wage employment formed the second stage. Once these options had been exhausted, farmers would rely on asset sales or mortgage depending on current market conditions.

In a related development, a woman in the women focus group discussion in the Builsa South District pointed out that:

> *"Our husbands engaged in roofing of thatch houses for money, fishing and weeding the farms of other individuals in return for food while we, the women, engage in trading and selling in nearby townships, obtaining loans from social contacts, selling of livestock, premature harvesting of crops, weaving and basketry. There is dependence on food from previous crop seasons as well".*

Another discussant said:

> *"Sometimes we sell off assets, reduce food consumption and eat food that we do not want for the fact that you had no choice and the family had to do with it. The majority of households that were forced to sell assets sold livestock which serves as the main safety valve".*

Diversification of income activities was specified by expanding livelihood activities which could be directly linked to migration. A reduction of expenditure and reliance on external help was not visible during the discussion. Varying income means that women played a central role in complementing the family's finances with their small-scale processing and selling activities. During the discussions one woman in a group said:

*"This is the time the men venerate us because they depend on us more. They are very temperate and peaceful. They do not yell at us, and they heed to what we say. But when they harvest the food, they are there again, yelling at us and sometimes threatening to beat us."*

In this regard women and men were answerable for food supply, but the women's role was more noticeable and accredited in times of crisis. At this time of the year, they played an important role since their husbands or male relatives tend to rely on their financial support. This finding was consistent with the finding of FAO (2011) that in Zimbabwe, women serve as an important source of fuel, food, collection of non-timber forest products and income in response to crop-loss driven by climate change.

**Agricultural Insurance as a Measure of Adaptation**

Agriculture has always been a risky business. Unlike the industrial sector, it is subject to the vagaries of the weather. The variations in productivity induced by nature cannot be fully accommodated by farmers. It is true that since time immemorial, farmers have devised measures to limit these risks. These measures include crop rotation and diversification, inter-cropping, use of low yield but hardy varieties, tillage systems, share tenancy, contractual inter-linking, development of non-farm sources of income such as handicrafts and handlooms, socio-cultural strategies which distribute risks within the extended family and informal financial arrangements.

However, while these measures continue to be helpful, the problem of residual risks remains. The farmers are, in addition, subject to the common risk of

a catastrophe, and the aggregate group risk has still to be confronted. This co-variability of risks reduces the efficacy of traditional measures. The modern insurance sector can play a major role here and, considerably, strengthen the security of farmers (UNCTAD, 1994).

The study investigated the knowledge of respondents on agricultural insurance to determine whether farmers in the study area wished to have their agricultural products insured against floods. The results in Figure 16 point out that many of the respondents 54.5 percent had not heard of agricultural insurance. Meanwhile, the 45.5 percent of respondents who had heard of agricultural insurance, also, did not insure their agricultural products against floods.

It was obvious that some respondents had heard something about agricultural insurance but have limited knowledge on how it is done and the benefits accompanying it. This, therefore, suggests that if proper measures were put in place by insurance companies to educate and create awareness among respondents on the benefits of agricultural insurance, vulnerability to floods could have been reduced and adaptation strategies, enhanced.

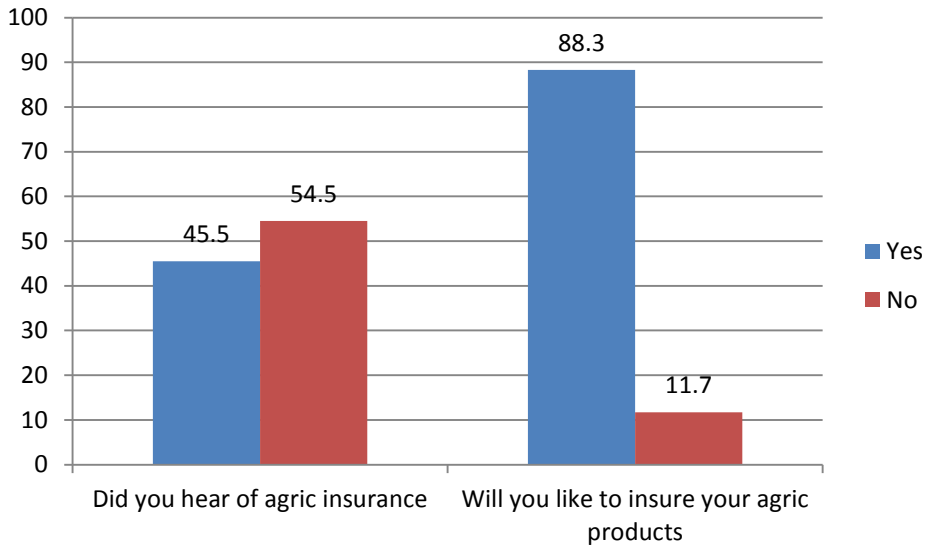


**Figure 16: Knowledge of agricultural insurance**

Source: Field survey (2017)

**Challenges to Floods Adaptation**

O'Neill et al. (2013) described challenges to adaptation as societal or environmental conditions that, by making adaptation more difficult, increased the risks associated with any given level of climate change. There are several significant aspects of this description. First, in unpacking their description, O'Neill et al. (2013) pointed to the varying and evolving definitions and interpretations of concepts such as vulnerability, which underpinned the idea of challenges to adaptation. Second, the inclusion of environmental conditions implies that other environmental factors are part of challenges to adaptation. Finally, the level of climate change is taken as given, implying that challenges to adaptation are not dependent on the actual level of climate change.

In this study, challenges to adaptation had a particular meaning for farmers and refer only to those conditions that made adaptation more difficult for farmers. In this regard, it is argued that challenges to adaptation share much in common

with a starting-point or contextual framing of vulnerability. Furthermore, it should go beyond traditional socioeconomic factors (Nakicenovic et al. 2000).

In an attempt to comprehend what limits farmers from executing adaptation strategies in the study area, farmers were asked to categorise challenges to flood adaptation. The results, as shown in Table 30, pointed out that the most commonly recognised challenge was the lack of financial resources (cited by 92% of respondents). Another 84 percent of the respondents professed that there was a lack of institutional support to facilitate agricultural adaptation. In addition, 81 percent stated that a lack of improved farm implements and machinery to support farmers was a challenge. About 80 percent of the respondents stated that high cost of crop variety also served as a serious obstacle. Also, 76.4 percent of the respondents identified lack of a ready market as a challenge. Respondents also reported unavailability of credit facilities to purchase farm inputs such as fertilizers and farm implements and to pay labourers.

These have serious implications for climate adaptation and agricultural development, especially in the Upper East Region. The risks presented by climate change to the livelihoods of these households were set to increase (IPCC, 2007); yet, the mechanisms needed to reduce these risks were not fully supported.

**Table 30: Challenges to Floods Adaptation**

| Challenges | Percentage scores | | | | Total |
|---|---|---|---|---|---|
| | VH | H | L | VL | |
| Lack of financial resources | 74.9 | 17.2 | 2.9 | 5.0 | 100.0 |
| Poor access to climate information | 37.6 | 35.0 | 19.8 | 7.6 | 100.0 |
| Lack of institutional support | 61.5 | 22.7 | 12.0 | 3.8 | 100.0 |
| Complex tenure system | 22.2 | 23.6 | 29.2 | 25.1 | 100.0 |
| Sociocultural barriers | 17.8 | 22.7 | 29.7 | 29.7 | 100.0 |
| Lack of ready markets | 40.2 | 36.2 | 13.7 | 9.9 | 100.0 |
| High cost of crop variety | 51.9 | 27.7 | 12.5 | 7.9 | 100.0 |
| Limited access to improved crop variety | 37.9 | 33.8 | 18..1 | 10.2 | 100.0 |
| Lack of farm implements | 56.6 | 24.5 | 10.8 | 8.2 | 100.0 |

VH = Very high H = High L = Low VL = Very low
Source: Field survey (2017)

**Flood Mitigation and Prevention**

Many countries have adopted several means of flood mitigation/control. Mitigation refers to the effort to reduce the loss of life and property by lessening the impact of the floods. These include desilting of drains and dredging of water bodies, demolition of buildings blocking water ways, reforestation exercises, proper town and country planning and the putting up of levees and other barriers. According to Nelson (2012), mitigation of flood hazards can be attempted in two main ways: an engineering approach to control flooding and a regulatory approach designed to reduce vulnerability to flooding. Other natural mechanisms like wetland preservation are also helpful.

As far as this study is concerned, efforts have been made by respondents to mitigate floods, but prevention was the key to the flood problem in the study

area. The results revealed that majority of the respondents (63%) indicated that engineering solutions (like constructing a dam) have been the effective way of preventing floods (Figure 17). This was followed by improved drainage systems (14.3%), preventing building on water ways (7.9%) and proper planning (7.5%).

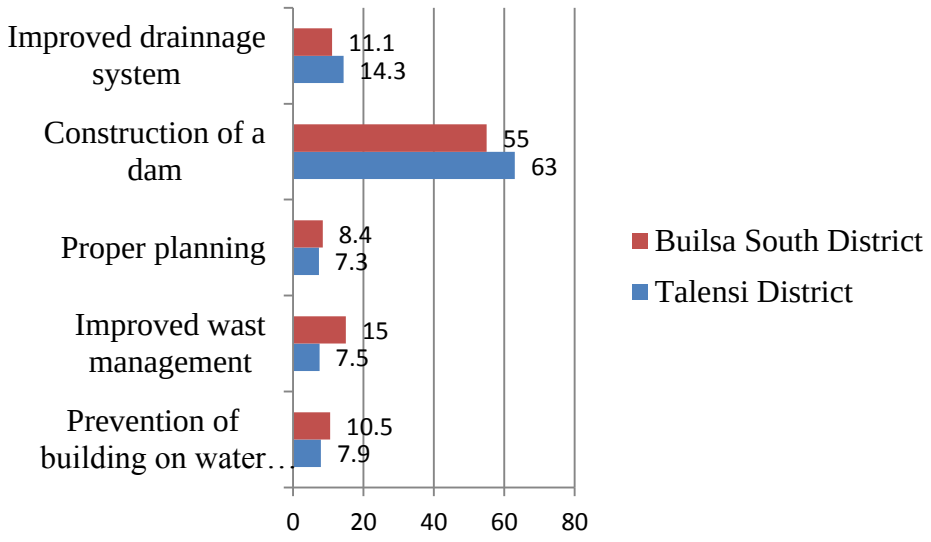


**Figure 17: Floods mitigation and prevention**

Source: Field survey (2017)

Observations carried out in the study area revealed that there were no well-designed and properly constructed drains within the communities. The few drains or trenches that were made were either not well networked or were choked with rubbish. Occasionally, attempts were made to prevent farmers from farming on river banks, but enforcement was always on the low side. Educational campaigns were also adopted to sensitise people on the risks associated with floods.

One of the key informants (an agricultural extension officer), who corroborated the findings from the respondents, proposed an engineering approach as the best option to prevent flooding in the study area. He said:

> *"Constructing of dams could be used to hold water back so that discharge downstream can be regulated at a desired rate. Man-made dams had spillways that could be opened to reduce the level of water in the reservoir behind the dam. Therefore, the water level could be lowered prior to a heavy rain, and more water could be trapped in the reservoir and released later at a controlled discharge".*

He, however, acknowledged that such an approach was capital intensive, and only a committed government could execute such a project in the study area. He explained that:

> *"The White Volta which passes through the study area takes its source from the Bagre dam in Burkina Faso. The White Volta is a huge river which is also fed by many streams along the line. So when water comes from the Bagre dam, it comes with force and nobody could stop it except the building of a Dam along the White Volta which has been on the drawing board since centuries without implementation. For instance, Kwame Nkrumah made the bench marks to establish a Dam along the White Volta some years back".*

He argued that successive governments in Ghana had collaborations with many companies to build the Dam which could be compared to the Vea – Tono

Dams with different designs to provide hydro power and a unique irrigation project. He added that:

> *"If it was implemented, we those from the northern part of Ghana could enjoy, since it was going to be big and could change the lifestyles of the people. Our young people who go down south for non-existing jobs would be comfortably engaged with the land to, at least, produce cash crops for sale".*

Based on the above narrative, the construction of such a dam requires government commitment. The government must, therefore, see the flood situation in the study area as a national issue which demands urgent attention if the government wants to bridge the developmental gap between the north and south. Currently, there is no visible project implemented to prevent floods in the study area.

# CHAPTER EIGHT

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Introduction

This chapter presents a summary of the research processes and major findings as well as the conclusions drawn from these findings. It, further, presents recommendations based on the conclusions of the study. Finally, it advances suggestions for further research.

## Summary

The study set out to examine the effects of flooding on farmers' livelihood and the adaptation strategies of farmers to ensure food security in the Upper East Region. It was guided by five specific objectives: to assess livelihood assets available to farmers, assess farmers' perception and vulnerability to flooding, evaluate the effects of flooding on farmers' livelihood resources, explore the livelihood adaptation strategies of farmers and their preparedness in response to floods and assess farmers' challenges with the adaptation strategies to flooding.

To achieve the objectives of the study, both quantitative and qualitative approaches as well as the cross-sectional and descriptive study designs were employed for the study. Two districts (Talensi and Builsa South) in the Upper East Region constituted the study area. These two districts were selected for the study because of their vulnerability to annual floods in the region. A total of 343 respondents (farmers), two agricultural extension officers and two coordinators from the National Disaster Management Organisation constituted the key informants for the study. Two focus group discussions were also conducted to

gain important qualitative insights into the effects of and the adaptation strategies to floods. The 343 respondents were chosen via stratified random sampling. Data collection was by the use of a questionnaire, in-depth interview guide, observation and focus group discussion guide. The analysis of data encompassed the application of descriptive statistics, chi-square test of independence and Friedman mean ranking test.

**Key Findings of the Study**

Based on the analysis, results and discussion of the study, the key findings according to the objectives are presented in this section. Among them include the following:

1. Majority of the respondents had access to land for crop farming purposes but did not have absolute control over the use of the land. Inheritance still served as an important medium of land transfers among land owning groups and agriculture remained the largest source of income for the study area. Poultry constituted the bulk of livestock holdings of respondents in the study area. The results also established a higher percentage ownership of physical assets such as beds, TVs, radios, bicycles and mobile phones. However, the contribution of these assets to livelihood adaptation and withstanding floods was very low because their financial value for floods adaptation was very minimal.
2. Respondents generally demonstrated a sound understanding of flooding with more than half of the respondents interpreting floods to mean a natural hazard which causes a lot of destruction. Majority of the

respondents were highly vulnerable to floods, which implies that they required special support to recover from flood damages and respondents who had no formal education were more vulnerable than those who had tertiary education.

3. Majority of the respondents identified crops as the livelihood resource most severely affected by floods in the study area. It was also established by discussants that hunger, together with a decline in environmental quality resulting from flood associated impairment, fuelled the desire for migrating out of the study area. The reduction in food production resulting from floods led to loss of income for many farmers in the study area which further reduced their ability to purchase food and, thereby, contributed to increasing the problem of food shortages and starvation among farmers and their families.
4. Over three-quarters of the respondents indicated that they did not do anything to prepare for the flood; while the majority of the respondents pointed out that awareness campaign was the effective measure of preparing for floods. The study established that respondents engaged in cutting trees and selling firewood while others went into stone quarrying or selling of some livestock to buy some food stuffs for the family as a way of adapting to the floods in the study area and others also did casual work to support their families.
5. The most commonly recognised challenge for flood adaptation from the study was lack of financial resources. While some respondents indicated

that engineering solutions (e.g. the construction of a dam) had been identified as the most effective way of preventing floods.

**Conclusions**

Based on the main findings of the study, the following conclusions have been drawn:

It was obvious that almost every farmer had a farmland for crop cultivation, but they could not exert absolute dominance over its usage. Largely, respondents had a lot of poultry and physical assets; it was not enough to help them recover from any adversity such as floods. Even though they depended on varied income sources, the main source of income was agriculture which is unpredictable in nature; thus, sustainable livelihood was threatened.

Respondents demonstrated a fair understanding of floods. A majority of the respondents were considered to be highly vulnerable to floods and therefore, required assistance to recover from floods if they were to be food secure. The vulnerability level was higher among those who had not been to school or had little formal education.

Floods have negatively impacted on the respondents as the most affected livelihood resource was crops. There had been a tremendous reduction in food production, leading to hunger and a decline in environmental quality which pushed young farmers to migrate in search of other opportunities. Floods, therefore, affected seed supply either through affecting crop production (on farms) or destroying seed stores (in homes). Whichever way, the lack of seeds for

successive planting created a reinforcing effect of lower food production and food insecurity.

Irrespective of the negative impacts of floods on the respondents, little was done on flood preparation, which was mostly attributed to financial difficulties. Respondents engaged in multiple activities such as logging and selling of firewood and crop diversification practices such as mixed cropping and crop rotation as ways of adapting to flood adversities. The most commonly acknowledged challenges to adaptation from the study were inadequate financial resources

**Recommendations**

The conclusions drawn from this study formed the basis for the following recommendations.

i. With the support of agricultural extension officers, farmers should make good use of the land available to them by engaging in good farming practices such as crop rotation and avoid farming close to rivers. They should also negotiate with family heads to use the land allocated to them for a period of at least 5 to 10 years to maximise crop production. Farmers should begin to explore more alternative livelihood activities such as bicycle and motor repairing, hairdressing, barbering and tailoring. Farmers should also consider the need to engage more in livestock production, more especially, ruminants such as goats and sheep which can easily be obtained as compared to cattle. The rearing of poultry such as chicken and

guinea fowls should also become a priority of farmers to supplement their livelihood needs.

ii. Because farmers have a fair understanding of the floods in the study area, they should work with the various NADMO coordinators in the districts to develop a comprehensive public information system within their localities to create awareness on the dangers and impacts of floods as a way of preparing themselves for the floods. This information system can be used to ensure that information is brought together from many sources regarding the onset of floods. This could help reduce the farmers' level of vulnerability to floods in the study area.

iii. Additionally, farmers should cultivate flood resistance and short-term matured crops in other to escape or avoid the flood impact on their crops. Cultivation of crops can also be done on uplands to prevent flood destruction. They should also engage in small scale enterprises in the form of petty trading and joint businesses to support their traditional livelihood source and put them in a proper position to recover quickly when floods occur. More social networking should be encouraged as a way of providing farmers with financial assistance to adequately prepare for floods.

iv. Community platforms and forums should be annually organised between the months of July and August for the exchange of information and ideas on effective flood preparedness, response and recovery activities. This could help reshape the structure and flood management operations of most

of the farmers in the study area; hence, make them more appropriate and efficient in meeting demands of present day flood management.

v. Resource mobilisation methods by community leaders towards alleviating the suffering of the flood affected population must be strengthened. Timely mobilisation of finances and goods from multi stakeholders and administering relief to vulnerable farmers at flood disaster sites is very crucial in ensuring a well-embraced flood disaster response operation. Therefore, logistics is central and crucial to the effectiveness and speed of response for major humanitarian interventions covering health, food, shelter, water and sanitation.

vi. Public education and awareness campaign by opinion leaders and other civil society organisations on the effects of floods must be intensified to discourage farmers from farming close to rivers. It is, therefore, important for residents to adhere to construction plans put out by the planning units of the municipal assembly to help address the annual floods in the study area.

**Areas for Further Research**

Further research is recommended to assess the feasibility of farm-level adaptation practices to floods. This could help governments, researchers, non-governmental organisations (NGOs) and farmers to develop and implement adaptation measures that are sustainable, resilient and reliable.

A study could also be designed to simultaneously explore the factors that influence the adoption of indigenous and climate-related strategies in the study

area. Such a study should comprehensively profile all climate change related initiatives that have been implemented or planned for the study area. Future studies could also consider measuring the level of vulnerability of farmers to floods and variability by employing different quantitative or econometric approaches to assessing vulnerability.

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# APPENDIX A

## QUESTIONNAIRE FOR FARMERS

## UNIVERSITY OF CAPE COAST

## FACULTY OF SOCIAL SCIENCES

## INSTITUTE FOR DEVELOPMENT STUDIES

**Introduction:**

The purpose for this study is to fulfill the requirements for the award of Doctor of Philosophy Degree in Development Studies, at the Institute for Development Studies, University of Cape Coast. The study solicits for data in order to examine the effects of flooding on household's livelihood and the adaptation strategies of farmers to ensure food security in the Upper East Region. You are assured that responses given will be treated with confidentiality and will be used solely for academic purposes. Kindly answer the questions as objectively as possible.

Thank you.

Select the district you belong: Talensi District [ ] Builsa South [ ]

## Section A: Background information

1. Sex of respondent {1} Male [ ] {2} Female [ ]
2. Educational level of respondent {1} Never attended school [ ] {2} primary [ ] {3} JHS [ ] {4} SHS [ ] {5} Tertiary [ ] {6} other specify…….
3. Age of respondent [ ]

4. Marital status of respondent {1}Not married [ ] {2}Married [ ] {3}Divorced [ ] {4} Widowed [ ] {5}Separated [ ] {6} Cohabiting [ ]
5. Religion of respondent {1} Catholic [ ] {2} Muslim [ ] {3} Traditionalist [ ] {4} Protestant [ ] {5} other specify……
6. What is your main occupation? 1 Agriculture [ ] 2 Petty trading [ ] 3 Craftsmanship [ ] 4Salaried work [ ] (formal sector) 5 other (specify): ……
7. What other occupation do you engaged in?

   .....
8. How many years of experience of farming to you have? ……
9. How many persons are in your household? Total: [ ] Males: [ ] females [ ]
10. Number of persons with age below 15 years [ ] Males [ ] Females [ ]
11. Number of persons with ages above 65 years Total [ ] Males [ ] Females [ ]
12. How long have you live in this community?

    ……..

**The source of household income**

13. What is the approximate monthly income of your household?.....
14. Are members of your household engaged in any off-farm income generating activities?

1 Yes [ ] 2 No [ ] If no skip to 14

15. If yes provide details below

| Activities | Males | Females |
|---|---|---|
| Petty trading | | |
| Handicraft making | | |
| Gathering | | |
| Rice processing | | |
| Shea butter processing | | |
| Pito brewing | | |
| Dawadawa processing | | |

**Section B: Households livelihoods assets**

16. Do you personally own agricultural land? {1} Yes [ ] {2} No [ ]
17. If yes how did you acquire it? {1} purchase [ ] {2} Inherited [ ] {3} Family land [ ]
18. If yes how many hectares of agricultural land do you own [ ]
19. If no by what arrangement do you have access to your land for farming activities? {1} Lease [ ] {2}Share cropping [ ] {3} land rented [ ]
20. Do you receive remittances from family or friends? {1} Yes [ ] {2} No [ ]
21. Does your household own any livestock {1} Yes [ ] {2} No [ ]
22. If yes how many of the following animals does your household own {1} Cows/Bulls [ ] {2} Horses/Donkeys [ ] {3}Goats [ ] {4} Sheep [ ] {5} Chickens [ ]
23. Does any member of the household have a bank account {1} Yes [ ] {2} No [ ]
24. What is the main source of drinking water for household chores? 1. Pipe water [ ] 2 Dam [ ] 3 Rain [ ] 4 River Lake Stream [ ] 5 Wells [ ] 6 Borehole [ ] {7} other specify……

25. How long (minutes) does it take to get to the water source? On foot..... by bicycle ……

26. Has water availability been a problem? 1Yes [ ] 2 No [ ]

27. How many of these functional assets does your household own?

| ASSETS | Number |
|---|---|
| Bed | |
| TV | |
| Radio | |
| Machete | |
| Knapsack sprayer | |
| Tractor | |
| Bicycle | |
| Harrow | |
| Plough | |
| Sewing machine | |
| Motor cycle | |
| Mobile phones | |
| Stove (electric/gas) | |
| Fridge | |

28. How do these assets impact positively on households livelihoods?

_____

_____

**Section C: Households' perception and level of vulnerability to flooding**

29. What changes have been observed in the rainfall pattern? 1=Unpredictable [ ] 2=No change [ ] 3=Decreased [ ] 4=Increased [ ]
30. Did you hear of flood disaster? 1 Yes [ ] 2. No [ ]
31. Has your household suffered from flood since 2000? 1 Yes [ ] 2 No [ ]
32. What changes have been observed in the temperature pattern? 1=Unpredictable [ ] 2=No change [ ] 3=Decreased [ ] 4=Increased [ ]
33. Do you agree that flood is the biggest problem for your community? 1 Strongly agreed [ ] 2. Agreed [ ] 3. Strongly disagreed [ ] 4. Disagreed [ ]
34. Does flood disaster happen every year in this community? 1 Yes [ ] 2 No [ ]
35. In your lifetime, how many times have you personally experienced this disaster? [ ]
36. Compared to 10 years ago, do you think this type of disaster happens more often, less often, or the same as always? 1. More often [ ] 2. Less often [ ] 3. Same as always [ ] 4. Don't know [ ]
37. What do you think are the causes of flooding in this community?

| Causes | Very high | High | Low | Very low |
|---|---|---|---|---|
| Nature | | | | |
| God | | | | |
| Bursting of a dam | | | | |
| Deforestation | | | | |
| Improper waste disposal | | | | |
| Building on water ways | | | | |
| Dams spilled overs | | | | |
| Heavy increased rains | | | | |
| Punishment by ancestors | | | | |

38. To what extend will you say that households in this community are vulnerable to this disaster? 1. High [ ] 2. Moderate [ ] 3. Low [ ]
39. Which among the following dimensions are more vulnerable to floods in this community?

| Dimensions | High | Moderate | Low |
|---|---|---|---|
| Land | | | |
| Soil | | | |
| Water | | | |
| Equipment | | | |
| Livestock | | | |
| Remittance | | | |
| Saving | | | |
| Farm labour | | | |
| Dependence ratio | | | |
| Information | | | |
| Social networks | | | |
| Community support | | | |
| External families | | | |

**Section D: Household's preparedness to floods**

40. Do you receive early warning about the flood before it happens 1 Yes [ ]

    2 No [ ]

41. What is the main source of the information 1 Radio [ ] 2 TV [ ] 3

    Community announcement [ ] 4 other specify:

    ……

42. Do you have access to information on seasonal forecasts for your farming activities? 1. Yes [ ] 2. No [ ]
43. Do you have local methods or means of forecasting floods? 1 Yes [ ] 2 No [ ]
44. If yes, how do you forecast floods?
45. Do you have access to extension advice for your farming activities base on the floods? 1. Yes [ ] 2. No [ ]
    Please describe the kind of advice

_____
_____
_____

46. Have you received training to deal with the changes in rainfall and

    temperature patterns for your farming activity in the past 5 years? 1. Yes

    [ ] 2. No, if yes, who organised this? .....

47. Have you ever had training on flood related issues 1 Yes [ ] 2 No [ ]

48. I If yes, from which institution? Tick all that apply. 1= Government [ ] 2= NGOs [ ] 3= Private sector entity [ ] 4= Other, Specify:……
49. If yes what was it all about? Tick all that apply 1=Awareness [ ] 2= Vulnerability [ ] 3= Ways of mitigation and adaptation [ ]
50. Do you usually plan for the floods before the happened? 1 Yes [ ] 2 No [ ]
51. What do you do as a way of preparing for floods

    _____
    _____
    _____

52. Rate the following measures as effective way of preparing for floods

| effectiveness of household's preparedness | Very much effective | Very effective | effective | Fairly effective | Not effective |
|---|---|---|---|---|---|
| awareness campaign | | | | | |
| Construction of wooden bridges | | | | | |
| Use of concrete embankment | | | | | |
| Relocation of residence | | | | | |
| Use of sandbags | | | | | |
| Temporary accommodation | | | | | |
| Constructing of water pathways | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Building on raised platform | | | | | |
| Appeal to water gods | | | | | |
| Flood insurance | | | | | |

**Section D: The effects of flooding on livelihood resources**

53. Has your household (ever) been affected by a flood? 1. Yes, but not severely [ ] 4. Yes, severely [ ] 3. No [ ]
54. How would you describe the level of floods damage done to livelihoods resources in this community? 1. Very High [ ] 2. High [ ] 3. Low [ ] 4. Very Low [ ]

55. What is the level of floods damage to the following category of livelihoods resources in this community?

| Effects | Very much severe | Very severe | Severe | Fairly severe | Not severe |
|---|---|---|---|---|---|
| Damage of physical structures | | | | | |
| Damage to crops | | | | | |
| Damage to food supplies | | | | | |
| Damage to livestock | | | | | |
| Contamination of water supplies | | | | | |
| Causalities and Loss of life | | | | | |
| Epidemics | | | | | |
| Disruption of schooling | | | | | |
| Transport disrupted | | | | | |
| Communication is disrupted | | | | | |
| Famine | | | | | |
| Traumatise | | | | | |
| Continuing stress | | | | | |
| Reduce investment & savings | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Proliferation of poisonous snakes | | | | | |
| Easily spread of water borne diseases | | | | | |
| Mass migration | | | | | |
| Non- functioning of infrastructure facilities | | | | | |
| Internal displacement | | | | | |
| Depleting of soil nutrient | | | | | |
| Social ties | | | | | |

**Section E: The resilience mechanisms and livelihood adaptive strategies of households to floods**

56. Do you belong to any social organisations or groups in this community or outside this community? 1. Yes [ ] 2. No [ ]
57. How often do you have contacts with extension officers? 1. Very often [ ] 2. Not often [ ] 3. Not at all [ ]
58. Have you heard of agricultural insurance before? 1. Yes [ ] 2. No [ ]
59. Will you like to insure your farm or crop activities against floods? 1. Yes [ ] 2. No [ ]
60. In the event of noting early warning signs about flood, what are the indigenous ways of responding to the situation Tic all that apply 1= Pray to God, [ ] 2= Pray and offer to Ancestors [ ] 3= Invite traditional spirit medium or doctor [ ] 4= Others, Specify [] _____
61. What are some of the ways you have used to cope with the floods in the past five years?

| Coping Strategies | Very much effective | Very effective | Effective | Not effective |
|---|---|---|---|---|
| reduce size or number of meals a day | | | | |
| have any days without eating all day | | | | |
| change family diet to cheaper or less preferred foods | | | | |
| resort to longer seasonal migration to | | | | |

| | | | | |
|---|---|---|---|---|
| find animal pasture | | | | |
| one or more HH members work overtime or take another job | | | | |
| child/rens discontinue school or had to work to bring food home | | | | |
| consume more of small livestock than usual in order to have food to eat | | | | |
| use money meant for investment in order to have enough food | | | | |
| sell some HH possession in order to have enough food to eat | | | | |
| borrow food or money for food | | | | |
| sell agricultural tools or other productive tools to have enough food to eat | | | | |
| sell or consume seed meant for next season planting | | | | |
| pledge to sell any property eg land for food | | | | |
| have access to micro finance loan | | | | |

62. Do you consider the above as the best option to adapt to the floods? 1. Yes [ ] 2. No [ ] If yes why and if no why

_____

**Section F: Challenges to adaptation strategies on flood**

How does the following contribute to prevent you from implementing adaptation strategies?

| Issues | Very high | High | Low | Very low |
|---|---|---|---|---|
| Lack of financial resources | | | | |
| Poor access to climate information | | | | |
| Lack of institutional support | | | | |
| Complex land tenure systems | | | | |
| Social-cultural barriers(beliefs system& local norms) | | | | |
| Lack of ready markets | | | | |
| High cost of crop varieties | | | | |
| Limited access to improved crop varieties | | | | |
| Lack of farm implements and machinery | | | | |

64. What can be done to mitigate or prevent floods in the study area?

1. Construction of a dam [ ] 2. Improved drainage system [ ] 3. Improved waste management [ ] 4. Proper planning [ ] 5. Preventing building on water ways [ ]

## APPENDIX B

## FOCUS GROUP DISCUSSION GUIDE FOR FARMERS GROUPS

**Introduction**

I am a PhD student from the University of Cape Coast, and I am conducting a study in the Upper East Region to examine the effects of flooding on household's livelihood and the adaptation strategies of farmers to ensure food security in the Upper East Region. The study is basically for academic purposes and may help the government to formulate policies to address flood disasters in the region. I therefore cannot offer you any direct aid or incentive as a result of this discussion. However, your opinions and experiences will make a very important contribution to my understanding of the problems you face as far as flood disasters are concerned. This will in turn support planning and policies which aim to benefit flood prone communities in the Upper East Region and Ghana as a whole. Everything you say to me will be kept confidential. I am interested to hear all your opinions, both positive and negative. At the end of this discussion I will make a report and share it with all actors involved in disaster management planning, but I will not mention your names, or who said what. You can decide whether you want to take part in the discussion or not. Once my questions have started, you have the right to refuse to answer any question, or to leave the discussion at any time. If you choose not to take part or to skip any questions, it will have no negative impacts on you. Please feel free to ask me any questions now, or at any point during the discussion.

To make sure that I record your views accurately, I would like to record this discussion. This recording will not be shared with anyone outside of the research team. It will only be used for translation purposes and will be destroyed as soon as translations are complete.

**Do you consent to my recording this discussion?**

Probing question: Do not ask unless question is not already answered by previous responses.

**Section 1: Defining and identifying household assets available to households**

- ❖ What does the phrase "household assets" mean to you?
- ✓ How many kinds of household assets can you list?
- ✓ Which of the assets listed contribute a lot to household livelihoods?
- ✓ Describe the factors that influence household assets choice?
- ✓ How does this household asset contribute to household's livelihood?
- ✓ What has been or is the state of livestock ownership households in this community? (do many people have access to livestock)
- ✓ How effective is networking to livelihood sustainability in this community?

**Section 2: Households vulnerability to floods**

- ❖ What is your understanding of the term "Floods"?

  How severe are floods?
- ❖ What is your understanding of the concept of vulnerability?
- ✓ How severe is vulnerability in this community?
- ✓ Has this changed over time?
- ✓ How vulnerable are farmers in this community to floods?
- ✓ What practices make different groups (farmer, women, children, elderly etc) particularly vulnerable to floods?
- ✓ What resources are in this community to help farmers withstand the effects of floods in this community?
- ✓ Are these resources equally available to farmers all the times?

- ✓ What has been the land, soil and water quality of this community to farmers before and after floods?
- ✓ What practices generally make farmers more vulnerable to floods?
- ✓ How would you describe farmer's vulnerability to floods in this community?
- ✓ Do farmers in this community get internal/ external support during floods in this community? ( in the form of remittance, food aid, clothes, shelter)
- ✓ Do farmers in this community have savings the can relied on during floods to survive on?
- ✓ Describe the factors (social, cultural, environmental and economic) that increase farmer's vulnerability to floods in this community?
- ✓ What would be the general description of the level of vulnerability of farmers to floods in this community? (Low, moderate or high)

**Section 3: Household's preparedness for floods**

- ❖ Do you receive any information or warning about floods disaster? (please describe)
- ✓ From what source?
- ✓ How effective is it to farmers?
- ✓ Did this information include education on flood risk reduction?
- ✓ What signs or indicators do you receive before floods occur? What proxy indicators do you use to forecast weather patterns?
- ✓ How is information received on floods treated by farmers?

- ✓ Are there community- based institutions that give education on floods and ensure that right things are done by farmers in this community to prevent or prepare for flooding? If yes state them and if no what type of institutions (rules, organisations and policies) do you think can be put in place to ensure that farmers prepare for flooding in this community?
- ✓ How do farmers plan or prepare for floods? (Activities they do)
- ✓ Are these preparations or activities effective to withstand floods in the community?
- ✓ Are there government institutions that ensure that farmers prepare for flooding in this community? If yes state them and describe how effect they are
- ✓ As a community what do you think farmers can do to prepare and ensure that they are not always affected by floods when the happen?
- ✓ What do you think government can do to assist farmers in this community prepare for floods?
- ✓ How prepared are farmers in this community if floods were to happen tomorrow?
- ✓ What is the general description about the effectiveness of farmer's preparedness to floods in this community?

**Section 4: Effects of flooding on livelihood resources**

- ❖ Can you describe in detail what happened the last time farmers in this community experienced flooding?

- ✓ Who and which groups are most affected by the floods, and how are they affected?
- ✓ Have livelihood changed as a result of floods?
- ✓ What will be the effects of floods on the community (infrastructure, livelihoods, people, animals, relations between different groups and availability of food etc)?
- ✓ What will the physical, environmental, social, and economic effects of the floods be on farmers in this community? How will different groups experience these effects?
- ✓ Are certain groups more affected by flood, based on location, livelihood, age and sex?
- ✓ Does it affect everybody the same or different people in different ways? How?
- ✓ Does it affect different things (e.g. houses, crops) in different ways?
- ✓ Does it affect crops in this community? (short and long term effects)
- ✓ Does it affect health in this community? (short and long term)

**Section 5: The resilience mechanisms and livelihood adaptive strategies of households to floods**

- ❖ How do you cope with floods in this community?
  - ✓ Within your households?
  - ✓ At the community level are there any organised responses?
  - ✓ How do different groups cope with these floods? How do they change the way they live in order to survive?

- ✓ What could farmers do differently to ensure that they have a better future?
- ✓ What happened the last time this event happened? How did farmers in the community cope?
- ✓ What are the most important livelihood strategies employed by farmers during and after flooding?
- ✓ What coping strategies are currently used by farmers to deal with floods? How well do they work?
- ✓ Are there different coping strategies that could be used by farmers to adapt to floods? What resources would you need to adopt them? Who can the farmers seek help from? (resources can be tangible - something that people can hold, or community groups that exist within the community)
- ✓ Are any sectors of the community negatively affected by the current strategies in place?
- ✓ What changes have happened to make farmers life harder?
- ✓ We've talked about how farmers responded to the disaster. What do you think were the good points about how farmers responded? What do you think could be improved?
- ✓ On the whole what long term measures do you think can be put in place by farmers to protect households from flood destruction in this community?

**Section 6: Challenges to adaptation strategies on floods**

- ❖ How difficult is it for farmers to adapt to flood disasters in this community?
  - ✓ Within the household level?
  - ✓ What resources do farmers and different groups can have access to in order to help them cope with floods?
  - ✓ What prevents farmers from adopting them?
  - ✓ What are the major issues that prevent farmers from achieving their adaptation strategies to flood disasters in this community?
  - ✓ How are the issues, mentioned preventing farmers from achieving their adaptation strategies to flood disasters in this community?

**Are there any other issues you would like to discuss?**

## APPENDIX C

## IN – DEPTH INTERVIEW GUIDE FOR NADMO AND AGRICULTURAL OFFICALS

**Introduction:**

The purpose for this study is to fulfill the requirements for the award of Doctor of Philosophy Degree in Development Studies, at the Institute for Development Studies, University of Cape Coast. The study solicits for data in order to examine the effects of flooding on household's livelihood and the adaptation strategies of farmers to ensure food security in the Upper East Region. You are assured that responses given will be treated with confidentiality and will be used solely for academic purposes. Kindly answer the questions as objectively as possible.

Thank you.

**Section A: Households assets available to farmers and their impact on livelihoods**

1. Can you please describe your role in this community and the role of your organisation?
2. How would describe household assets to farmers in this community?
3. What are the main household assets to farmers in this community
4. How would you categorise household assets to farmers in this community?
5. How are these assets (livelihood activities) vulnerable to changes in weather pattern?

6. Describe the factors that influence household's assets choice to farmers in this community?
7. Describe how the listed household assets to farmers influence livelihoods in this community

**Section B: Perception and household's vulnerability to floods**

8. How would you explain flooding in this community?
9. How often do floods occur in this community?
10. How are farmers of this community informed about the occurrence of floods?
11. In your opinion what are the causes of floods in this community?
12. What is you understanding of vulnerability?
13. How would you describe a farmer vulnerability to floods in this community?
14. What makes farmers vulnerable to floods in this community?
15. Describe the factors (social, cultural, environmental and economic) that increase farmer's vulnerability to floods in this community?
16. If you were to rate the level of household vulnerability to floods in this community how would you do that?

**Section B: Household's preparedness for floods**

17. What is the source of information to farmers in this community in terms of floods?
18. How reliable is the information?
19. How are farmers of this community informed about floods disasters?
20. How effective is the communication channel to farmers?

21. Are there community base institutions that give education on floods to farmers and ensure that right things are done in this community to prevent or prepare for flooding? If yes state them and if no what type of institutions (rules, organisations and policies) do you think can be put in place to ensure that people prepare for flooding in this community?
22. How do farmers plan or prepare for floods? (Activities they do)
23. Are these preparations or activities effective for farmers to withstand floods in this community?
24. Are there government institutions that ensure that farmers prepare for flooding in this community? If yes state them and describe how effect they are
25. As a community what can farmers do to prepare and ensure that they are not always affected by floods when the happen?
26. What do you think government can do to assist farmers in this community to prepare for floods?
27. How prepared are farmers in this community, if floods were to happen tomorrow?
28. What is the general description about the effectiveness of farmer's preparedness to floods in this community?

**Section C: Effects of floods on livelihoods resources**

29. Can you describe in detail what happened the last time this community experienced floods
30. What kind of effects did the flooding have on farmers in this community?

31. How does the floods affect farmers crops in this community (short and long term)
32. How does it affect infrastructure (short and long term)
33. How does it affect farmers health (short and long term)
34. How difficult is it for farmers in this community to protect themself against flood disasters?
35. What else can you talk about the effects of floods on livelihoods resources of farmers?

**Section D: The resilience mechanisms and livelihood adaptive strategies of households to floods**

36. Are there community base institutions that give education on floods to farmers and ensure that right things are done in this community to prevent flooding? If yes state them and if no what type of institutions (rules, organisations and policies) do you think can be put in place to ensure that people do not behave in a way that leads to flooding in this community?
37. Are there government institutions that ensure that right things are done to prevent flooding in this community? If yes state them and describe how effective they are
38. From the farmers point of view, what do you think they can do to ensure that they are not always affected by floods when the happen?
39. What do you think government can do to ensure that farmers of this community are not affected when there is flooding?

40. Are there any institutions or organisations that can assist farmers in that direction in this community?
41. Have you heard of agricultural insurance before? If yes how does it work If no how do farmers get back investment when they are affected by floods?
42. Is there any form of agricultural insurance in this community for farmers? If yes are they using it and if no why
43. How do farmers of this community adapt to flood disasters?
44. In what ways can government institutions support farmers to adapt to floods in this community?
45. Are there any beliefs or social norms that prevent farmers in this community from taking certain decisions to respond to floods in this community?
46. What things can be done to prevent farmers from been affected whenever the community is flooded?
47. Are there any other issues you want to discuss concerning floods and livelihoods that we did not talk about?

**Section 5: Challenges to adaptation strategies on floods**

48. What things prevent farmers from implementing adaptation strategies in this community?
49. How difficult is it for farmers in this community to protect themselves against flood disasters?
    - ✓ Within the household level?
    - ✓ Within the community level?

50. What are the major issues (social, cultural, environmental and economic) that prevent farmers in this community from achieving their adaptation strategies to flood disasters?
51. How are the issues, mentioned preventing the farmers from achieving their adaptation strategies to flood disasters?