SUSTAINABLE MANAGEMENT OF FLOOD DISASTERS IN THE UPPER EAST REGION, GHANA

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(B.A. INTEGRATED DEVELOPMENT STUDIES)

A THESIS SUBMITTED TO THE SCHOOL OF GRAUDATE STUDIES

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN DEVELOPMENT POLICY AND PLANNING

Department of Planning

College of Architecture and Planning

September, 2011

DECLARATION

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

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ABSTRACT

Disasters, natural or man-made can strike at any time. It is nature's way of altering terrains and creating new biodiversities. Flood hazard become a vicious threat, rather than a natural occurrence when humans interfere with flood plains. Although various governments across the globe have developed and implemented programmes intended to control flood disasters, the phenomena persist. The impact of flood disaster is felt most by the poorest members of society particularly those whose livelihoods are tied to climate sensitive sectors of the economy such as rain fed agriculture.

Floods are often blamed on natural hazards however human activities on the environment exacerbate the effects of natural hazards often causing widespread damage to lives and property. Institutional incapability and lapses in planning and managing flood disasters are guilty for the increasing negative impact on the people. If we are adequately prepared, it is possible to severely reduce the impact of flood disaster through a good understanding of preventive action as well as having knowledge of certain life-saving techniques.

The study is devoted to discussing how the stakeholders and flood victims cope with the floods particularly in the farming communities in the Builsa district and to contribute to the establishment of a sustainable flood disaster management system to reduce losses that are borne by flood-affected households.

Library research in form of literature review was undertaken as part of data. Field data gathering were undertaken in the Builsa District and at the regional level for the study. The research used household and institutional survey and face-to-face interviews to collect data on flood disaster experiences over the years. The sample for the study was selected using both probability and non-probability methods.

The study suggested short and long term solutions based on practices adopted for sustainable management of disasters in Mozambique, Malaysia and China and as suggested by IFRC (2007). These include strengthening of the key stakeholder capacities, mainstreaming disaster risk reduction plans into Medium Term Development Plan for Builsa and implementing them for sustainable development. This could be replicated in other districts to help reduce the flood impact and bridge the gap between the north and south of Ghana.

ACKNOWLEDGEMENT

This is not a gospel talk show but to God be the glory. I will not want to blame my mistakes on my supervisor Dr Imoro Braimah, and/my colleague editors. I admit you will just have to blame me for the mistakes no matter how they appear in this work.

I love to thank a particular personality mentioned above: Dr Imoro Braimah who had the difficult job of shaping this work into a fine piece through his meticulous direction.

Those who have advised me in the preparation of this work or provided me material to support and to whom I am especially grateful include: Dr K O Agyeman-Director, Development Policy and Planning, College of Architecture and Planning, Kwame Nkrumah Uuniveristy of Science and Technology; Mr Philip Yinbil Regional Coordinating Council Upper East Region; Mr Aaron Bundi Aduna, Basin Officer Water Resources Commission, Upper East Region; Mr Anafo Danladi, Acting Regional. Hydrologist; Mr Saawug Alfred, Hydromet/Administrator National Disaster Management Oroganisation Upper East Region; Mr Joseph Achana, Regional Meteorologist, Bolgatanga; Mr Thomas Ayamga, Monitoring and Evaluation officer Ministry of Food and Agriculture Upper East Region; Lawrence Webadua, Planning officer Builsa District Assembly; and Jonas Azantillow, Senior Disaster Control Officer, National Disaster Management Organisation, Builsa district. I appreciate the financial and every support I received from Mr Martin Dery, Director of ProNet North, Non-Governmental Organisation.

Special thanks are due to my colleagues at Department of Planning DEPP Class of 2009-2011 especially Rev. Father Eric Anokye, Moses Oswald Avoyinga Amoah, Dei David, and Dorothy Akufo for their support.

Finally I give special thanks to Felix Puopiel and Aloysius A., National Youth Employment Coordinator, Builsa District for the support in data collection. To Ferdinand Gyireh, Emmanuel Bekyieriya, Richard Dery, Frederick Yourkuu, for their prayers and support in the ways that really count. To Mark of Mark printing press KNUST.

What I ask for is the blessing of the Almighty God for the various contributions and contributors that saw this work become a reality.

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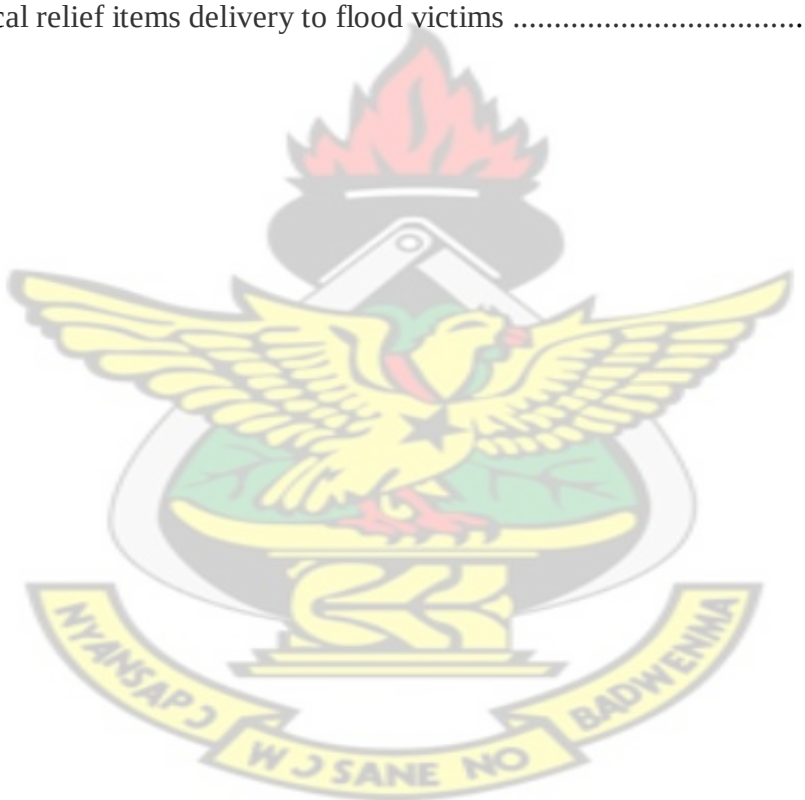


LIST OF ABBREVIATIONS

DID	-Department of Irrigation and Drainage
DA	-District Assembly
DPCU	-District Planning and Coordinating Unit
EPA	-Environmental Protection Agency
GHS	-Ghana Health Service
GIDA	-Ghana Irrigation Development Authority
HSD	-Hydrological Services Department
IPCC	-Intergovernmental Panel on Climate Change
IDPs	-Internally Displaced Persons
IDNDR	-International Decade for Natural Disaster Reduction
IFRC	-International Federation of Red Cross and Red Crescent Societies
MTDP	-Medium Term Development Plan
MSA	-Meteorological Services Agency
MoFA	-Ministry of Food and Agriculture
NDMC	-National Disaster Management Committee
NADMO	-National Disaster Management Organisation
NDMP	-National Disaster Management Plan
NGO	-Non-Governmental Organisation
RCC	-Regional Coordinating Council
RPCU	-Regional Planning and Coordinating Unit
SWRMP	-Sabah Water Resources Master Plan
UN	-United Nations
VBA	-Volta Basin Authority
WRC	-Water Resources Commission
WHO	-World Health Organisation

CHAPTER ONE

GENERAL INTRODUCTION

1.1 Study Background

Disasters are repeated events that may strike at random but impact on both the rate and pattern of development (Arriens and Benson, 1999). From the beginning of time, water has been a major determinant of settlement development and accounts for the situation of many ancient towns along river bodies since civilisation. The Nile valley in Africa and the Ganges in Asia are good examples attracting many people especially farmers.

As humans desire relieve in their being coupled with the free will, people tend to live close to their most needed resources-water and food. In many instances, large numbers of people budge from their original settlements to places with abundant water and fertile soils. Such places include the confluences and banks of rivers, and or natural springs for water, food supply as well as protection at the same time.

The water bodies facilitate livelihoods in areas of transport, fishing, agriculture, and energy among others. However, the co-existence of man and water has a very chequered history and at most times led to devastation of human population and property. Among natural disasters, floods are probably the most widespread, that occur in most countries, and cause the most deaths (Noji and Lee, 2005). Floods are 'acts of god,' but flood losses are largely acts of man (White, 1945). Most flood-related literature analyzes floods as natural disasters. However, human habitation at some instances improves the environment and ensures sustainability but the interaction at other times spell doom for the environment through plundering and depletion of natural resources (UNDP, 2004).

Flood disasters take enormous toll on human lives and property as no country is totally insulated against their occurrence and impact. Natural hazards and the disasters they trigger hit all countries, rich and poor but the already underprivileged suffer most. More than 700 major natural catastrophic events occur each year, and direct economic losses have increased 14-fold since the 1950s (IIASA, 2000).

According to UNISDR's 2011 Global Assessment Report on Disaster Risk Reduction (GAR11), extensive catastrophes such as floods are responsible for a small proportion of disaster related deaths, nevertheless, they account for a significant chunk of damage to

public assets, such as health and education facilities, as well as to the livelihoods, homes and assets of poor people. Disasters can wipe out years of development in minutes and consume precious resources that could be better used for development. They damage infrastructure, reduce productivity, generate social tensions and confine vulnerable communities to cycles of disaster and response (IFRC, 2007).

There is no such thing as natural disaster. Events such as earthquakes, cyclones, tsunamis, volcanic eruptions, landslides, storms, fires, droughts and floods by themselves, are not considered disasters. Rather, they become disasters when they adversely and seriously affect human life, livelihoods and property (IFRC, 2007, White, 1945, Sinnakaudan et al., 2003).

Disaster is unnatural and risk reduction measures diminish the odds of it occurring by doing everything possible before the event to protect life, limit damage and strengthen a vulnerable community's ability to bounce back quickly from adversity. The solutions may lie in simple strategies like educating people on what to do during emergencies, development of early warning systems, and preparedness planning. Of late, there has been a shift from strong reliance on flood defence and prevention towards a more integrated approach to flood hazards (Smith and Ward, 1998). The integrated approach seeks to blend the structural and non-structural methods within a socio-economic context which increasingly recognises that complete prevention or protection from floods is impossible and that some level of risk has to be accepted and borne by humanity.

1.2 Problem Statement

Although various programmes and projects have been designed and implemented by governments in the past and present all aimed at controlling natural hazards principally flood, flooding has persisted and is increasing in frequency. Around the world, over 250 million people are affected by natural disasters each year (IFRC, 2007). While many countries are making progress in systematically recording disaster losses, most losses due to extensive disaster events are unaccounted for (UNISDR, 2009).

Ghana ranks high amongst African countries most exposed to risks from multiple weather related hazards) particularly the natural hazards such as floods and droughts (UNDP/NADMO, 2009). Flood occurrence has been an annual ritual in northern Ghana

especially in the Upper East region for the past decade and it is still causing widespread destruction, increasing risk of vulnerability and general underdevelopment of the region (UNDP/NADMO, 2009). What is not certain is the fact that all the flood occurrences did not attract the attention it deserved in the past resulting in the annual loss of lives, property, and livelihoods.

What accounts for the floods from both the technical and ordinary citizen's view points to natural incidence of heavy down pours and human activities. Torrential rains which are concentrated within a two month period (August and September) in the savannah belt during rainy season cause high discharges and large-scale sudden flows above the capacity of the drainage to carry. Again the annual spillage of the Bagre Dam in neighbouring Burkina Faso also places the region in a danger of flooding. More so, the region records prolonged dry season and annual drought which takes precedence over the floods and the consequences are dire.

However, human activities in the course of the flood plains-(agricultural practices) lead to degradation of environment, loss of vegetation cover resulting in erosion and siltation of rivers. The challenge here is that the capacities of the major drains are reduced and as heavy rains increase water volumes, the rivers give up the excess water resulting in flood in years of copious rain.

Both flood and drought cause poor harvest with growing food insecurity and hunger, worsening poverty levels, and high out migration among the youth. Flood disasters play a substantial role in inhibiting economic development and create greater difficulties for many of the regions' poor (UNDP/NADMO, 2009).

Today, there appears to be great public concern about the perennial floods that ravage the region, and the social and economic consequences. The relevant institutions and partners seem overwhelmed by the causes and negative effects in dealing with the problem.

Hence to be able to manage the issue efficiently and effectively, research is necessary to generate required information, and knowledge to throw more light on decision making, policy planning and implementation in an attempt to reduce the impact of floods on the people. The study therefore seeks to answer the following questions:

1. Do District Assemblies incorporate disaster management plans into the DMTD Plans to reduce the delay in responding to flood victims?

2. What is the impact of floods on local development?
3. What is the capacity of disaster management organisation(s) and actors to respond effectively and efficiently to flood disaster?
4. What would form the best adaptation strategy to mitigate the impact of floods?

1.3 Objectives of the Study

The overall objective is to establish how ready the region is to adapt to the perennial flood disaster. Specific research objectives are:

1) To assess the role of Regional Coordinating Council, District Assembly, and stakeholders in mainstreaming disaster planning and management at the district level.
2) Examine the capacity of National Disaster Management Organisation and other collaborators in managing flood disasters?
3) To examine the impact of floods on affected people.
4) To assess the kinds of support services given to victims before, during and after the floods.
5) To make rational suggestions for sustainable management of flood disaster risk at district and regional level.

1.4 Justification

Flooding continues to ravage various parts of the world and interrupting the development process. Disaster risk management is essential to the fight against poverty, because, often the poor, uneducated, very old or very young, the sick, and the oppressed experience the worst impact (Comfort et al., 1999, IFRC, 2007).

The Builsa district is dissected by several tributaries of the Red and White Volta-Sissili, Kulpawn, Besibeli Tono, Afeomeli, Atembele and Azimzim with a low lying plain of between 150-250m. The Builsa district which is the chief producer of food crops often referred to as the food "basket" of the region has repeatedly been hit badly by flood disaster. The implication is that any time floods occur, the livelihoods of crop farmers along the flood prone areas are at risk. The repeated failure of crops or loss of

infrastructure, homes, lives and properties due to floods leads to increased household costs, decline in income, displacement/disintegration and high youth out-migration.

Until 2007, flood disasters occurrence in the region did not attract the needed attention. The impact of flood disaster on local development is enormous. When development plans are laid and disaster strikes, resources for development are diverted to emergency and reconstruction needs to restore the affected community or individual back on track towards economic and social development. There is no absolute safety from disasters, all that is needed is to prepare and adapt.

According to IFRC, (2007) thousands of lives and billions of dollars could be saved every year if a fraction of the cost of disaster response was spent minimizing the impact of hazards. Studies have shown that every dollar invested in risk reduction can save between two and ten dollars in disaster response and recovery cost. Hence Governments need to support vulnerable communities to develop and implement adaptation strategies that respond to the wider scale implications of climate variability.

The result of the study will serve as a rallying point on action decisions on a sustainable approach to flood risk management which are subtle and persistent. The output will also serve as reference material and provoke further research on the phenomena. Since much of the disaster management literature is based on studies in the west it will be useful to conduct research in the understudied areas of the world.

Again, according to Abramovitz et al (2001), while we cannot do away with natural hazards, we can eliminate those we cause, minimize those we exacerbate, and reduce our vulnerability to most. Viewed in this light, disaster mitigation is clearly part of a broader strategy of sustainable development i.e. making communities and nations socially, economically, and ecologically sustainable. Studies of this nature will contribute significantly to the views expressed above.

1.5 Scope of Study

Geographically the study covered Builsa district in the Upper East Region of Ghana because of the perennial flooding in the district. Contextually the focus is on the increasing risk of flooding, the impact and the capacity of the institutions and victims of these disasters to respond in an efficient manner in order to reduce the risk and vulnerability associated with floods and their associated disaster.

1.6 Limitations of the study

The subject is one that touches many hearts at the district and the regional level but there is limited space for affected persons to express their views. Since the flood disasters are widespread phenomena in the selected communities the data collectors were on countless occasions accused of picking on some predetermined set of people to benefit from disaster aid. Again male family members (heads) always wanted to be interviewed because they did not want any benefit to come in the name of the wife.

The rural nature of the whole of the Builsa district made the adoption of the non probability sampling approach in the selection of compounds and household respondents appropriate. Time and resources were also of essence. Nevertheless the data collection techniques employed and the support of the team of data collectors, the study was conducted smoothly despite the personal biases of respondents and confrontations.

1.7 Organisation of Study

The study report is presented in five chapters. Chapter one constitute the background to the research encompassing the statement of the research problem, objectives of the study, research questions and the relevance of the study. Chapter two examined and reviewed relevant literature in the subject matter and basic definition of the concepts of disaster (flood), and disaster management practices, and policies globally. The data collection methods and analyses are covered in the chapter three. The chapter also carry the profile of the Builsa district. Chapter four contains the analysis and discussions, deductions and inferences from the data collected, while the chapter five covers the summary of major findings, conclusion and recommendations.

CHAPTER TWO

FLOOD DISASTER MANAGEMENT: CONCEPTS AND ISSUES

2.1 Introduction

Various disasters like earthquake, landslides, volcanic eruptions, fires, flood and cyclones are natural hazards that kill thousands of people and destroy billions of dollars of habitat and property each year (IPCC, 2001). The rapid growth of the world's population and its increased concentration often in hazardous environment has escalated both the frequency and severity of natural disasters (Sara G. 2006). The tropical climate and unstable landforms coupled with deforestation, unplanned growth proliferation and non-engineered constructions makes disaster prone areas more vulnerable. Non preparedness, poor or no budgetary allocation for disaster prevention in developing countries makes them suffer more or less chronically from natural disasters (IFRC, 2007). This chapter explores literature in order to provide an insight on how various people and scholars consider the phenomenon and ways to managing its impact.

2.2 Definition of Some Key Disaster Related Terms and Concepts

Disaster and emergency management have terms and concepts which shape the understanding of the idea of flood disaster. In his editorial introduction, Chambers (1989) noted that the words "vulnerable" and "vulnerability" are common terms in the lexicon of disasters. The concept of "vulnerability" and the related terms "coping", "resilience" and "adaptation" to disaster are used in different ways by different disciplines and policy communities (Füssel and Klein, 2002, Moench and Dixit, 2004).

2.2.1 Flood

The term flood or flooding is variously defined. 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. According to Ward (1978) defined floods as a "body of water which rises to overflow land which 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 understandable from the above that flooding involves large volumes of running water inundating areas or places that under the 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).

2.2.2 Hazard

A hazard refers to the potential occurrence, in a specific time period and geographic area, of a natural phenomenon that may adversely affect human life, property or activity to the extent of causing a disaster. A hazard occurrence (the earthquake, the flood, or the cyclone, for example) becomes a disaster when it results in injuries, loss of life and livelihoods, displacement and homelessness and/or destruction and damage to infrastructure and property (IFRC, 2007). Each hazard is characterised by its location, intensity, frequency and probability (UNISDR, 2002). Sinnakaudan et al. (2003) quoted, "a flood can be treated as a hazard if it has the potential threat to humans and their welfare". A cyclone that surges over an uninhabited island does not result in a disaster however it would be a disaster if it hit the populated coast of Bangladesh and caused extensive loss of lives and property (IFRC, 2007).

2.2.3 Disaster

Disaster is defined by (UNISDR 2004) as a "serious disruption of the functioning of a community or society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources". The Centre for Research on the Epidemiology of Disasters (CRED) cited by ISDR 2004, classifies an event disaster if at least one of the following has occurred: 10 or more people killed, 100 or more people reported affected, a call for international assistance, and/or a declaration of state of emergency (UNISDR, 2004).

IFRC (2007) also defined disaster as an extreme disruption of the functioning of a society that causes widespread human, material, or environmental losses that exceed the ability of the affected society to cope using only its own resources. Events such as earthquakes, floods, and cyclones by themselves are not considered disasters; rather, they become disasters when they adversely and seriously affect human life, livelihoods and property. Disaster results when a hazard with adverse effects occurs in a context of vulnerability.

2.2.4 Vulnerability

Vulnerability refers to the condition of a person or a group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (Dixit, 2003). The World Health Organisation/Environmental Hazard Analysis ((WHO/EHA, 2002) describe vulnerability as a state of having limited resources to manage hazards, thus being at risk of experiencing serious consequences. It is a condition determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Disasters in whatever form often acts as "agents of change", resulting for instance in innovations in hazard-resistant architectural and construction designs (Chan et al, 2004). It results in advocacy for change in human behaviour in response to disasters. Although a community may be susceptible to certain hazards, such as annual floods, vulnerability is mitigated by preparedness activities that reduce loss of life and damage to property, thus averting the occurrence of a disaster.

2.2.5 Risk

Risk is the probability of harmful consequences, or expected losses which include deaths, injuries, property, livelihoods, economic activity or environmental damage resulting from interactions between natural or human-induced hazards and vulnerable conditions (UNDP, 2004). Conventionally risk is expressed by the notation: Risk = Hazards x Vulnerability (Wisner et al, 2004). Whiles other disciplines talk of the concept of exposure to vulnerability in aspects of physical harm, it is crucial to recognize that risks are inherent or can be created within social systems and that people do not necessarily share the same perceptions of risk and their underlying causes and associated disasters.

2.2.6 Capacity

Capacity is a combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may also be described as the means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster (UNISDR, 2004). Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management.

It involves managing resources, both in normal times as well as during crises and building resilience to natural and human-induced hazards.

2.2.7 Risk Assessment/Analysis

This is a methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend. The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities related to the risk scenarios (ISDR, 2002, WHO/EHA, 2002).

The level of loss a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions is termed acceptable risk. In engineering terms, acceptable risk is used to assess structural and non-structural measures undertaken to reduce possible damage at a level which does not harm people and property, according to codes among other issues based on a known probability of vulnerability (ISDR, 2002, WHO/EHA, 2002).

2.2.8 Disaster Risk Management/Reduction

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards on people. (UNISDR, 2002; WHO/EHA, 2002).

2.2.9 Adaptation

Adaptation refers to the actions that people take in response to, or in anticipation of, projected or actual changes in climate, to reduce adverse impacts or take advantage of the opportunities posed by climate change. Adaptation is not about returning to some prior state, because all social and natural systems evolve and, in some senses, co-evolve with each other over time (Tomkins and Adger, 2004).

Floods disasters are not a recent development, they occur in most countries and cause the most deaths (Noji and Lee, 2005). Climate change is occurring and is widely recognised to be a serious risk to development (IPCC, 2001).

The impacts of climate variability which manifest in floods, droughts, and extreme environmental events create enormous developmental challenges for developing countries due to their dependence on climate sensitive economic sectors (agriculture), their limited economic, technological and human capacities (IPCC 2001), developing countries and poor communities experience disproportionately high levels of social disruption and economic damage from disasters (Sperling and Szekely, 2005). Unfortunately, current development policies, plans and programmes are not well attuned to existing climate vulnerabilities nor sufficient for increased levels of risks and new risks like rising sea levels posed by climate change (Burton and van Aalst, 2004).

These natural disasters are of geophysical origin such as earthquakes, volcanic eruptions, landslides, and climatic origin albeit intensified by humans such as drought, flood, cyclone, locust, forest fire. Though it may not be feasible to control nature and to stop the development of natural phenomena, efforts could be made to at least avoid disasters and assuage their effects on human lives, infrastructure and property (Abramovitz et al 2001).

Rising frequency and intensity of natural disasters and associated problems such as the loss of human lives prompted the General Assembly of the United Nations to proclaim the 1990s as the International Decade for Natural Disaster Reduction (IDNDR) by a resolution (44/236 of December 22, 1989) to focus on all issues related to natural disaster management.

In spite of the 1989 UN resolution on disasters, a string of major disasters occurred throughout the decade- the 1991 cyclone induced flood in Bangladesh that claimed 200,000 deaths (Nelson, 2006), the Yangtze River floods in 1998 with US$65 billion in economic losses (Lui, 2004), the Mozambican floods in 2000 (Christie and Hanlon, 2001 and the Hurricane Katrina in New Orleans United Sate of America in 2005 (Wisner, 2006). Others include the catastrophic floods in Northern Ghana in 2007 which affected more than 325 000 people with close to 100 000 requiring assistance in some form or another to restore livelihoods (NADMO, 2007). Nevertheless, by establishing the International Strategy for Disaster Reduction (ISDR) and by spreading public awareness, the strategy provided the required motivation for disaster reduction.

Disaster mitigation works mainly to minimise the potential risks by developing early warning strategies, prepare and implement developmental plans to provide resilience to such disasters, mobilise resources including communication and improve services delivery and to help in rehabilitation and post-disaster reduction (UNDP, 2004).

Disaster management on the other hand involves pre-disaster planning, preparedness, monitoring, prediction, early warning, damage assessment, and relief management capability UNISDR. Disaster reduction is a systematic work involving different regions, professions and scientific fields, and has become an important measure of sustainable development. The intensity and effect of flood on population depends largely on the combination of such factors as; seasonality and the frequency of occurrence, the water quality, and depth and velocity of the running water (Smith and Ward 1998).

Although floods are more or less natural phenomena, the flood hazard is often largely intensified by human action (White, 1945). The pain and havoc caused by flood in almost all parts of the world have been intellectually examined in an attempt to find ways to reduce their occurrence and the negative effects on humans. This evolution would seem inevitable when one considers the high costs that flood disasters carry.

2.3 Types of Flood

Available literature, distinguishes two kinds of floods depending on the style of occurrence. River floods and coastal floods can either be fast or slow flood depending on the velocity of the flood waters (Smith and Ward 1998).

River floods otherwise known as flash floods occur when a wall of water quickly sweeps over a flood plain or wash land due to flow exceeding the capacity of stream channels. 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 at 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 surge at the coast.

2.4 Dimensions of Flooding

The velocity of flooding can be slow or fast and depending on the frequency, seasonality and or flood outline. The slow kinds of flood occur when runoff from sustained rainfall or rapid snow melts exceed the capacity of a river's channel to carry. Heavy rains from monsoons, hurricanes and tropical depressions, foreign winds and warm rain affecting snow pack are primary causes.

Unexpected drainage obstructions due to human activities such as landslide, ice or debris can also cause slow flooding upstream of the obstruction (IFRC, 2007). The fast flood includes flash floods resulting from convective precipitation (intense thunderstorm) or sudden release from an upstream impoundment created behind a dam.

2.4.1 Flood Frequency and Seasonality

The number of times flood occur in 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. Flooding is associated with seasons such as winter, summer, autumn or spring (Smith and Ward 1998). In Ghana floods occur during the rainy season (NADMO, 2009).

2.5 Causes of Flood

Flood disaster risk is seen as the probability of harm emanating from determinable physical causes (Jasanoff, 1999). 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 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 adjust its velocity and cross sectional area in order to form a balance, thereby going beyond its normal channel boundaries (Nelson, 2003).

People are divided 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 such as space use and location of economic activities (Zhang et al., 2008).

2.5.1 Natural Causes of Flood

There are two main discourses on 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 tides conditions and increasing storm surges which create tidal waves driven into enclosed bays and batter the coast causing coastal floods (Smith and Ward, 1998).

2.5.2 Human Induced Causes

Disaster risk managers have long known that environmental risks such as rain, storms, high winds, heat waves that create environmental hazards do not always have to result in disasters. According to Zhang et al, (2008), and ActionAid (2005) agreed that human activities driven by socio-economic factors should be considered responsible for the recent increasing level of flood risk. White (1945) stated that floods are "acts of God" but flood losses are "largely acts of man". 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 the settlement, unregulated expansion into flood zones and intrinsic land use and economic development of flood plains (Smith and Ward, 1998).

Human interventions into the processes of nature have considerably changed the situation in whole river basins. The alteration of the environment such as change in the drainage patterns from urbanization, construction of concrete and stone building causes additional run off due to poor water absorbing capacity. Inappropriate agricultural practices resulting in erosion and siltation of rivers and clearing of forest for wood and wood products and settlement development-contribute to the disaster (Lui, 2004).

Vegetation captures significant amount of water and return it to the atmosphere before it gets the chance to hit again at the ground. Without vegetation cover to trap the rain, the ground receives more water and its absorption limits are reached rapidly and flooding can

increase. It is now common knowledge that the causes of natural disasters are complex and attributable to a combination of socio-economic factors that modulate for better or worse the impact of environmental hazards on human systems (White, 1945; Zhang et al., 2008; Action Aid, 2005).

Scholars such as Alexander (2000), Pelling (2003), and Wisner et al. (2004) advanced the thinking, that disasters are the combination of environmental hazard, poverty, and other causes of vulnerability including the income level of individuals, age, political power, health, education, and gender. As such, vulnerability is a birthright determined by income distribution, political capital, access to education and health services and to other assets that influence the capacity of individuals and systems to cope with and recover from disasters (Brant, 2007).

2.6 Effects of Flooding

Flood disasters impose the largest burden on developing countries. While the inter-regional distribution is variable, based on income disparities, the per capita burden of catastrophic losses is dramatically higher in developing countries (Freeman, 1999). Flood disaster causes major infrastructure damage i.e. disruption to transport, electricity, and water supply and sewage disposal systems. The economic effects of floods are often much greater and often spread well beyond the flooded area and may last much longer than the flood itself. Floods impact interpretation may have positive impact though most floods assessments emphasises the negative effects. These effects on humans could be direct/tangible and or indirect /intangible (Smith and Ward, 1998).

2.6.1 Direct/Tangible Effects

Direct or primary effects of floods include damage caused by direct flood waters coming in contact with humans and damageable property. Physical assets such as shelter and infrastructure will be more susceptible to damages as frequency of flooding, storms, landslides, untimely rainfall and climate related hazards increase. Though human lives, livestock, buildings are lost, capital infrastructure such as road, culverts/bridges, and drainage systems are often seriously affected (Smith and Ward, 1998).

2.6.2 Indirect/Intangible Effects

Disaster losses include not only the shocking direct impacts that we see on the news, such as the loss of life, housing, and infrastructure, but also indirect impacts such as the foregone production of goods and services caused by interruptions in utility services, transport, labour supplies, suppliers or markets. Secondary losses include impacts on such macroeconomic variables as economic growth, balance of payments, public spending, and inflation (Smith and Ward, 1998).

The indirect effects mostly involve losses that are difficult to assess in monetary terms. Floods directly modify the natural environment and undermine the poor who depend on local ecosystems for a variety of goods and services. Changes in local ecosystems entail changes to agricultural systems and practices which form the basic livelihood of the poor. The loss of entire harvest reduces livelihood security, the contamination of potable water supplies, unhygienic conditions, the incidents of infectious diseases like cholera and water borne diseases are all indirect and are predicted to rise with flooding.

Another important indirect impact is that funds targeted for development are reallocated to finance relief and reconstruction efforts, jeopardizing long term development goals especially in developing countries (Smith and Ward, 1998). Natural disasters, therefore, impede progress towards social and economic growth, as they wipe out investments made and divert resources from federal, state, and municipal/district assembly budgets and aid agencies to recovery activities (UNISDR, 2004).

In a global economy changes in the perception of risk can adversely affect an economy if investors demand higher rates of return. Increased investor demand can lead to increased household costs, decline in income, slower economic development and poor livelihood security.

2.7 Benefits of Floods

Although there are many disruptive effects of floods on human settlements and economic activities, flooding can bring benefits such as making soil fertile and providing nutrients that are deficient through deposition (Smith and Ward, 1998). However this is depended on the frequency, velocity, depth and season and water quality. Periodic flooding was

essential and account for ancient farming communities along the Nile River, Tigris-Euphrates, Indus River, and the Ganges among others (Smith and Ward, 1998)

2.8 Flood Control and Official Response

Man has long tried though not always successfully to prevent and control the occurrence and damaging effects of flooding. A comprehensive body of literature has been developed over the past 50 years that describes the theory and application of disaster risk reduction measures in flood management. The dominant view of what the best strategy for prevention of flood disaster evolved through three distinct paradigms: the engineering, the behavioural and the development paradigm, (Smith and Ward, 1998).

2.8.1The Engineering Paradigm

According to Smith and Ward (1998), the engineering paradigm states that the cause of flood was due to extreme hydrological events and the best cure is to exert physical control over flood flows. The engineering paradigm captures all the physically based techniques which seek to modify the flood as natural disaster. Hydrological engineers may build artificial flood banks or defence walls, straighten the river course, and or dredge the riverbed to make it deeper and wider so as to carry more water.

2.8.2 The Behavioural Paradigm

The behavioural school of thought believes that flood incidence is due to failing of engineering to deal with the phenomenon. It is argued that failure of the flood prevention authorities to consider the implication of non structural alternatives such as land zoning, forecasting and early warning systems accounts for the worsening flood disaster.

The behavioural paradigm further states that behavioural failure of individual flood plain managers and residents to assess the full risk from floods are the cause of the devastation that society is confronted with. They prescribe a full vulnerability and risk assessment of all flood plains so as to develop a human response plan for flood control.

2.8.3 The Development Paradigm

The development paradigm phase relates flood disaster to development and underdevelopment. The development group criticised the behavioural paradigm and concluded that though local issues are considered at the behavioural level as alternatives, it is still the technocrat that leads the process. It is argued therefore that the public should participate in planning the process of managing rivers and water bodies and made to understand the importance of adopting community based flood response than allowing the technocrats to plan for them.

2.9 The General Disaster Response Approach

Various guidelines on managing natural hazards and reducing the damaging impacts from them have been compiled (Smith, 2001; Alexander, 2000). The disaster risk reduction approach often begin with disaster risk ‘‘prevention’’ followed by ‘‘preparedness’’, then ‘‘response’’ and finally ‘‘rehabilitation’’ (UNDP, 2004). For instance, Wisner et al., (2003) emphasise two clear dimensions of disaster risk reduction: the short-term recovery and relief aspect that is predominantly humanitarian, and the other longer-term planning aspect which addresses sustainable risk management. The processes of responding to disasters are further discussed below.

2.9.1 Early Warning and Disaster Preparedness Response

Preparedness is a medium-term planning activity that involves developing and testing disaster management plans. It involves the development and implementation of early warning systems, resource inventory and stockpiling of resources, coordinating agencies, and ensuring evacuation plans work (IFRC, 2007).

2.9. 2 Emergency Relief Response and Recovery

Response occurs when the hazard is about to happen, or is happening and involves real-time disaster response (assessment, coordination, and relief). Rehabilitation focuses on recovery taking into account long-term planning objectives (Pelling, 2003). This framework has been applied in many different contexts i.e. the landslides and tsunami on the east coast of Canada (Liverman et al., 2001).

Disaster risk management is essential to the fight against poverty, because the poor are inexplicably affected more by disaster (Ribot et al., 1996). As with any risk, such as the death of a bread winner, the poor are much more vulnerable to disasters due to their lack of assets with which to even consume and respond to catastrophic events.

The poor are often forced to accept a higher exposure to hazards and risk. Characteristically they live in unsafe areas on marginal lands such as flood plains and river beds. Although they live in more vulnerable areas, the daily struggle to survive takes priority over investment in mitigating the impacts of potential disaster events such as flooding (Ribot et al., 1996; Adger et al., 2001). Consequently, poverty plays a big role in keeping people vulnerable to disasters in the same fashion that disasters serve as a powerful downward trigger to poverty by continually destroying the few assets of the poor and wiping out investments in public infrastructure and services that serve the poor (Comfort et al., 1999).

It is very lucid that access to public infrastructure comprises a large component of the wealth of the poorest households and therefore the annual direct damage to rural infrastructure due to natural disasters such as roads, bridges, irrigation, electrification, schools, are said to cost billions of dollars around the globe pushing the poor further down the poverty drainpipe (UN, 2004). The links between poverty and disaster vulnerability make disaster management an important part of development planning particularly in developing economies where poverty levels are startling. While these elements are critical for effective disaster risk reduction, they are not always designed to concurrently bring about long-term development.

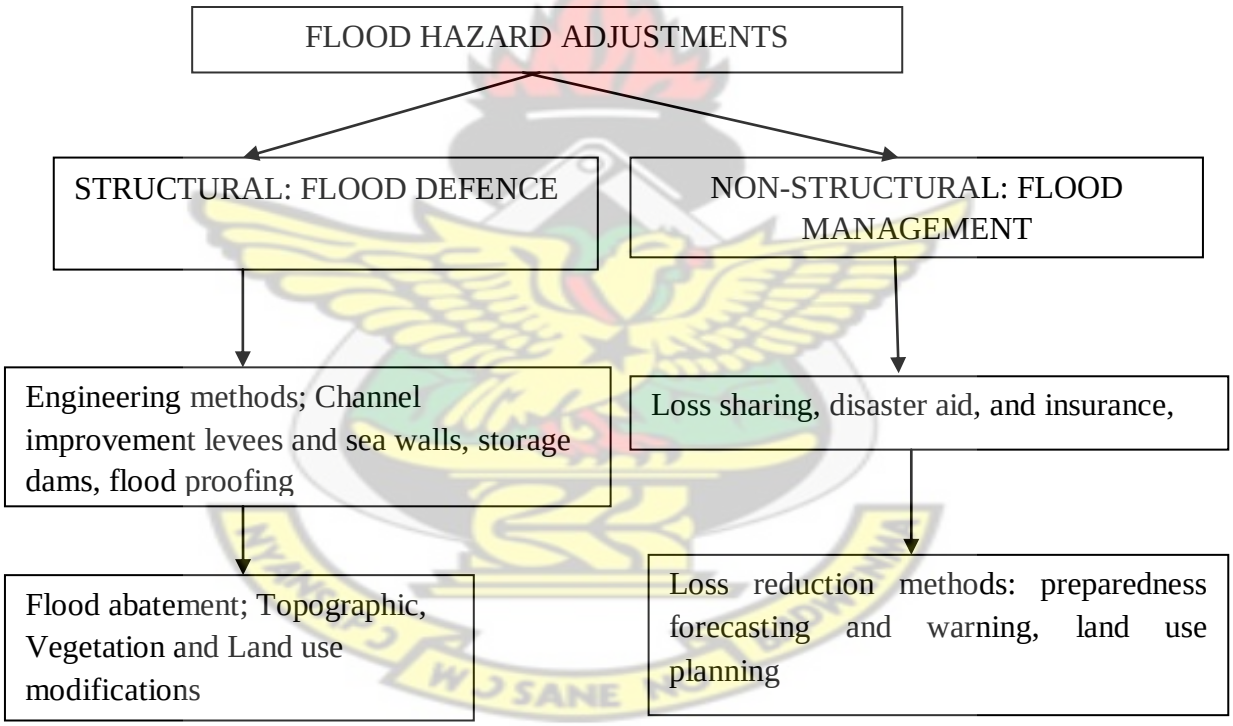
According to (Smith and Ward, 1998) the disaster management response is put into structural and non-structural measures. The structural aspect covers the technical or physical control measures which are usually geared towards flood prevention. The non structural part deals with the human behaviour and response which seeks to reduce flood disaster impact by the process of adjusting people to damaging events, loss sharing, disaster aid and insurance to reduce future loss.

The ‘structural’ school of thought argued that, specific actions have to be taken to reduce general social vulnerability. They advocated the need to bring together agency and behavioural change for disaster risk reduction with concurrent change to economic and political structures (Alexander, 2000; Pelling, 2003).

However, wider disaster literature has paid relatively less attention to understanding how to foster such integration with significant attention been put on the challenges of structural reform for pro-poor growth and less about how different approaches to disaster risk reduction can create policy environments that are conducive to the design and implementation of structural reforms.

They argue that good disaster risk reduction may foster structural reform and vice-versa. However structural reform in areas where there are high levels of inequality and poverty appears to be the most important element in producing sustainable outcomes. In fact, it is precisely in the synergy between disaster risk reduction and structural reform that they believe the great opportunity for success lies. Figure 2.1 below depicts the above views.

Fig 2.1Range of Potential Human Adjustment to the Flood Hazards



Source: Adopted from Smith and Ward, (1998)

Chan (1997) said "structural solutions are attempts at controlling floods and non-structural solutions are largely preventive efforts". These strategies could also be implemented in the flood-prone areas that are not fully developed. Non-structural flood mitigation measures can also complement the structural approaches in areas where future development may occur, and they may also represent an independent approach where some control over floodplain development can be exercised at low cost. All of the above methods of flood

control can work, however the structural methods often have negative effects on the river as a natural habitat for other organisms (Chan, 1997).

2.10 Flood Disaster Management Approaches

Disaster risks can be minimized and losses substantially reduced by enabling local bodies such as Unions and Municipalities to undertake planned interventions. Most governments have national disaster and emergency policies with special ministries, departments and agencies charged with the responsibility for disaster preparedness and response. For example in Vietnam, the Department of Dyke Management, Flood and Storm Control, the Hydro-meteorological Service, and the Red Cross are in charge of advance planning and implementation of appropriate mitigation (development) strategies to significantly reduce the drudgery and cost of rescue, relief, resettlement and reconstruction (IFRC, 2007).

Disaster risk reduction in Ghana has its main institutional home within the National Disaster Management Organization (NADMO) established in 1996 under a National Security Council, under the NADMO Act (Act 517, 1996) in the Ministry of the Interior. The organisational framework indicates that NADMO is responsible for assisting the Government of Ghana in observing and investigating the establishment and implementation of the annual flood preparedness solutions and plans for all disaster types and phases. NADMO functions under a National Secretariat in Accra with 10 Regional Secretariats, 170 District/Municipal Secretariats and 900 Zonal offices. Since its inception, NADMO has contributed considerably to the management of disasters across the country, despite a constant struggle to obtain resources and maintain response capacity on the ground.

The National Disaster Management Committee (NDMC) has administrative oversight responsibilities for NADMO and reports to the National Security Council, which is NADMO's Governing Council. Seven hazard-specific technical committees of governmental and non-governmental experts have been established to advise the NDMC on specific issues. Confronted with a variety of natural hazards, and prompted by the recent floods in the north, the Government of Ghana initiated actions on several fronts in order to develop strategies and strengthen institutional capacity in disaster risk management. A draft National Disaster Management Plan (NDMP) has recently been prepared as a revision of the 1997 NDMP along with an Amendment to the Act, (UNDP/NADMO, 2009).

Governments across the world located within flood prone zones often draw up policies and strategies to at least reduce the occurrence of flooding and lower the effects on populations living in the flood plains. In many countries across the world, rivers prone to floods are often carefully managed (Dunne and Leopold, 1978), using structural measures such as levees, bunds, reservoirs, and weirs to prevent rivers from bursting their banks. When these defences fail, emergency rescue measures are used to reduce the effect on the people.

Remembering the misery and destruction caused by the 1910 Great Flood of Paris, the French government built a series of reservoirs called Les Grands Lacs de Seine (or Great Lakes) which help remove pressure from the Seine during floods, especially the regular winter flooding. London is protected from sea flooding by a huge mechanical barrier across the River Thames, which is raised when the sea water level reaches a certain point. Venice has a similar arrangement, although it is already unable to cope with very high tides (Dunne and Leopold, 1978).

The defences of both London and Venice would be rendered inadequate if sea levels were to rise. The Adige in Northern Italy was provided with an underground canal to drain part of its flow into the Garda Lake (in the Po drainage basin), thus lessening the risk of estuarine floods. The underground canal has been used twice, in 1966 and 2000. New Orleans in the United States of America which lies within low lying area of about 35% below sea level is protected by hundreds of miles of levees and flood gates (FEMA, 2008).

The largest and most elaborate flood defences can be found in the Netherlands, where they are referred to as Delta Works with the Oosterschelde dam as its crowning achievement. These works were built in response to the North Sea flood of 1953 of the south western part of the Netherlands. The Dutch had already built one of the world's largest dams in the north of the country: the Afsluitdijk.

Currently the Saint Petersburg Flood Prevention Facility Complex in Russia was to be finished by 2008, to protect Saint Petersburg from storm surges. It has a main traffic function as it completes a ring road around Saint Petersburg. In Austria, flooding for over 150 years has been controlled by various actions of the Vienna Danube regulation, with dredging of the main Danube during 1870-75, and creation of the New Danube from 1972-

1988. In the Grand Canal of China region, flood diversion areas are rural areas that are deliberately flooded in emergencies in order to protect cities.

The results from some of these comprehensive programmes are mixed with some chalking success and others requiring review and re-development. The famous levee failure occurred in August, 2005. Hurricane Katrina resulted in the inundation of the central and eastern sections of the New Orleans Metropolitan area (Wisner, 2006; FEMA, 2008). Many have proposed that loss of vegetation (deforestation) will lead to risk increase because with the natural forest cover, the flood duration should decrease. Hence reducing the rate of deforestation should improve the incidents and severity of floods.

2.11 Case Studies of Adaptation measures in China, Malaysia, and Mozambique

The governments of China, Malaysia and Mozambique suffer from extensive flooding annually. These countries therefore set out to protect their people from the perennial flooding by adopting various adaptation policies and measures depending on their local situation as the causes differ from place to place.

Malaysia and China advanced in technology adopted a more physical intervention approach through the building of dams, levees, and wet lands preservation. While Mozambique a developing country with little technical knowhow and locational problems opted for stringent land use policy to mitigate the flood effects.

2.11.1 Sabah, Malaysia

Malaysia is a fast-developing country progressing towards industrial developments in urban areas. With the scarcity of land in the city and town areas, the development is encroaching flood-prone areas. The situation promotes further economic growth especially in the commercial and residential aspects throughout the country, with little regard to the effects on the communities and environment. Flood-prone areas in Malaysia are still under heavy development because there is no proper guideline for development in floodplains even though several major floods had occurred in recent years both as localized flash floods and as basin-wide floods. It is estimated that RM 130 million financial losses and 200 reported deaths were recorded in December 1996 floods alone (Chan, 1997).

One such area severely affected was Sabah, the second largest of the 14 states in Malaysia also known as "the Land below the Wind". It is one of the two Malaysian states on the island of Borneo situated on the northeast of the Island. Virtually every district in Sabah is affected by flooding to some extent but areas most affected are mostly in the West Coast with the exception of the Kinabatangan River in the East Coast. The severity of flooding in these areas varies from year to year and from river to river (Chan, 1997). The Department of Irrigation and Drainage (DID) monitor flood in the low-lying areas and compile annual records of such floods.

Due to the flood situation, Sabah developed a Water Resources Master Plan (SWRMP, 1995) for the district. In the plan suggestions for the implementation of a flood and floodplain management were put forward to help reduce the negative impacts of flooding and flood liability on individual owner and occupiers and to reduce private and public losses ensuing from floods. The three measures suggested were structural, planning and contingency measures (SWRMP, 1995).

According to the SWRMP, (1995) structural measures should be used to purposely change the floods behaviour by reducing flood levels, or excluding flood waters from areas at risk. These structural flood mitigation works suggested included the construction of flood mitigation dams, levees and dikes, flood bypass/diversion, channel improvements, retarding basin and or on-site detention ponds among others. See appendix II for the details.

Addressing flood issues in Sabah was not only to reduce flood hazards, but also to address other socio-economic problems such as poverty and underdevelopment in many areas in the state. Though the government was keen to reduce flood loss, the official responses employed were not completely successful for the overall management of floods.

Observably, since relying solely on structural measures to address flood disasters would be limiting, the flood hazard in Sabah was tackled effectively through a comprehensive approach incorporating structural and non-structural flood mitigation methods, as well as traditional flood adaptation strategies applied by the past floodplain residents into the official flood management system.

The United Nations Development Programme (2004) declared "non-structural approaches do not mean "no use", but rather "wise use" of flood plains. Zhang and Wen, (2001) and Wisner, (1979) summarised the adaptation measures adopted by China and Mozambique to control and manage flood disasters in their various countries.

2.11.2 China

East China suffers from flood disaster caused basically by rainstorms in combination with coastal storm surges. Beginning twentieth century major rivers in China were struck by a number of serious disastrous floods. In the 1990s, big floods frequently hit the southern part of China with 1998 flood being the most noticeable, resulting in flooding in major rivers such as Yangtze, Songhua, Pearl, and the Min (Lui, 2004).

In response to the flood, China built and reinforced 245,000 kilometres of levees to protect 33 million ha of cultivated land and over 200 million people by 1997. Also over 84,000 large, medium and small reservoirs were completed with the storage capacity of 472 billion m^3 to serve as flood retardation basins for major rivers. Flood monitoring, information transmission and forecasting systems were also developed to complement activities in the sector. Far reaching water and flood laws were passed with institutional restructuring to fight the menace Zhang and Wen, (2001).

2.11.3 Mozambique

Mozambique appears to be battered by various natural disasters of which drought and floods are most notable. Located in a geographical region with a greater portion barely rising above 200m, the extensive flood plains increase the flood hazard risk to heavy rainfall variability. Flooding in Mozambique led to severe losses annually close to US$43m (Wisner, 1979).

The main rivers- Limpopo and Zambesi that take their sources outside Mozambique pose the first threat of flooding. The more frequent one happens around the Lurio, Nonapo, Ligonha, Messalo and Lucunga rivers that have their sources from the well watered highlands in Mozambique receiving rainfall between 1400 and 1800 mm/year. These rivers rise fast with very little warning, but their devastation is much smaller than the international rivers (Wisner, 1979).

In response to the floods the government of Mozambique adopted comprehensive land use planning in flood plain management such as land use regulations, zoning ordinances, enacting building codes, closing of low levels windows, subsidise relocation, flood insurance, modification of cropping practices among others. This was done to modify the damage susceptibility. These and other options considered are presented in a tabular form in appendix III.

The 2000 Mozambican flood cannot be attributed to failure of the chosen approach because it followed five weeks of torrential rain fall and cyclone landfall. Other countries in the same region with Mozambique like South Africa, Swaziland and Botswana although on a less scale suffered flooding (Christie and Hanlon, 2001; Wisner et al., 2004).

2.12 Adaptation Measures

Societies dependent on resources that are vulnerable to climate change have, in the past, adapted to change through strengthening their spaces of dependence to spread the risks associated with individual events. They expand their spaces of engagement through collective action, mediating and trading off the elements of effectiveness and legitimacy through negotiated outcomes and the potential benefits. This is to enable them to find a wider support network in the form of interaction with regional or national government or international agencies.

Paton et al., (2001) recognize the importance of the nature of social relationships as a factor that can enhance resilience. Although the lessons from these studies are context-specific, they do establish some broad criteria by which to assess the adaptive capacity of communities. The nature of the relationships between community members is critical, as are access to and participation in the wider decision-making processes (Adger, 2003).

Social resilience is often used to describe the capacity for positive adaptation despite adversity (Luthar et al., 2000). In the context of climate change, social resilience is the ability of groups or communities to adapt in the face of external social, political, or environmental stresses and disturbances (Adger, 2000). To be resilient, societies must generally demonstrate the ability to safeguard disturbance, self-organize, learn, and adapt (Trosper, 2002).

Social resilience in this context appears to be promoted through at least two distinct forms of cross-scale interaction: Networks and community relations of individuals and groups operating to cope with variability and change in everyday decision making, and wider networks of individuals or groups who may be able to influence the decisions that are being made at the local scale. These approaches offered pathways for vulnerable communities to engage in developing response policies and ensure that there is room for change in those policies. These principles are relevant to climate change in situations in which there is much uncertainty and disagreement about how best to manage the potential consequences of climate change issue, yet there is a need to take anticipatory adaptive action.

Networks can be explored in terms of the access to power and the representation that they provide to participants (Cox, 1998). For instance, networks of engagement, and the support they offer to participants in vulnerable positions (networks of dependence) and the expansion of their engagement appears to be critical to the enhancement of resilience in communities affected or likely to be affected by climate change.

Adaptation is not about returning to some prior state, because all social and natural systems evolve and, in some senses, co-evolve with each other over time. Adaptive co-management may promote the expansion of networks and thus enhance social resilience in the area of responding to climate change (Lee, 1999). Clearly the nature of the relationships between resource users at the community level, their access to new technology, and their willingness to change will determine their immediate response to climate change risks. However, it is their networks that enable individuals to engage in the wider decision environment that will affect their longer-term resilience (Tompkins et al., 2004; Trosper, 2002).

The existence and the usefulness of these networks are determined by institutional as well as social factors. At the community level, reducing the barriers to communication through sharing information and feedback that provides positive reinforcement are important elements in consolidating networks of dependence.

At the institutional level, integrated institutional structures may be better able to support the inclusion of climate stakeholders in decision-making processes to ensure that their needs can be addressed by as wide an audience as possible. The wider community is being drawn on for assistance and advice.

The adaptive management processes is informed by iterative learning about the ecosystem and earlier management successes and failures and increased threats of climate change and disasters. Present-day resilience which in turn increased the ability to respond to the threats of long-term climate change today came as a result of time tested adaption strategies. This type of adaptive management, according to Lee, (1999) can be used to pursue greater ecological stability and more flexible institutions for resource management.

2.12.1 Benefits of Increased Adaption

The potential benefits of increased adaptation to present-day disasters and how to cope with climate change in the long term include co-management, social acceptance of response strategy, as well as sustainable resource management. Co-management is one form of collective action whereby resource stakeholders work together with a government agency to undertake some aspect of resource management (Mercer et al., 2010). Collective action in this context is the coordination of efforts among groups of individuals to achieve a common goal when individual self-interest would be inadequate to achieve the desired outcome (Ostrom, 1990).

The role of co-management in building community resilience is very crucial. Further, the potential outcomes of co-management, i.e., resilient ecosystems, are likely to be more adaptable in future uncertain climates. Though further research is needed to determine whether these findings apply to more complex social and ecological situations or ecosystems, it is accepted that the determinants of resilience and vulnerability to external perturbations are universal to many resource situations (Adger, 2000; Pelling, 2003).

The reduction of social vulnerability through the extension and consolidation of social networks, both locally and at national, regional, or international scales, can contribute to increases in environmental resilience. This could help build a bridge so that a practical and innovative risk reduction strategy can be achieved on the basis of both outside and inside knowledge (Mercer et al., 2010). Social acceptance of any response strategy to environmental change of any form is critical as the response strategies themselves. Hence, when faced with some degree of uncertainty, management approaches need to be iterative, flexible and inclusionary taking into account the technological, institutional and management options available to individuals and communities.

Sustainable resource management requires government structures that are empowered to make collective decisions (Brown et al., 2002). Because the traditional resources that form part of the public good are regulated by the government, co-management most often involves vertical linkages and shifts in rights and responsibilities from government to local resource users (Folke et al., 2002). Ostrom and others (1999) argue that, although the scale of many environmental problems is now global and that global action is required, simply replicating local institutions of collective action at the global scale is not feasible.

Indeed, the imposed impacts of climate change are manifested at particular localities, in some political systems. Though, the appropriate institutional scale for adaptation is often that of municipal or local resource management institutions the interaction between institutions across scales is constrained by the power relationships among these bodies (O'Brien et al., 2004). In effect, the diversity of impacts of climate change means that the most appropriate adaptation responses will often be on multiple levels and locality specific.

The mechanisms for enhancing social and ecological resilience are often inherent in the communities and co-management institutions coping with environmental change. Building community resilience through the expansion of the networks of dependence and engagement facilitates this type of learning-based management. The review above is evident that being resilient to climate threats requires cementation of localized spaces of dependence, expansion of spaces of engagement, and to avoid being tied to specific response paths by implementing flexible learning-based management.

However, not all ways of adapting to climate change are in harmony with existing social norms, institutions, and structures. Although urban planning and land use zoning generally take place within local government structures, the enforcement and effectiveness of planning and zoning are dependent on the inclusionary and consensual nature of the processes. When collaborative planning is ignored, the sustainability of plans, adaptation and their implementation come into question (Pelling, 2003). Studies on inclusionary and participatory planning for resource management supports these lessons i.e. the barriers to community or individual action do not lie primarily in a lack of information or understanding alone, but also in social, cultural, and institutional factors Owens, (2000).

2.13 Summary

Although many risks associated with climate change are well known, adaptation to climate change is manifested in the first instance through adjustments in experienced variability and extremes. The reason is that the past is not always a good guide to the future as the landscape of risk is likely to be altered. Chronic stress on natural resource systems from human disturbance and pollution means that ecosystems may face irreversible change.

The cumulated impacts of more frequent or intense weather extremes further threaten the recovery of these systems. Thus, although there are limits to spatial or temporal analogs of climate change adaptation, the present-day capacity to adapt and to be resilient is a crucial starting point for that adaptation. The processes needed to adapt to catastrophic system changes would involve a major restructuring of the economy and society.

Vulnerability among certain social groups is prevalent in virtually all resource circumstances. Further, some climate change impacts, such as a significant and rapid rise in sea level, flood, are likely to significantly alter the resource systems and their ecosystem services.

Adaptation to both gradual and significant changes should involve encouraging the evolution of new institutions (statutory bodies) that are sensitive to the resilience of the ecosystems they are managing and knowledgeable about the specific nature of the risks of climate change and disasters. Without a doubt, these are dangerous entries in the climate system that needs to be avoided but, there is no substitute for the significant mitigation of disasters at the present time.

CHAPTER THREE

SOURCES AND METHODS OF DATA COLLECTION AND THE CURRENT SITUATION OF BUILSA DISTRICT

The quality of any research result depends on three methodological variables-the sources of data, the methods of gathering the data and how the data are analysed, interpreted and presented. The approach adopted also depends on the outline of the study area. Issues of the physical structures and accessibility informed the choice of the research approach. This chapter contains the processes of carrying out the research considering the current situation of the study district.

3.1 Research Methodology

The success of any research is based on the design and control of the research process in order to keep it in perspective and focus on the objectives of the study. A case study was carried out in one of the most flood prone localities in the Upper East Region-Builsa District, focusing on household and community vulnerabilities and institutional capacity to effectively manage the disaster. The research has been structured as outlined below.

3.1.1 Research Design

Kish, (1967) states that research design denotes all the stages and processes involved in research to reach the respondents. Sparrow, (1988) defined research design as a plan for conducting research which usually includes specification of the elements to be examined and the procedures to be used. It is done purposely to have the most feasible and appropriate methods for answering research questions. Therefore the study adopted correlational design often referred to as the cross sectional study. It follows the logical sequence of statement of problem, objectives, review of relevant literature, data collection procedures, analytical tool and process, interpretation and presentation of the results and drawing of inferences to make recommendations. The research design usually involves asking a sample of individuals to respond to a set of questions as regards their backgrounds, past experience and or roles in dealing with the subject matter (Frankfort-Nachmias and Nachmias, 1992).

3.2 Data Requirements

The data required for the research were collected from two main sources; secondary and primary sources. These are further discussed in the sub-sections below.

3.2.1 Secondary Sources

The secondary source includes books, articles, newsletters and internet sources and NADMO accounts examined in literature under chapter two. Qualitative such as the oral account of the flood by household respondents and disaster management agencies and quantitative data such as number of affected persons, value of farm losses, infrastructure destroyed, and financial commitment in managing floods was collected from relevant bodies for analysis, and interpretation.

3.2.2 Primary Sources

To ascertain the general flood disaster situation, primary data were collected from households and strategic public institutions responsible for disaster related management in the Builsa District and at the regional level. The units of enquiry are discussed further below.

3.3 Units of Enquiry

Data were collected from key actors in disaster management and local development. These included communities (households), and institutions such as NADMO, Regional Planning and Coordinating Unit (RPCU), Builsa District Assembly (DPCU), Meteorological Services Agency (MSA), Ministry of Food and Agriculture (MoFA), Town and Country Planning Department (TCPD), the Hydrological Services Department (HSD), and Water Resources Commission/Volta Basin Authority (WRC/VBA) and Environmental Protection Agency (EPA).

The information sought among others comprised the roles of stakeholders in flood disaster prevention and management, and the capacity of both the victims and local actors to respond adequately to the disaster, the impact and support services as well as what would form a good adaption strategy for sustainable management of floods. Again the study sought the perception of possible causes on the back of Bagre Dam controversy.

3.4 Instruments and Techniques for Collecting Data

Data collection tools help to provide a picture of the work environment. The goal is to help the researcher to clarify information, process knowledge, and identify opportunities for continuous improvement (Tague, 2004). Data for every research can be collected in a variety of ways.

The data collection process employed direct administration of structured and unstructured questionnaire to a sample of households and some public institutions to solicit information through interviews. According to Frankfort Nachmias and Nachmias, (1992), a personal interview is a face to face interpersonal interactive situation in which an interviewer asks respondents questions designed to elicit answers pertinent to the research hypothesis.

Structured interviews use very formal, predetermined sets of questionnaire by the interviewer to investigate or elicit information from the respondents using the same wording and order as specified in the questionnaire. An interview guide was used as instruments for discussing with other relevant bodies on the subject matter. The tool and technique combine attributes of formality and informality, with written and unwritten questions and offered the opportunity to probe further and obtain valuable information from the respondent's knowledge in the subject under study.

Again field observation was used. Kumar, (1999) defines observation as "a purposeful selective and systematic way of watching and listening to an interaction or phenomenon as it takes place." Though the tool cannot be used to assess past events it was used to survey the vestiges of the flood disaster in the abundance of critical evidence like videos, pictures, damaged and unrepaired physical infrastructure and the reconstruction efforts.

3.5 Triangulation

Triangulation requires the collection of data from a variety of sources, in a variety of ways, with a variety of perspective in the measurement of variables (Tague, 2004). The accuracy and whether information from one source contradicts information from another was checked by collecting similar data from multiple sources. Apart from information from secondary sources, observations and interviews were employed to cross examine the recorded evidence. The primary data provided information directly from victims of flood disaster and was used to validate and bridge the gap created by the secondary information.

3.6 Sampling Techniques

Understanding the fact that the entire population cannot be covered in one research process due to time limitation and resource constraints, the study adopted the multi-stage approach i.e. a combination of relevant sampling methods purposive, systematic sampling, simple random and accidental sampling. The approach was used to select 1 district (Builsa) from 9 in the region and to further select 10 communities which were the worst hit settlements and 146 households for interview.

3.6.1 Sample Frame and Sample Size Determination

The study obtained a total household size of 2,261 as sample frame from the ten selected communities based on the Ghana Statistical Services/Population and Housing Census in 2000 for the Builsa District and as estimated for 2011 (DMTDP) for interview.

To determine the sample size, Slovins' sampling method (Guildford and Fruchter, 1973) was adopted. The mathematical formula is stated: $n = \frac{N}{1+N(\propto)^2}$, Where **n**=sample size, **N**=sample frame **(2,261)** and **α** represents the margin of error of **0.08** with confidence level of **92%.** By substituting 2,261 and 0.08 into the formula: $n= \frac{2,261}{1+2,261(0.08)^2}$ **, n** $=\frac{2,261}{15.4704}$ **, n=146.15 hence: n=146.**

Therefore the sample size for the community household survey was 146. This was done to ensure that the sample mean was closer to the household population mean and minimise errors. The determined sample size of 146 households was proportionally distributed among the selected settlements as indicated in the table 3.1 below.

Table.3.1 The sampled size and share distribution among the communities

Name of Community	No. of households	Sample size	Sample share (%)
Sandema	1,035	66	45
Fiisa	161	10	6.8
Korii	163	10	6.8
Nyaansa	167	10	6.8
Kanjarga-Jiningsa	141	9	6
Kobdema	113	7	5
Siniensi-Kaasa	127	8	5
Chiok-Anpa yeri	72	4	3
Gbedema	178	11	7.5
Gbendem Kunkwa	178	11	7.5
Total = 10	**2,261**	**146**	**100**

Source: Adapted from GSS (2005) and estimated in DMTDP (2010-2013)

The district capital, Sandema had the highest household respondents as a proportion of the sample with a total share of 40%. The rest of the communities represented less than 9% of the sample as illustrated on table 3.1 above. Resource constraints both in time and finances impacted on the determination of the sample size. The two elements of cost and time were critical for the use of 92% confidence level or 8% margin of error for the study. The probability and non probability sampling methods employed for the study are explained below.

3.6.2 Purposive sampling

As the name implies, purposive sampling involves the selection of settlements, organisations, and or respondents (households/individuals) who can best answer the research questions (Tsumasi, 2001). The key institutions charged with the responsibility for planning and managing disasters at the regional and district level were also purposely chosen.

Out of the nine municipal/district assemblies in the region, the Builsa district was picked due to its dominance in terms of impact and susceptibility to flooding. The flood impact assessment data available vindicates the choice. See appendix IV (a) and IV (b) for tabular view of the statistics.

The Builsa district suffers more with large population at risk compared to the other districts in the region. Despite the fact that Bawku East and West lie directly along the course of the White Volta on which the Bagre Dam is built, the impact of flood in the region is tilted against the Builsa District primarily because of the relief of the land i.e. the Red and White Volta tributaries such as the Sissili, Kulpawn and Tono rivers and environmental degradation.

For instance out of 98,965 flood affected households for the entire region in 2007, 50% of the households were in the Builsa against 15% in Talansi-Nabdam, 16% in the then Kaassena-Nankani and 6% in Bawku East that lie directly along the Bagre dam on the White Volta. A total of 11,402 Persons were displaced and five deaths recorded in the Builsa District compared to 13 deaths and 10,000 displaced persons in Bawku East in the same year (appendix IVa). In 2009, out of 241 communities and 9056 households affected by the floods, the Builsa district recorded 76 communities and 1,453 households displaced (appendix IV (b).

Communities that persistently experience flood with adequate knowledge on flood disaster impact were chosen for the survey. The District Emergency Preparedness Team (DEPT) in 2009 prioritised the most affected communities to include the following selected communities Fiisa, korii, Nyaansa, Sandema, Siniensi-Kaasa, Gbedema, chiok-Anpa Yeri, Gbendem Kunkwa, Kanjarga-Jiningsa and Kobdema (MTDP, 2011).

3.6.3 Systematic Sampling

Systematic sampling was used to select the compounds in each community. Table 3.2 illustrates the systematic procedure followed in the selection of the Compounds. For example the number of compounds in Sandema was 412. Therefore every 6th house was selected for interview, thus 66 compounds were interview as shown in the table.

Table.3.2 Systematic Sampling Procedure

Selected Area	**No. of Houses**	**Number of Households to be Interviewed (Sample Size)**	**Sample Fraction (Kth House)**
Sandema	412	66	Every 6th house
Fiisa	61	10	Every 6th house
Korii	47	10	Every 5th house
Nyaansa	53	10	Every 5th house
Kanjarga-Jiningsa	32	9	Every 4th house
Kobdema	32	7	Every 5th house
Siniensi-Kaasa	37	8	Every 5th house
Chiok-Anpa yeri	21	4	Every 5th house
Gbedema	44	11	Every 4th house
Gbendem Kunkwa	32	11	Every 3rd house

Sources: Authors construct 2011

3.6.4 Simple Random Sampling

Since each compound contained at least a household, the study used the lottery method to randomly select the starting compound. Due to the unplanned settlement structure in the district, a serpentine movement and counting was used to select every Kth house. With this approach a respondent representing a household was interviewed in every Kth house in each selected area until the required sample share of the selected settlement was obtained.

For example the starting house number for Fiisa was 4 and ended at house number 58 for the 10th household respondent.

Once the compound is located using the Kth number (systematic), the accidental approach was used to select a household respondent. By the accidental sampling upon entering a compound the first person the researcher encountered eighteen years and older who was ready and willing to offer information was interviewed. The approach gave each household in the compound an equal and none zero chance of being part of the selected respondents.

3.7 Data Analysis

Data analysis involves a careful examination of the data using scientific methods in order to uncover the hidden issues on the subject matter. The study employed an analytical tool - Statistical Package for Social Scientist (SPSS) to process the responses from primary sources. With the aid of SPSS soft ware the household responses were coded and entered into a data base to generate tables for presentation and analysis. Coding was done to classify answers into meaningful categories and bring out essential patterns and make deductions from answers collated. The inter-related findings were used to draw conclusions and make recommendations.

Issues on the relationship between flood disaster and its impact on population, the capacity to respond efficiently, the level of awareness and what will form the best strategy for long term solution to the flood disaster were established through logical deductions or inferences drawn from the analysis. The facts gathered were combined with some literature and presented in the form of narratives, charts, tables, figures and graphs.

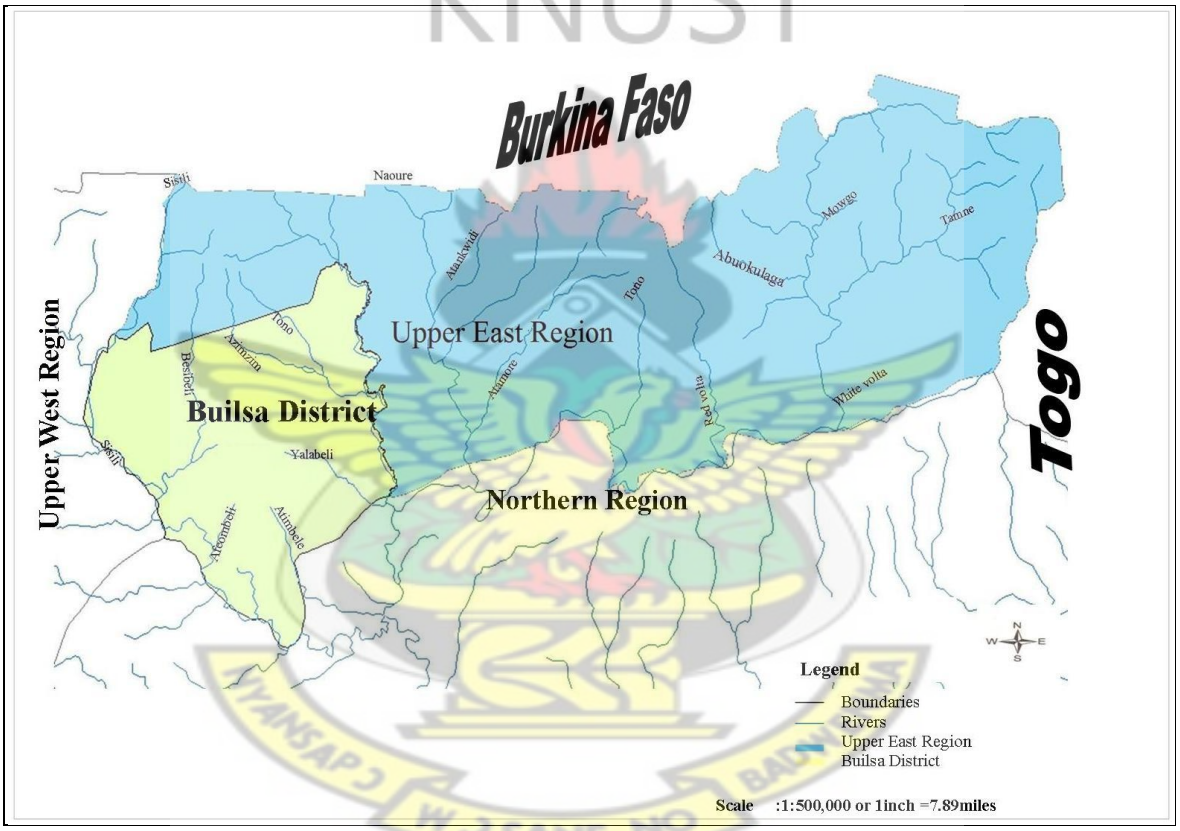
3.8 The Profile of the Study District

This part of the study covers the current situation of the Upper East Region with emphasis on the Builsa district. It basically looks at the socio/cultural, economic/livelihood and governance issues in the face of the daunting challenges the flood disaster presents to the entire region and in particular the Builsa district.

3.8.1 Location and Size

In the year 1983, the Upper East Region was carved out of the Upper Region and maintained Bolgatanga as the capital. The region covers a total land area of 8.842sq km which forms about 3% of the total land area of Ghana. Only 15.7 per cent of the population in the region live in urban areas (GSS, 2005) with Builsa and Bongo districts being entirely rural. Major ethnic groups in the region are Grune, Kusasi, Kasem, Nankani, Mamprusi, Builsa, Moshi and Bisa. Below is the administrative map of the region.

Fig 3.1 Map of the Upper East Region showing main rivers



Sources: Adopted from Survey of Ghana (1994)

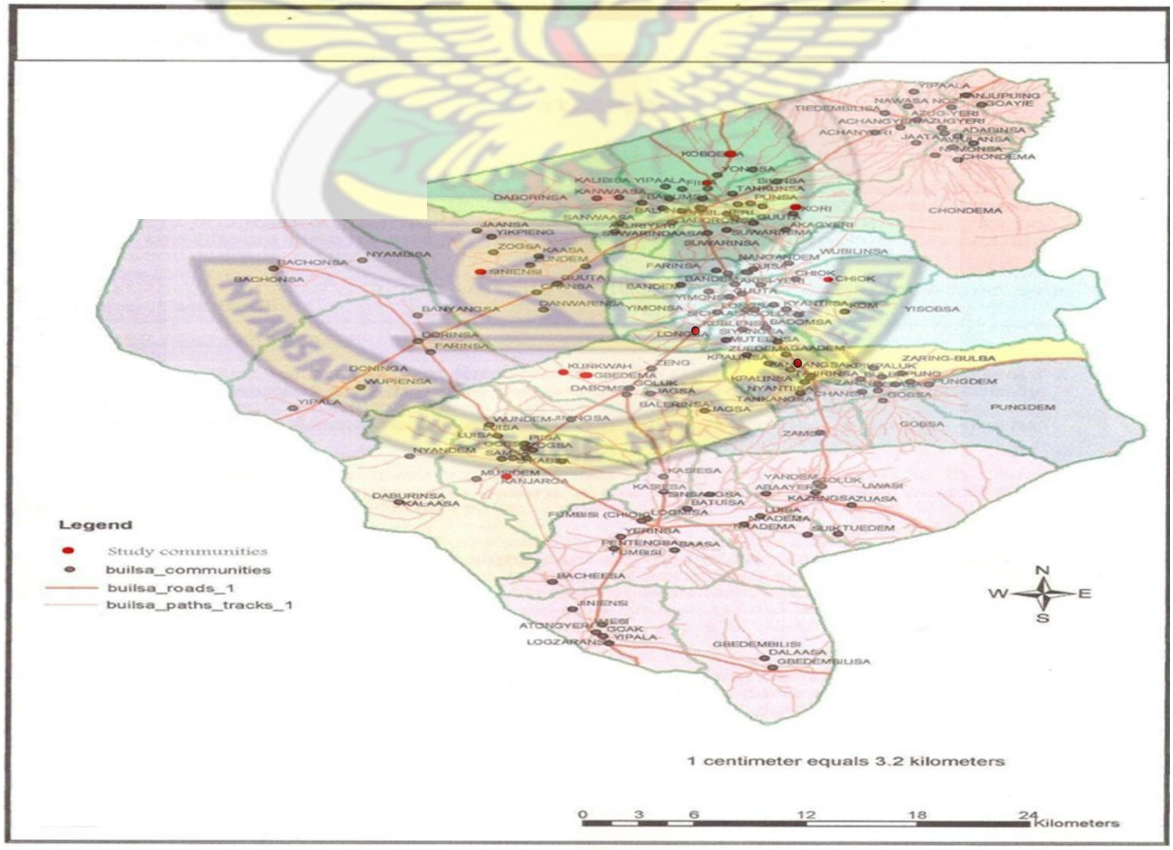
Politically, the Upper East Region is administered from Bolgatanga the regional capital. The nine decentralised municipal/District Assemblies are Bolgatanga and Bawku municipalities, Bongo, Kassena-Nankani East, Kassena/Nankana West, Bawku West, Builsa, Garu-Tempane, and Talensi-Nabdam district assemblies. Though with varying degrees all nine districts suffer flood effects.

The region shares borders with two West Africa neighbours, Burkina Faso to the north and Togo to the East. Locally it shares boundaries with Northern Region to the south and Upper West Region to the west.

Builsa has Sandema as its administrative capital. It lies between longitudes 1^0 05'West and 1^0 35' West and latitudes 10^0 20' North and 10^0 50' North (MTDP 2010-2013). The District covers an area of 2,220 km^2 and constitutes 25.1% of the total land area of the Upper East Region. The district is bordered to the North and East by the Kassena-Nankana West and Kassena-Nankana East respectively, to the Western part by the Sissala East in the Upper West region, and to the South by West Mamprusi district in the Northern Region.

The Builsa District has 155 communities bunched into eight area councils with no urban settlement (where urban settlement is community with 5000 or more inhabitants) as indicated on figure 3.2 below. Thus the District is wholly rural. The red spotted settlements on the map on figure 3.2 represent the ten selected study communities.

Fig 3.2 District Map of Builsa



Source: Adopted from DMTDP, 2011

3.8.2 Relief and Vegetation

The topography of the area is undulating and slopes ranging from 200 metres to 300 metres are found in the western and northern part of the District particularly around Bachonsa and Chuchuliga zones. In the valleys of Sissili, Kulpawn, Besibeli, Tono, Asibelika and the Azimzim, the slopes are gentler and range from 150 to 200 metres. Inselbergs and other granitic outcrops occasionally break the monotony of the near flat surfaces.

Generally the low-lying nature of the land makes greater part of it liable to flooding in years of copious rains. The vegetation of the Builsa District is characterised by savannah woodland and consist mostly of deciduous, widely spaced fire and drought resistant trees of varying sizes and density. These trees satisfy domestic requirements for fuel wood and timber for local housing construction, cattle kraals, vegetable garden fences and materials for handicraft.

Through the activities of man, the woodland savannah has been reduced to open parkland where only trees of economic value like baobab, acacia, shea-nut, mango and the dawadawa have been retained through time. The adverse effect of harmful environmental management practices; indiscriminate mining at Fumbisi and Kadema are causing soil erosion as annual bush fires decimate the grasses and shrubs destroying pastures for livestock. Recent fires have ravaged several acres of rice farms in the Fumbisi valleys and rendered several farmers' effort waste. These human activities on the environment couple with heavy rains exacerbate the flood hazard into a disaster threatening livelihoods and local infrastructure development.

3.8.3 Rainfall and Drainage

Like most parts of northern Ghana, Builsa have a uni-modal rainy season which builds up gradually from little rains in April to a maximum in August-September with irregular dry spells occurring in June or July. The rains decline sharply in September drawing to a complete halt in mid-October setting the dry season in. It has a mean temperature ranging between 21.9^0 C and 34.1^0 C, whereas the highest temperatures are recorded in March and could rise up to 45^0 C, the lowest temperatures are recorded in January during the dry harmattan. The district is dissected by a number of tributaries of the Red and White Volta, with rainfall ranging between 85mm and 1,150mm annually, there is increased drainage density and risk of flooding.

3.8.4 Geology and Soil

Generally, a greater part of the soil cover of the District is poorly drained. The dominant soil groups in the District are of granite origin and they cover over 70% or approximately 153,300ha of the district's land area. Majority of the soils can be used for agriculture however non-agricultural soils cover more than 2.0% of the District land.

The presence of iron pan boulders at shallow depths, rock outcrops and environmental degradation overtime has led to serious reduction in soil depth and arable land surface edging farmers to shift towards the fertile soils on low lying areas where ever possible. Due to degradation the soils require the regular application of mineral fertilizers and maintenance of high organic matter levels to sustain crop production in the District. The seasonal flooding in the district makes the alluvial soils of the south very suitable for rice production especially along the Fumbisi valleys due to deposition.

3.8.5 Demographic Characteristics (Size and Density)

The demographic characteristics of Builsa District have common features with other rural Districts in Ghana in terms of age and sex composition, and density. The District had a population of 66,357 in 1984 which increased to 75,375 in the year 2000 showing an average annual growth rate of about 0.82% over the 16-year intercensal period. The projected figures for 2005, 2006 and 2007 using the 2000 statistics were 79,144, 80,035 and 80,840 respectively with an average annual population growth rate of 0.8%. About 51.8% of the population are female and 48.2% are male (GSS, 2005). The projected population for the year 2010, for the District is 83,261(MTDP, 2010-2013). Of this figure, the female population is 42,394 and that of the male is 40,867.This gives a sex ratio, defined as the ratio of males to females, as 1:1.04 compared with the national figure of 1: 1.03 which is well within the experience of most African countries (GSS, 2005).

The population density based on the land surface of 2,220 sq km gives a figure of about 38 persons per square kilometre in 2010 against 34 persons per sq km in 2000. The 38 people/sq km compared with the population density of the Upper East Region of 104 persons per sq km in the year 2000, is relatively higher for the district.

3.8.5.1 Age structure of the population

The age structure of the population of the Builsa District, like that of the Region and the nation designates a broad base that gradually tapers off with increased age typical of the

age structure in developing economies. Examined in broad and sometimes overlapping cohorts, the size of each cohort has implications for; demand for social services, future population growth rate, employment generation, the overall dependency burden, as well as the total working force. Refer to appendix V for the projected population and age structure of the district as contained in the District Medium Term Development plan for 2010-2013.

The dependency ratio which is the sum of the population age below 15 years and 65 and above expressed as a percentage in the District is estimated at 51.5: 48.5 or 1:0.94. The implication is that every economically active person in the District takes care of him/her self and the needs of one other person on the average. The potentially large and youthful workforce especially in the age group 15-39 years of about 35% if properly managed can become a greater economic asset. However, considering the fact that several people in the productive age group may be unemployed or underemployed, the real economic dependency ratio of the district could be higher.

It is indicative from the above analysis that efforts must be doubled towards youth development. The analyses so far indicate that the District's population is growing at a rate of about 1% a year per the intercensal statistics (GSS, 2005, MTDP 2010-2013).

3.8.6 Social Characteristics

3.8.6.1 Households by Size in the Builsa district

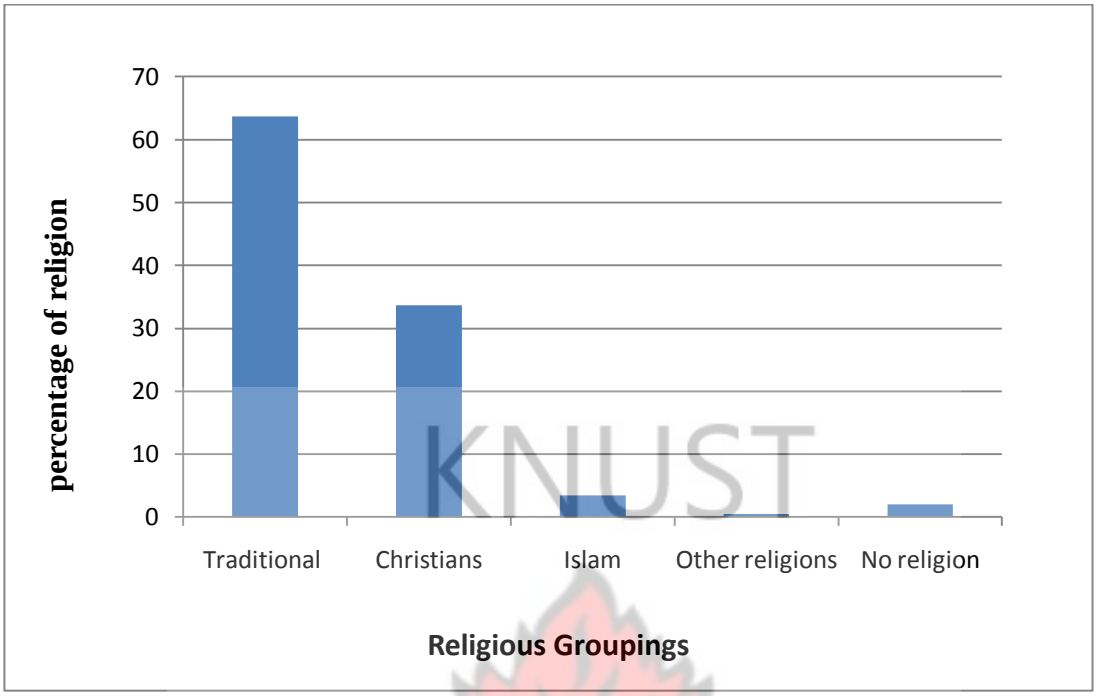
According to the Ghana Statistical Service (2005) a total of 15,537 households lives in 6,423 houses or compounds with an average household size of 4.9 persons in the Builsa district. The current average household size is estimated to be 5.2 persons which compares favourably with the national figure of 5.1 persons for Rural Savannah (GSS, 2005).

3.8.6.2 Ethnicity and religion

Builsa district is multi-ethnic and heterogeneous in terms of religion. By the ethnic chemistry, the Builsas constitute about 83% of the entire population with the remaining 17% comprising of minority groups such as the Kantosi, Mamprusi, Sissala, Nankani and Mossi.

The dominant religion in the district is the African Traditional Religion (ATR) constituting 63.7% of the population. The Christians and Moslems constitute 33.7%, and 3.4% respectively. Those who do not belong to any religious group constitute 2.5% of the total population as shown in figure 4.3 below.

Fig 3.3 Religious composition of the Builsa District



Source: Ghana Statistical Service, 2005

The over 60 per cent of the population practising African Traditional Religion explain why some cultural practices perceived to be hindering development such as child fosterage, forced marriages and other harmful traditional practices like Female Genital Mutilation (FGM) are still being upheld.

3.8.6.3 Culture and Festival

The main festival of the people which is usually celebrated in the third week of December is the Feok. It is an annual festival celebrated to commemorate the defeat of Babatu and his notorious slave raiders by the ancestors of Builsa in the nineteenth century. In view of its historic importance a number of tourists often participate in the celebration of the festival.

3.8.6.4 Education

The quality of education as indicated by pupils' performance at the BECE and SSS examinations is alarmingly low, further impinging on enrolment and retention in schools. In the academic year 2009/10 the total primary school enrolment was 5,229, comprising 2,511 boys and 2,718 girls. The completion rates remain quite low at about 74% for boys and 67% for girls at primary school and 80% for boys and 65% for girls at Junior Secondary School.

3.8.6.5 Provision of Health and Health Facilities

Similar to the national and developing countries situation malaria remains the number one cause of OPD attendance in the district for the past three years. There is a strong link between access to sanitary facilities and the incidence of malaria in the district. According to Ghana Statistical Service 2005, only 10.3% of the population have access to safe sanitation facilities giving rise to indiscriminate defecation, refuse disposal with their health implications. These two conditions have resulted in malaria being on the top of the list of causes of OPD attendance in the district). Artery respiratory infection and Pneumonia are ranked second and third respectively on the top ten causes of OPD attendance (DHMT report 2010 cited in MTDP, 2010-2013).

The ratio of doctor/population as 2007 was 1:40,420 resulting in the two doctors being overstretched. The nurse/population ratio of 1:3,981 in 2005 was favourable but is beginning to increase as population is growing.

On health infrastructure, there are six sub-districts health centres and nine Community Health and Promotion system (CHPS) compounds currently. The district also established two supplementary feeding centres in 2006 as there was none in the previous year. An additional clinic was provided in 2007 to augment what was in existence in 2005 and 2006.

3.8.7 Economic Characteristics (Production)

The economically active population i.e. 15-64 age cohorts is about 51.4% however, a greater proportion of them are engaged in peasant farming. Since low production is associated with peasant farming output levels have not kept pace with the district's food demand. The subsistence agricultural practice which is often labour intensive using rudimentary tools makes the people unproductive by the age 50 years.

In recent the major food crops like maize, rice, and millet record negative balances due to a combination of drought and flood disasters. Besides the production of major food crops, some farmers are into cattle, goats, sheep and pigs rearing. The poultry types include local fowls, guinea fowls, turkey, ducks, pigeons and ostriches.

Poverty in the District is high. Factors acting against poverty reduction include high levels of economic instability, particularly the high risk of flooding leading to limited growth in agriculture and agro-processing, low, regressive and unsustainable social spending, and

serious gaps in the planning and management of poverty reduction programmes in the district (MTDP, 2011).

3.8.8 The Disaster Situation in the District

Flood disaster in the district remains a threat to development as it wipes livelihoods and thwarts development efforts of local leaders. The situation currently though it is reducing with number of lives lost annually, the challenge on livelihood is even worsening. The tables on appendix VI (a), VII (a) and VII (b) demonstrate this.

The effect of flood is not only on humans and built environs. The 2007 floods resulted in the pollution of 145 boreholes and 238 hand dug wells and also, 15 school buildings had the roofs ripped off and parts of the walls damaged (NADMO, 2007). Refer to appendix VI (a). In 2009, floods caused massive destruction to both private and public buildings, crops and livestock, dams, roads, bridges and culverts. See appendix VI (b) for transport infrastructure damage in the Builsa district (NADMO, 2010). Though the flood disaster effect is witnessing a total fall in number of affected persons today, the flood impact on farmers is even greater. For instance, 6000 acres of cultivated land of various crops including rice, corn, guinea corn, millet, beans, among others in 2007 were destroyed. A total of 200 pigs, 1,200 goats, 900 sheep and 5000 birds (guinea and fowls) were lost during the floods.

According to MoFA evaluation in 2009, 8000 hectares of rice, maize, guinea corn and millet were submerged in water, with close to a thousand domestic birds swept away. In 2010, 5000 acres of farm lands were wholly inundated destroying the crops. Refer to appendix VI (a) and VII (b) for data.

Despite the statistics provided by NADMO (2010), questions still remain as to the coverage of their assessment. There are many communities that have not been included in the data available though they are affected by the annual floods. The District Assembly and NADMO admit there are challenges regarding collection of such data due to the widespread nature of the phenomenon.

3.9 Summary

The study collected secondary and primary data for purposes of the work. The basic investigative tools were interviews using questionnaire and interview guide. Primary data were analysed with the aid of Statistical Package for Social Scientist (SPSS). The outcomes were discussed and presented in tables, graphs, charts and pictures. Purposive, random and accidental sampling techniques were employed to choose the study district, communities, and household respondents and strategic public institutions that are in one way or the other associated with the prevention, controlling development and management of disasters for the study.

The situational analysis of the study district covered the physical, demographic, economic and social characteristics as well as the disaster situation in the district. It gives a thoughtful sense of the place in terms of location, resource endowment, opportunities, and threats of flood disaster and other related risks.

CHAPTER FOUR

ANALYSIS AND PRESENTATION

4.1 Introduction

The Upper East may rightly be considered one place that is exposed to multiple forms of natural and manmade disasters- a true epitome of the word "disaster". The geological assessment unfolds a number of vulnerabilities key among them is the flood disaster. The conventional relief and response oriented model which can best be described as casual and incoherent, largely focusing on a reactive strategy of relief and response have been the approach over the years. This chapter looks at the analysis of data gathered from the affected communities, and key actors or institutions charged with the responsibility directly or otherwise to manage risks and disasters.

4.2 Physical Environment of Builsa District

The Builsa district generally has a low relief with elevations between 150-250m above sea level. The Red and White Volta course and other river tributaries that meander their way through several settlements expose the inhabitants and their environs to the danger of floods. The 10 sampled study communities covered in the survey have various rivers and their tributaries running through them accounting for the high susceptibility rate to flooding. The district is sparsely populated with scattered settlement and little penetration of planned settlement making the delivery of development projects quite challenging. Sandema, the district capital experiences serious sanitation and drainage problems.

4.3 Disasters and Related Management Issues in the Upper East Region

There is no pattern on the frequency of flooding in the region. What is however known is that, the floods are the most frequent and widespread disaster and they are directly linked to the rains. About 88% of the indigenous household respondents have experienced flooding in one way or the other before in the past two seasons. Other common disasters include prolonged drought, rampant bush fires, epidemics, and conflicts. The 4.1 below shows the frequency and percentages of persons affected or otherwise by flooding and the length of stay in the community.

Table 4.1 Flood experience and frequency

Flood Experience			Flood frequency			
Response	No.	(%)	Once		Twice	
			No	%	No	%
Suffered flooding	129	88	144	98	2	2
Not suffer flooding	17	12	-	-	-	-
Total	146	100	144	98	2	2

Source: Field survey, April 2011

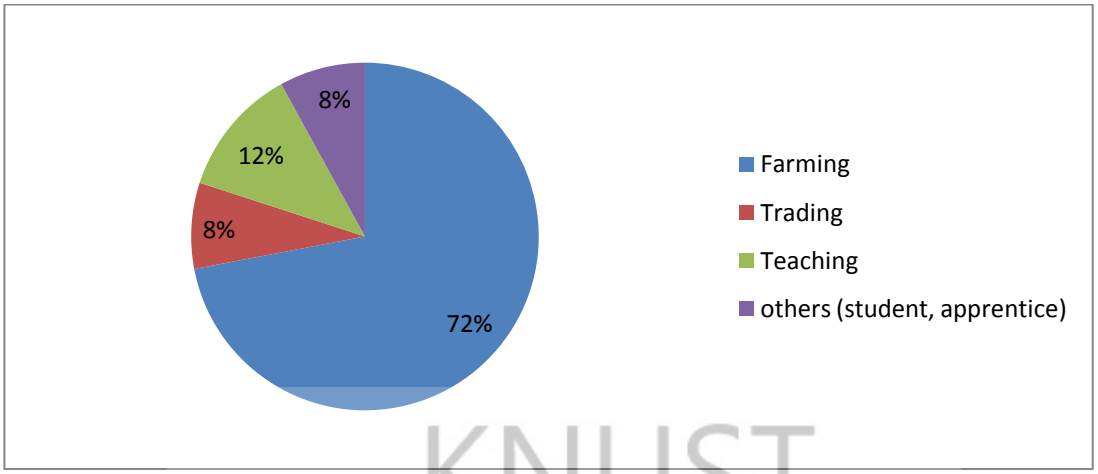
The study established that there was a difference between the experience of flooding and the frequency of its occurrence among the inhabitants. From table 4.1 out of the 88% of the household respondents that experienced flooding, 98% of them said the flood occurs once every year.

On the other hand, while 12% of the respondents have not had flood waters affecting them directly, 2% of the victims declared that floods occurred twice annually. The second flood is normally as a result of the spillage of the Bagre dam in Burkina. Because this second occurrence is minimal, majority of the people agree that the floods happen once in every season. However the 17 households that had not experienced any flooding were either traders or formal employees who do not rely so much on the rains for their livelihood.

4.3.1 Occupation of the Respondents

Like other districts in Ghana, agriculture is the mainstay of the people. Out of the number of households interviewed 72% of the respondents practise subsistence agriculture. Their activities also depended on the rains as there is no irrigation facility in the district. Figure 4.1 below illustrates the occupational structure of the household respondents in a pie chart.

Fig 4.1 Occupational status of sample population



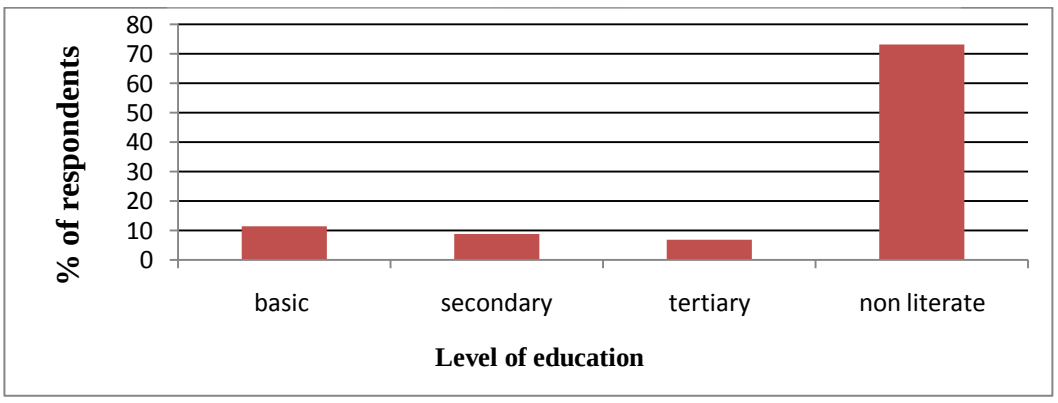
Source: Field survey, April 2011

The climate change situation in the region affects agricultural production and hence, any environmental changes such as heavy down pours that destroy crops threaten the livelihood of majority of the people who are peasant farmers. There is greater risk with the people losing their source of living as the torrential rains are preceded by long spells of drought. Since there little diversity in livelihood with about 12% of the respondents doing formal jobs such as teaching, and less than 9% being students or doing petty trading, when there is crop failure the capacity to sustain one another is critically limited.

4.3.2 Educational level of respondents

Education is a necessary tool for understanding and appreciating issues and adopting change methods to reduce the impact of disasters. Figure 4.2 below presents graphical impression of educational attainment of the sample.

Fig.4.2 The educational Status of Respondents



Source: Field survey, April 2011

The apparent indiscipline displayed by the populace in physical development in the district can be explained by the high level of ignorance. The number of people who have no formal education from the sample (illiteracy rate) on figure 4.2 above is 73%. It is a major contributing factor to bad environmental practices and inability to comprehend the relationship between degradation and climate variability. The people are not able to take any concrete structural steps (indigenous) to mitigate flood disaster impact on lives and property.

4.3.3 Perception of possible causes of floods

Majority of the respondents agree with the public perception among Ghanaians that the occasional spillage of the Bagre Dam as often emphasised by the media is the major cause of flooding. See the table 4.2 below.

Table 4.2 Peoples' perception of possible causes of flood disaster

Agent	**Respondents**					
	Male		**Female**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Bagre dam spillage	60	71	37	61	97	66
Torrential rains	12	14	24	39	36	25
Environmental degradation	13	15	-	-	13	9
Total	85	100	61	100	146	100

Source: Field survey April, 2011

The statistics on the respondents' perception on the causes of flood disaster in table 4.2 above shows the differences in opinion by sex. While the female respondents identify the Bagre Dam and torrential rains as the factors that trigger the flood, with 61% and 39% respectively, the male respondents alludes all three causal factors-the dam spillage (71%), heavy rains (14%) and environmental degradation (15%) respectively. Collectively the respondents, 34% of the sample studied alludes to climate variability issues triggering the floods, 66% put the blame squarely on the Burkinabe authorities.

Contrary to this view, the study established among the key disaster management agencies particularly WRC, HSD, MoFA, and NADMO that various human actions and inactions have been the fundamental cause of the perennial flooding. Human behaviour in the use of the physical environment has over the years altered the environment so much such that the

rainfall pattern has changed rendering the natural drainage system incapable of carrying excess surface run off in times of copious rain.

Notable issues identified from the key disaster management agencies are encroachment on water banks, farming on river beds, felling of trees, burning of bush, construction of feeder roads, illegal mining, dumping of waste and building on water courses. These human activities result in siltation of rivers, drainage systems which trigger the floods.

Since the middle of the 1990s, while the intensity of rainfall (mm) has been rising the number of wet days has been reducing. The rainfall pattern for three seasons is shown on table 4.3.

Table.4.3 The rainfall pattern from 2007 to 2009 cropping season

Year	Unit	Feb	Mar	April	May	June	July	Aug	Sept	Totals
2007	Rain (mm)	0	1.6	93.6	107.9	95.5	252.6	469.3	177.8	1198.3
	Days	0	1	7	5	4	11	18	13	59
2008	Rain (mm)	0	20.3	51.6	85.4	107.4	227.2	239.2	147.9	879
	Days	0	2	3	5	9	13	17	14	63
2009	Rain (mm)	17.7	8.2	35.0	57.0	154.0	140.7	267.2	212.1	891.9
	Days	1	1	3	3	8	9	15	11	51

Source: MoFA/MSD Flood reports (2007-2009)

For instance there was 647.1mm of rain in 31days between August and September 2007, 441.1mm of rain in 31 days in the months of August and September in 2008, and 479.3mm of rain in 26 days in the months of August and September 2009. The concentration of heavy down pours within the months of August and September could inundate any low lying plain and flood farms and nearby homes. Indeed according to the Water Resources Commission and NADMO account of the flood, before the Bagre dam is spilled each year, the Upper East is already inundated by heavy rains. From a purely technical point of view the dam spillage is not the major cause of the floods in the area rather, unfriendly environmental activities leading to climate variability is to be blamed.

Evidence abounds to support the minority but technical view that environmental concerns such as human activities directly fuel the problem. Plates 1, 2, 3 and 4 show some human activities in space that accelerate the flood occurrence and associated disasters.

Plate 1 Farming along river banks

Plate 2 Farming on the river course

Source: Field survey April 2011

Though there are two major irrigation facilities in the region (Tono and Via), water for off season agriculture is often lacking. The situation and fertile low land soils in the valleys compel farmers and dry season gardeners to move to low lying plains to establish their farms or gardens (plates1and 2). The practice leads to loosening of the soil structure on the banks and river beds, increasing siltation of the river bed resulting in the overflow of the river banks which cause damage to both farm and non-farm properties.

Plate 3 The Encroachment of River/Drainage Courses

Sources: Field Survey April, 2011

The unplanned nature of the Builsa district coupled with inadequate drainage infrastructure is increasing the vulnerability to flood hazard. The development of swampy areas (farms), building on water courses and dumping waste into nearby streams with impunity as shown in plates (3) above and (4) below affect the flow of runoffs. The effect of the poor drainage systems unable to carry the excess water from the heavy rains is the flood disaster that is experienced annually.

Plate 4 Building and dumping of waste into streams

Source: Preliminary Field Survey February 2011

Due to inaction by the appropriate bodies; Town and Country Planning Department (TCPD), and the Waste Management Unit within the district assembly in charge of domestic waste, individual locational decisions and actions increase the flood disaster risk. The non-enforcement of land use plans and inadequate sanitary/waste management facilities (disposal containers) are noticeable challenges confronting the district. These issues propel the flood occurrence due to poor drainage designed/system.

4.3.4 The Effects of Flood on Household Livelihood

Though flooding may have some positives in terms of agricultural production, in disaster assessment, the negative impact is of priority to development actors. Floods affect every aspect of the lives of the people. As a predominantly agrarian district, the flood disaster causes a lot of damage to crops and animals alike. Often, crops are submerged or washed off and animals drowned.

In other cases, animals like sheep, goats, and cattle go days without food and often suffer foot and mouth diseases and die as a result. Birds are especially drowned as the coops get flooded. The Table 4.4 below shows the people's assessment of the effect of the flood on their livelihoods.

Table 4.4 Impact of flood on household livelihood

Effect of flood	Frequency	Percent (%)
Loss of farm crops	10	6.8
Loss of animals	7	4.8
Trade/businesses	2	1.4
all the above	127	87
Total	146	100

Source: Field survey, 2011

From the table 4.4 above, 87% of the households consented that floods destroy their livelihoods (farms, animals, and small scale businesses) and increase their vulnerability through impoverishment. It confirms the literature from IFRC, (2007) on the subject that flood disaster posses' serious challenges to livelihood security among the victims. On the average, 5000ha of farms are inundated and or destroyed in the district annually as production levels barely kept pace with demand MoFA, (2007-2009). Plate 4 below shows maize and rice farms flooded with water in the district.

Plate 5 Flooded farms in the Builsa district of the Upper East region

Source: MoFA, 2010

The flood water inundates farms especially along the valley areas causing massive crop failure and/poor yields if any (Plate 5 above). Crops like maize, groundnut, vegetables, yam and millet, beans suffer poor yield due to too much water and threatens food security of all households in the district as well as the region.

4.4 The Impact of Flood on Infrastructure

Flood loss in the district is not limited to human lives, crops, and animals, but also public and private infrastructure. Several places are cut off and made inaccessible during floods. Ninety-two percent (92%) of the households interviewed maintained that flood disasters lead to massive destruction of housing and transport infrastructure in the district. See the pictures below.

Plate 6 Collapsed buildings in Kanjarga central in the Builsa district

Source: NADMO Archives, 2009

The poor quality of materials used and the structural problems coupled with heavy rains lead to the total collapse of several buildings across the district. Plates 6 above and 7 below are clear cases of private infrastructure damage in flood affected areas. Poverty in technology, locational decisions and finance make it difficult for individuals to acquire improved building materials for the construction of flood resistant structures.

Plate 7 Collapsed houses in Seniensi and Nyaansa in the Builsa districts

Source: NADMO, UE/R. 2010

Beside households' infrastructure, a lot of damage is done to public infrastructures which are the assets of the poor and vulnerable in most communities. The appendix VI (b) contains statistics on the annual flood destruction of culverts and transport facilities in the district. The road transport infrastructure(s) in the Upper East except the high ways are mostly feeder roads that get washed off by floods making them unmotorable in most parts of the rainy season. Plate 8 below is evidence on the ground.

Plate 8 Roads and Culverts washed off in Doninga & Kanjarga-Gbedema

Source: NADMO Archives, 2007 NADMO, 2009

The Doninga road (plate 8 above) was completely washed off limiting vehicular movement on the road, affecting about 1,703 users while the road that link Sandema to Gbedema was also almost cut off by the flood waters in 2009 (NADMO, 2010). About 9,169 people were cut off from the district capital as a result of the culvert damage. The people who are mostly farmers had to rely on head potters to cart farm produce across to access the market. Some of the effects of the destruction of transport infrastructure are common and render essential service providers such as health and Aid workers ineffective leading to loss of lives and prolonged suffering when ever disasters occur.

4.5 Households' Capacity to Respond to Flood Disaster

Flood disaster response in the community though similar, varies among the individual households and actors depending on the level of knowledge and ability to act appropriately. Usually, the few valuables such as clothing, beds, electronic appliances if any and food stuff are removed immediately the water levels are rising or warnings are issued. Refer to Table 4.5 below.

Table 4.5 Peoples level of awareness of disaster management activities

Response	Frequency	Percent (%)
Aware	37	25
Not aware	109	75
Total	146	100

Source: Field survey, April 2011

The high levels of ignorance of the sample on the activities of NADMO illuminate the fact that NADMO is not on top of the issues. In table 4.5 above just about a quarter (25%) of the respondents knew about some activity by NADMO in the management of floods (formation of disaster management teams and public education). Public education on disasters and risk management actions is not being taken seriously. As a result the problem persists and mass suffering often placed at the doors of NADMO. However one needs to understand the difficulties such as inadequate budgetary allocation and the delay in the release of the funds to the organisation. These challenges coupled with technological and human resource capabilities adversely affect NADMO's ability to deliver on its mandate especially on awareness creation or preventive measures.

4.6 Household Response to Floods

In the area of flood prevention, 7.3% of respondents embark on structural measures like channel development within the built environment to carry flood water away. Again six per cent of the sampled population had moved their farms 30 metres away from the river banks under the IWRM project being implemented by WRC in collaboration with CARE international and NADMO which aims at the development of buffers.

The farmers are being supported with water pumps to lift water from the rivers to distant places during dry season for gardening. This is one good way of getting farmers to shift activities away from river banks to reduce siltation.

The rest (the 86.7%) of the households in the communities believe they have no control or direct role in flood disaster prevention. Close to same percentage (84%) of respondents disapprove of NADMOs response strategy to flood victims in the district. See table 4.6 below.

Table 4.6 Level of satisfaction of NADMO response to flood disaster

Response	Frequency	Percent (%)
Satisfied	23	16
Not satisfied	123	84
Total	146	100

Source: Field survey, April 2011

The public dissatisfaction of the current response strategy of NADMO borders on fairness, and the delay in acting. About 85% of the respondents believe human biases have eaten into the very fibre of the organisation while just a minute 2% think that resource constraint is giving NADMO a bad name in the eye of the public. Interestingly the minority view was upheld by all key stakeholders such as WRC, HSD, NADMO, DA, and MoFA as the main reason for the organisation's poor delivery of disaster relief services to the public.

4.7 Relief Services

The only time relief support services were near adequacy throughout the district and the region was during the 2007 floods which assumed a national crisis and attracted international support. The 2007 flood disaster impact led to the establishment of the

Northern Ghana Floods Disaster Management Fund to help restore lives of the victims to normal.

Although 88% of the respondents have experienced flooding before, few acknowledged ever receiving official support. Out of the 146 households interviewed, 32% confirm ever receiving disaster aid as shown on Table 4.7 below.

Table 4.7 Number of households that ever receive official aid

Response	Frequency	Percent (%)
Received Support	46	32
No Support	100	68
Total	146	100

Source: Field survey, April 2011

Ironically the same number of respondents however complained about the quantity and relevance of the aid items to the victims. This fact reemphasises the claim that NADMO is incapacitated by resource inadequacy in managing disaster situations effectively. In many instances, the items given to victims are not only insufficient but also not the felt needs of the disaster victim at the particular time. Items such as plastics and beddings are always on supply to victims. See plate 8 below

Plate 9 Typical relief items delivery to flood victims

Source: NADMO UER, 2010

While majority of the farmers who lose their crops, homes, stock, and animals do not receive any aid, items often delivered are non food such as shown on plate 9 above. NADMO has not been able to define a standard for the supply of relief items. Normally, what is available is served regardless of what one has lost in the process. Since the impact

varies from one household to another, the absence of a standard procedure for distributing aid leaves some victims worse off in the process.

4.8 Sustainable Management Strategy of Flood Disaster

The views expressed on what can form the best management strategy to deal with the flood hazard were diverse and capacity specific. About 78% of the respondents believed the solution must come from outside the community and take the constructional approach. The building of dams and other water detention points as well as the construction of storm drains is a common opinion (66%) expressed by the respondents. See the table 4.8.

Table 4.8 Perception of Sustainable Management of Floods

Strategy	Frequency	Percent (%)
Build dams to collect water	71	49
Reduce degradation	32	22
Construct big drainage systems	25	17
Others(empower NADMO, mobilize relief items)	18	12
Total	**146**	**100**

Source: Field survey, April 2010

However, the institutions responsible for public safety in agreeing with the populace place premium on fighting degradation and as such adopting an integrated approach should be the way forward. They concluded that relying solely on constructional measures would be limiting and that desert conditions setting in will increase vulnerability and wipe out livelihoods if unchecked.

A change in the human behaviour in respect of the use of physical resources will be a wonderful measure. Issues like recreation of buffer zones, effective enforcement of anti bushfire laws, and mass tree planting would significantly change the situation in the medium to long term.

As the lead organisation, NADMO is advocating for more collaboration especially with District Assemblies to mainstream disaster response plans and programmes into the medium term plans. It will help raise the awareness and cause action to fight the hazard.

The political leadership and the planning units (RPCU and DPCU) advocated for diversification of the local economy that will reduce the over dependence on climate sensitive livelihoods. Livelihoods programmes such as animal rearing, bee keeping, stone quarry, and mining are potential areas that require investment to offer alternative livelihood to inhabitants.

4.9 Flood and Poverty in the Upper East Region

The link between poverty and disaster vulnerability make disaster management an important part of development planning especially in poverty stricken economies and regions like the Upper East. There is universal consent that; there is direct relationship between the frequent flood disaster and the levels of poverty in the region.

The economy of Ghana and for that matter the Upper East region thrives on climate sensitive sectors like agriculture. The people are extremely vulnerable to acute climate events such as drought and flood because issues of livelihoods are paramount. Floods wash away farms/crops, animals, pollute water bodies and subsequently increase diseases, hunger and starvation. Droughts also result in poor yields, no water for animals and dry season gardening to supplement family income for the lean season. The floods may therefore increase the levels of poverty.

4.10 Mainstreaming Disaster Management into Local development Plans

The National Development Planning (System) Act, 1994, (Act 480), the Local Government Act, 1994 (Act 462) and the Civil Service Law, 1993, PNDC Law 327, prescribed the planning functions for the Regional/District Planning and Coordinating Units. Besides preparing detailed work plans covering activities to be carried out, the District Assemblies and planning units also assist in the development of community development plans and bye laws.

According to the Ghana Shared Growth and Development Agenda (2010-2013), cross-cutting issues such as gender, environment, HIV and AIDS, vulnerability and exclusion are critical with respect to development. These issues can contribute to accelerating or derailing the progress of development.

On the environment, the Medium Term Development Framework concluded that "the development activities of the District may tend to aim mainly at achieving the District objectives (e.g. increasing crop production), while neglecting the nature, stability and resilience of the environment (socio-cultural, economic and natural resources), upon which the long term sustainability of the District's activities depend. Districts are to indicate the mitigation measures to embark on to address the effect of their programmes on the environment using the Strategic Environmental Assessment tool, climate change strategies as well as ensuring sustainable production and consumption" GSGDA (2010-2013). However NADMO and the District Assemblies do not have the requisite capacity to act in accordance with this framework.

As leaders in the development of the local economy, the RCC, and NADMO have no strategy locally to ensure that the assemblies incorporates disaster and emergency preparedness plans into the Medium Term Plans. For instance the Medium Term Development Plan 2010-2013 identified flood as a threat to sustainable development yet no specific activity or concrete strategy is designed to tackle the phenomena.

The National Disaster Management Organisation which is always under resourced in terms of personnel, funding, and logistics is unable to lead the crusade. The organisation relies heavily on donor agencies and the central government for support without local commitment. The implication is that NADMO when global economic meltdown such the economic recession the world is witnessing since 2007 affect donor commitments and in the unlikely event of disaster, ad hoc and non sustainable measures will be taken.

The Regional Coordinating Council headed by the political appointee of government of who chairs the committee uses the regional disaster management committee meetings as a platform to engage various agencies particularly District Assemblies to consider disaster management issues as urgent and provide for their implementation in the MTDPs according to the NDPC guidelines.

4.11 Public Participation in Disaster Management

The determinants of resilience and vulnerability lie in the consolidation of social networks. Therefore the acceptance of any adaptation measure will often have to be at multiple levels and locality specific. It must take into account the technological, institutional and management options available to individuals and communities. It calls for collective action where resource stakeholders work together with government agencies to reduce the effects of disasters on population.

The continuous and deteriorating mass suffering and despair is evidence that public participation in disaster management is limited. About 98% of the respondents do not remember the last time NADMO organised any programme for the communities. The only time people are called to sensitisation foras/durbars is during the crisis or distribution of relief items. This practice serves NADMO better because it attracts funding during crisis. Considering the scale of disaster impact, non-involvement of the populace will continuously hinder the adoption of suitable measures to deal with problem. Non-participation by the public limits their coping capacity and makes it extremely difficult for the flood victim to cope without external support.

4.12 Stakeholder Response to Flood Disaster Management

The institutions covered in the study have stakes in the annual flood ordeal that the people suffer from. They are either blamed for their action or inaction directly or indirectly or linked to the prevention and management of flood disaster there off.

4.12.1 National Disaster Management Organisation (NADMO)

NADMO is responsible for the prevention and management of all disasters in the region at both the regional and district level. Floods are the most widespread disaster in the region, caused basically by environmental degradation and torrential rains. Prior to the rains they try to embark on radio talk programmes and organising public durbars in the flood prone communities to help prepare the people for any eventuality.

In times of flood crisis, NADMO undertakes rescue missions together with other stakeholders to save lives, assess the impact and organise aid for victims. The organisation constituted and inaugurated a forty-member District Emergency Preparedness Team

(DEPT) in 2009 in charge of strategising on the persistent flood hazard in the district. The DEPT includes staff from Ghana Health Service (GHS), Ministry of Food and Agriculture (MoFA), Ghana Fire Service (GFS), Ghana Police Service (GPS), District Assemblies (DAs), and Non-Governmental Organisations (NGOs). NADMO also facilitated the formation of an eighty-member community/Area Council Emergency Preparedness Teams (CEPT) involving 10 members each from an Area Council.

With the support of CARE International, NADMO instituted and inaugurated 30 Disaster Volunteer Groups (DVGs) for flood and bush fires response teams in 45 communities in Builsa district in 2010. However, the functionality of these teams could not be established.

NADMO and DA liaised with the district health directorate after flood disasters to undertake redevelopment and disinfection of 145 boreholes in 2007, and 47 boreholes in 2010. Also a total of 238 hand dug wells have been disinfected since 2007.

4.12.2 Ghana Meteorological Services Department (MSD)

The mission of MSD is to provide efficient weather services by collecting, processing, archiving and disseminating meteorological information to end users. To this end the meteorological services agency in the region has established weather stations in various parts of the region to enable it collate, process and disseminate weather information to the populace. The meteorological agency in the region is committed to ensuring a proficient delivery of meteorological data for the relevant institutions and actors to be vigilant and respond appropriately in the event of a disaster.

As part of its mandate, information dissemination is done through the local radio stations using local dialects to ensure target population receive the information. It could not also be established if their actions were indeed reaching their targets considering the level of ignorance and suffering. The MSD collaborates with NADMO, Water Resources Commission, the district assemblies and other agencies through the sharing of weather information.

4.12.3 Water Resources Commission/Volta Basin Authority

Water Resources Commission has the mandate to manage all fresh water resources in Ghana either as surface or underground water. Its mandate includes the management of trans-boundary water resources of which the Volta is prominent. Since its inception the

commission has work closely with the Burkinabe authorities, the MLGRD, RCC, and NADMO to reduce the undue delay of vital information about possible spillage of the Bagre dam. The commission has succeeded in reducing the long chain of communication to; from the Bagre Dam authority to RCC/NADMO instead through the Foreign Ministry, MLGRD, RCC, DA, NADMO, and community. This has significantly reduced the human suffering particularly loss of lives in recent times.

Since the Volta (White and Black) are shared among five West African countries (Ghana, Burkina Faso, Mali, Benin and Ivory Coast) water resources commission played a significant role for the successful establishment of Volta Basin Authority. Though the head quarters' is in Ouagadougou the headship is rotated among member countries to ensure efficient course management as it runs through the countries.

The commission is currently implementing the single major flood disaster management programme in northern Ghana in collaboration with CARE International called-Climate Change and Sustainable Livelihoods in the Upper East Region. The programmes is basically looking at the development of buffers and the protection of water bodies in collaboration with traditional authorities using vertiver grass, tree planting, construction of dug outs, supply of water pumping machines to groups, conducting Vulnerability Capacity Assessments (VCAs) for communities and organising public fora to share information on climate change.

The commission engages and is willing to engage any relevant disaster management organisations in the search for sustainable management of weather and flood hazards. However the commission does not involve itself in relief management because flood disaster prevention is its ultimate focus.

4.12.4 Hydrological Services Department (HSD)

The drainage and sewage units of the HSD is responsible for the designing and supervising of the construction of primary drains such as storm drains to carry run off away from population and economic facilities. They do drain improvement such as realigning, re-channelling of earth drains and streams to prevent flooding of built environs.

Although the HSD works closely with the WRC and NADMO in the management of water resources, it has not embarked on any specific drainage improvement programme in the region to reduce flooding. The department is short of the ability to perform its

functions because of resource constraints. The department noted however that encroachment and siltation of river courses were some of the causes of flooding.

4.12.5 Environmental Protection Agency (EPA)

The EPA grants licenses and permits to future developers that meet the requirements of locating in environmentally sensitive regions such as wet lands, watersheds and close to water bodies. Per flood disaster management, the EPA did not report of any activity undertaken either as an entity, or in collaboration with any other institution in flood disaster management in the region and or district. The agency however is willing to work with any group to design programmes, projects and activities to drastically reduce the occurrence and impact of flood on society.

4.12.6 Town and Country Planning Department (TCPD)

The activities of Town and Country Planning Department to a large extent have serious implications for a successful design and implementation of flood disaster mitigation strategies. It is the department that through land use planning and zoning determines the type of development that is allowed safeguarding such environmentally sensitive locations and the negative hazards occupying them may generate.

The Builsa District Town and Country Planning Department did not appear to be on top of its constitutional mandate. The Departments' inaction due to logistics and personnel to monitor the erection of illegal structures is leading to the unplanned development, occupation of environmentally sensitive areas like building and dumping of refuse on water ways with impunity particularly in the district capital.

4.12.7 Ministry of Food and Agriculture

The Upper East Region has a uni-modal but erratic rainfall pattern dissected by spells of drought. The region has been experiencing both drought and flood hazards for the past cropping seasons with dire consequences. The heavy rains in the months of August and September each season affect crop production.

MoFA activities in flood management are geared towards cutting down on the loss of farm produce. The organisation is working with farmer unions to develop alternative livelihoods programmes such as bee keeping, animal husbandry and dry season gardening, assisting in the creation and enforcement of buffer zone policy, engage in tree planting,

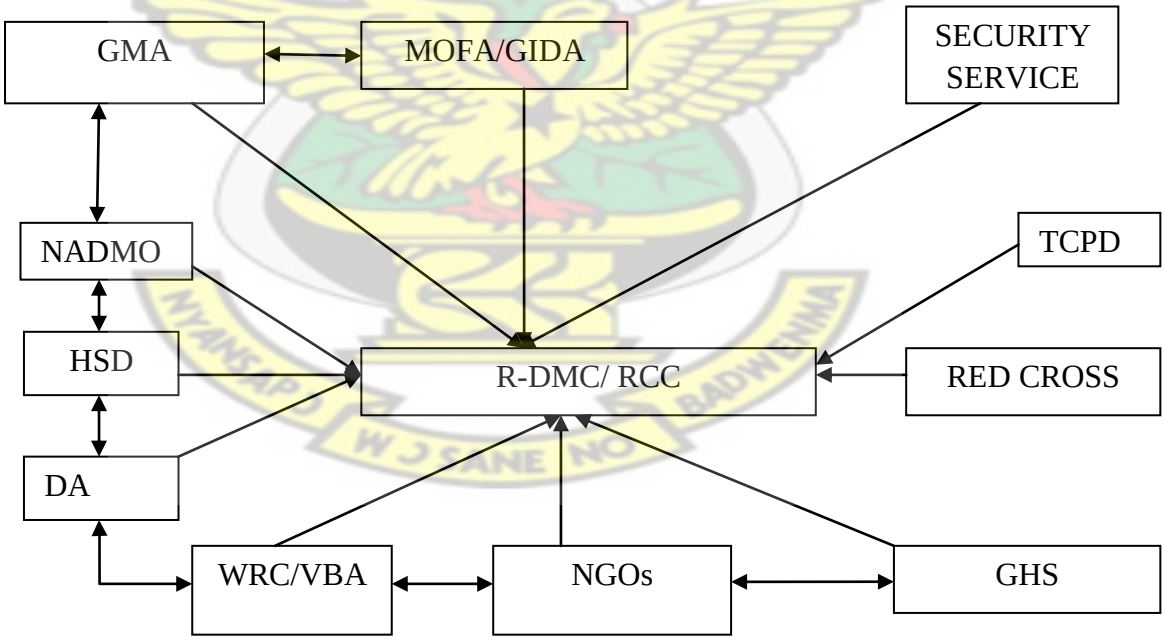
developing efficient dry season water management systems and negotiating for extension of time for farmers who lose their crops to floods to repay their loans.

Through the farmer development programmes the Ministry is assisting farmers to shift 30 meters away from flood plains and river banks, marshy areas and river beds. The organisation in collaboration with some religious organisations (Presbyterian Agriculture Development Programme) and private organisations such as CARE, and ProNet, had supported farmers with improve seeds and breeds of animals to cross local ones for farmer benefit.

4.12.8 Stakeholder Collaboration in Disaster Management

It is widely accepted that the management of disasters require an integrative approach even more so in harnessing the strengths of all actors for a holistic approach. Many actors embarked on various efforts to build synergy in disaster management as earlier indicated. The actors included both government and the private sector players. See figure 4.4 below.

Fig 4.3 Working relationship among actors in flood disaster management



Source: Authors construct, April, 2011

At the centre of the collaboration is the Regional Disaster Management Committee headed by the political leadership. It joins forces with NADMO to organise stakeholders to deliberate on the way forward in dealing with disaster risks in the region.

The regional disaster management committee involve many decentralised agencies and departments as well as private institutions. The committee is to convene regular meetings but available records confirm that meetings are regular just about the times of the crisis.

The non-governmental organisations including Action Aid Ghana, Presbyterian Agriculture Services, Technoserve, ProNet North, CARE International, and World Vision are more involved at the community and district level. The security agencies play a very critical role in disaster management especially in regard to rescue missions.

4.13 Institutional Challenges

Despite the individual and or collective willingness of stakeholders to reduce the incidence of flood disaster and provide the population with a safe environment, their efforts are constraint on several fronts; human, financial and logistical resource constraints.

4.13.1 Human Resource

All the institutions covered in the study had acute shortage of staff in the right numbers and possessing the right knowledge and or man power skills to function appropriately. The central agency in the management of disasters (NADMO) does not attract the calibre of professionals needed to manage disasters due to poor remuneration. The high labour turnover particularly those of professional category especially for NADMO is a major challenge for institutions development. Field staff of NADMO changes along with political regimes. As a result the capacity of the organisation to function efficiently and effectively in continuous manner has often lagged.

4.13.2 Financial Constraints

There is no doubt that the key stakeholders in flood disaster management are government sub-vented agencies such as NADMO, MMDA, MSD, HSD, WRC, EPA, and TCPD. Inadequate funding for the agencies that support disaster management especially for NADMO is key constraint. According to the NDMC report to parliament in July 2011, NADMO has only one per cent of its resources required to function properly. The case is that because they just provide services and not engage in income generating activities the least delay in subvention brings the agencies work to a standstill. This has implication for

financing preventive activities. Many a time allocations are made (to NADMO) only when there are issues to be addressed.

4.13.3 Logistical Constraints

Closely linked to financial constraints in the delivery of disaster management services in the region is logistics and equipment. The nature of disaster management requires high capacity tools and equipment. In the region basic facilities such as mechanical equipment for archiving information, digital cameras, and means of transport are posing threat to the operations of the organisations. The Builsa District NADMO has no vehicle, cameras for taking pictures, computers for storing information. They rely solely on the regional office or the mercy of the chief executive to go to the field. The district currently has no soft copy of any flood disaster archives at the district level except at the regional office.

The logistical constraints hinder NADMOs ability to respond quickly to disasters and making a good assessment of the impact. The general situation at the regional level is not different. Poor coordination and communication remain serious challenges in fighting the threat of disasters. The Builsa district office will require one desk top computer two digital cameras, four motor bikes, and a pick-up while the regional office need a desk top computer, two lap top computers, a pick up and one digital camera to support the regional office operations.

4.14 Post Flood Disaster Management

The focus of disaster management in the post crisis phase is on public infrastructure maintenance. Usually funds for post disaster activities are channelled directly through local authorities (DA) dedicated for the rehabilitation of public property like road infrastructure, school buildings, health post, and government quarters. The situation in Sandema follow the logic expressed above to the neglect of private infrastructure. The continuous neglect of victims in the rehabilitation stage in disaster management leaves many victims in cycles of vulnerability. It is entrenching poverty as livelihoods are not restored and it is creating disharmony among people.

4.15 Emerging Issues (summary)

The flood problem and the livelihood of the people is a critical area. The destruction of crops, animals, economic trees, homes, and the public infrastructure among others wipe away the supporting systems for affected groups especially women and children. Flood damage to agricultural products in the region is the key determinant of the rising poverty among food crop farmers in the region.

The threat of declining food surpluses and the move into food deficit of more than 30,000 tons (MoFA, 2010) over the years partly explain the exodus of the youth to other parts of Ghana for odd or non existing jobs. The link between the persistent flood and the rising poverty, migration and marginal development in the region particularly in the Builsa district deserve urgent attention for sustainable development.

CHAPTER FIVE

FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Key Findings

Disaster management involves a combination of such activities as disaster preparedness, prevention and management of the crisis. In line with the objectives set for the study critical observations and deductions were made as are summarised below.

The Upper East region suffers and will continue to experience flash floods with annually averages of 1,200 and 5000 persons in the region and Builsa respectively. The situation is likely to increase in the future due to increasing climate variability. Although almost every district suffers flooding, flood disaster management and mainstreaming is not given the necessary attention. There are institutional lapses on effective coordination and collaboration which has led to the mass suffering, and fallen living standards.

It can be safely said that the Upper East region besides flooding, is overwhelmed with a mirage of other disasters such as long spells of drought, epidemics (CSM), bush fires, indiscriminate waste disposal, environmental degradation, conflicts, over-dependence on fuel wood as a source of energy, uncontrolled winning of sand and gravel, and "galamsey" activities. Managing all these put a lot of stress on the already scarce resources and contributes to the increasing negative effects of heavy rains.

Although inaction by some public institutions exacerbates the flood effect, the challenges that hinder the effective operations of these institutions cannot be underestimated. Most of the stakeholders in acknowledging their various roles in managing disasters have serious capacity issues in finance, skilled personnel, and logistics. These challenges impact on the quality of service delivery at all levels.

Due to the financial difficulties, NADMO appear to have been reduced to a National Relief Management Organisation (NRMO) relegating the first principle of disaster management (prevention) to the background. The organisation becomes operative during crisis.

There is no standard for impact assessment and support services delivery resulting in significant variations in the aid given to victims of the same/similar degree of disaster. The kinds of items given are usually woefully inadequate, and at times worsen the plight of the victims. Mats, rubber plastic containers, and some grains are common aid items normally supplied. There is huge public concern on the neutrality of NADMO especially in impact assessment and relief management.

Collaboration between and among the actors in disaster management at both the regional and assembly levels is merely a formality and basically for emergency/rescue operations. Current disaster response strategy (by NADMO) takes care of only emergency needs (crisis issues) neglecting fundamentals like rehabilitation of livelihoods in the long run. As a result many affected persons do not report their loss to NADMO.

Economically there is little diversity in livelihood (peasantry) and the food and livelihood security situation in the district and region is continuously leaning towards the imbalance due to persistent floods and drought hazards.

It is established that the Bagre Dam spillage insignificantly adds to the problem. The technical opinion about the flood occurrence points at local environmentally related practices such as degradation and loss of vegetation cover.

5.2 Recommendation

After a critical analysis of the current situation and its associated problems there is the need to suggest workable and sustainable solutions to reduce the occurrence and impact if not to totally eradicate the incidence of flood disaster. The development of policies, strategies and plans to combat the risks associated with natural disasters should be based on a comprehensive risk assessment. The goals of disaster management are: Reduce, or avoid losses from hazards, assure prompt assistance to victims, and achieve rapid and effective recovery. On the whole, full consideration should be given to the social, environmental and economic impact of the disaster management policies and programmes.

This section provides guidance meant to complement other practical means such as forecasting, development of early warning systems, constructional and non constructional measures. These are important tools within the range of options being considered in flood disaster management today as proposed by the International Strategy for Disaster Reduction and the IFRC. The suggestions to deal with the flood disaster in the Upper East are grouped into non constructional (short term) and constructional (long term) measures.

5.2. 1 Non Constructional (Short Term) solutions

The aim of these propositions are to help in reducing possible flooding in the short to medium term some of which are usually due to inaction by the appropriate agency. Short term or Non-Constructional control measures involve land use policies that either prevent or limit development within floodplains either by prohibition or public purchase of such land, or place limitation on the creation of impervious surface within specific river banks. Policies that limit the development of wetlands as well and reduce the economic and physical damage that natural flood events may cause are now widely believed to be truly sustainable methods of managing development along river systems. The most critical element in activities associated with flood loss reduction in the short to medium term is emergency preparedness response activities.

5.2.1.1 Preparedness and Response Plans

NADMO must lead to prepare detailed response plans in advance and review it with all of the key players. There is no one "common" response plan depending on the type of disaster. The plan should be in writing and available to those that will be responding indicating key pieces of information such as: agency and individuals responsible, experts,

and where to find information and communication systems. Such information is constantly changing and needs to be verified periodically. Multiple contact points should be established with means for coordination to increase access for victims.

Again the implementation of these plans must be emphasized with specific roles assigned to the various professionals and agencies with like objectives. Such plans must be accessible with clear instructions as to who, where, what and other alternative communication plans for implementation.

5.2.1.2 Training and Response Exercises

Emergency response teams comprising NADMO staff and disaster volunteers need to be well trained in advance and their skills constantly upgraded. Once the disaster strikes, it will be too late to train or try to find missing expertise. Trained staff should know their responsibilities, have immediate access to response plans and other critical information, and should have built a good working relationship with colleagues in other organizations earlier.

There should be periodic emergency exercises to test response plans and critical gaps identified and addressed with the appropriate backup strategies. It is costly but the benefits in the event of an actual emergency are more. Exercises like immediate community summons are good in emergency response training and response.

5.2.1.3 Collaboration and Coordination

Reduction of flood losses will involve a number of agencies either government or private. Emergency planning and preparedness is first a local responsibility, but requires collaboration and coordination with other like-minded and expert groups to deal with. Memoranda of understanding, institutional policies, and joint preparedness planning can serve as the basis for coordination. In particular, there should be strong and reliable communication linkages between forecast centers (MSA) and disaster management organisations (NADMO), so that the emergency response actions can be appropriate to the magnitude of the disaster and timely.

The network of linkages from the local level upward must be established in advance delineating the role and relationship between public and non-public institutions, and any specific references dealing with the National body's role. Key players must meet often (inter-agency collaboration) to exchange information and become comfortable working

together. Working on disaster preparedness planning prior to the disaster helps involved agencies better understand each other's aims, objectives and capacities. Such understanding and communication result in more coordinated efforts, and help avoid duplication and identify gaps and weaknesses in necessary services during an actual emergency response. Information sharing should be bi-directional (upward and downward) between the different levels of disaster response agencies and not limited to national bodies.

The emergency response strategy must include inputs from the community and political leaders with clearly defined lines of authority to act depending on the seriousness and the magnitude of the flood. Communities and individuals must be empowered to have a good understanding of what is expected of them before during and after disaster by making information that specifies actions to be taken before and during flood disasters available.

5.2.1.4 Inventory of Resources

A key component of any emergency preparedness plan is an inventory of resources that can be accessed. It helps the planners to know in advance what to appeal for in the unlikely event of disaster. In the case of flooding, the inventory of items could include emergency vehicles, pumps, plastic containers, and communication equipment, access to forecasting specialists, the media and community leaders will be an added advantage.

The process of obtaining assistance must all be documented. Since local resources are hardly sufficient, the resource assessment should include strategies for attracting central government, private and international community support.

5.2.1.5 Public Participation in Governance

A sustainable disaster management plan must include indigenous knowledge and coping strategies. It makes such plans more acceptable and adaptable to the particular local situation. To effectively deal with a complexity and uncertainty, various forms of knowledge are required. Local knowledge and practice are as vital to take into consideration as outside specialist, technical or western knowledge. A disaster risk reduction strategy could be achieved and easily adapted too.

The Assembly Persons and Unit Committees in the various communities should be encouraged to mobilize communities to participate in local government activities by attending organised public functions. The involvement of people in impact assessment and relief management will help build trust and confidence in the system. This requires a clear

relief management strategy indicating the kinds of relief items for different hazards, the mode of assessment and selection of beneficiaries and possible quantity of items to be supplied. Households should be supported technically to develop and use improved building material to construct more resilient structures and drains.

5.2.1.6 Environmental Management Education

Climate change is real and the signs and effects will impact more on the poor and marginalised. A vigorous public education and campaign on climate variability and what adaptation strategies will help ameliorate the increasing risk should a priority to local leaders and professionals as well.

Ministry of Food and Agriculture, Hydrological Services Department, Water Resources Commission, Environmental Protection Agency, District Assemblies should collaborate with chiefs and NGOs to embark on safe environmental conservation education and practices. Activities such as planting of trees, buffer zone creation along rivers and around wetlands, shifting of farms away from river banks should be encouraged while bush burning and indiscriminate feeling of trees (economic trees), charcoal production, illegal mining, sand winning among others discouraged. Once the individual get to understand how their daily activities adversely affect the environment and their livelihood it will set the stage for local solutions to tackle increasing environmental perils.

5.2. 2 Long Term/Structural Measures

Disaster response should not end with relief services because the economic and social implications of flood are more serious in the post-disaster phase. People who have lost property, livelihoods should know what assistance will be made available, who is responsible, and how to access the assistance.

Because floods impact is often wide-spread, the suffering could be long-drawn besides the immediate impact. Long term strategies and programmes require enormous resources to undertake and usually involve strategic institutions such as central government, commissions, and professionals like engineers to contain the phenomena. The results are not immediately felt in the short to medium term but they serve as basis to draw short term activities towards a long term reduction or elimination of disaster.

Advance preparation prevents ad hoc, politically and emotionally motivated responses and set precedents that can stand the test of time. Therefore natural disasters would turn out to be a positive motivator for change if it is properly managed.

5.2.2.1 Basin Wide Planning

Reduction of flood losses must be considered, using the basin that causes floods as the basic planning unit. It is absolutely essential to have knowledge of the hydrological conditions, water uses, diversions, storage, and management practices in all parts of the basin. NADMO, HSD and WRC should be equipped with up to date information on the activities along the Volta basin.

Trans-boundary basins such as the Volta represent a special challenge in that, international collaboration is required which is beyond the local level. Therefore there is the need for bilateral or regional arrangements for exchange of data and information and the negotiation of treaties. Agreements could include the option of projects of mutual advantage such as construction of flood storage or other flood preventative measures at the most advantageous locations in the basin as a whole to be funded by all.

Since the Volta is multijurisdictional in nature, basin-wide planning should be employed to engage other countries for unifying measures. There should also be a role of higher orders of government in auditing enforcement of policy measures at the local level. This process could be led by the MLGRD.

5.2.2.2 Central Government

Disaster risk is shared responsibility and the onus lies on central government to pave the way through political commitment either in the form of developing a national programme or formulation of disaster policy backed by legislative instruments that mandate annual allocation of funds by the state for disaster related management and prevention.

A strong political leadership commitment is required to create and support NADMO to provide effective assistance in the wake of increasing disasters particularly in northern Ghana. A unit for the coordination of natural hazards for northern Ghana should be established under NADMO and resourced from the Northern Development Fund. Allocations to this unit should be based on annual risk and hazard mapping programmes/projects to empower, educate, and analyse potential disaster prevention and mitigation in order to ensure sustainable development.

In line with this, district assemblies, regional coordinating councils, and community leaders should engage the Savannah Accelerated Development Authority to design programmes for flood hazard management for the three northern regions. The programme should cover mechanised irrigation, buffer zone policies, afforestation and dredging of the basins of the rivers that usually overflow their banks.

Central Government should develop strategies and policies that ensure a consistent framework wherever they are applied such as flood proofing standards, cost sharing arrangements, incentive and insurance programmes that exceed the capability of the local level. Education and environmental conservation are suitable ways to combat flood hazard.

5.2.2.3 International collaboration

There are a number of United Nations specialized agencies and programmes that can be of assistance to Ghana in establishing a programme aimed at reducing the losses that result from flooding. The UN Department of Economic and Social Affairs (UNDESA) has been actively involved in providing advice to governments on water resource management during extreme hydrological events in a wide range of environmental and climatic settings. They assist with expertise and finances.

One major problem with disaster management agencies in Ghana is financial incapacity. When funding for water resource organizations declines, monitoring networks and the capacity to collect, store and analyze data break down. In Ghana, it is only in times of drought or severe flooding that the political will to fund these activities is revived by which time it is often too late. The government of Ghana should develop a strategic disaster programme to engage the UN for support in sound water resource management and capacity building for the disaster management agencies.

5.2.2.4 Institutions/Commissions

In the long term government must strive to strengthen the public services institutions and departments like the public sector reforms agencies through adequate resourcing, remuneration, and logistics. The provision of the necessary working tools will enhance service delivery and the retention of critical staff for professional functioning of the institution particularly NADMO.

The government should collaborate with the insurance companies to review the insurance policy in the country to accommodate agriculture and flood effect. It will serve as a

motivation for farmers and policy makers (government) to strive for prevention to reduce the incidence of flood.

On the diversification of livelihoods, clay, an important raw material for the production of electrical materials and accessories abounds in the Builsa district. With the right support, the clay industries could be developed to create employment and diversify the reliance on rain fed agriculture and produce items to boost the electrical industry in Ghana.

5.3 Conclusion

Disasters whether natural or man-made can strike at any time. In general response to a disaster is in terms of relief and rescue operations - after the event. However, if we are adequately prepared, it is possible to severely reduce the impact of a disaster through a good understanding of preventive action as well as having knowledge of certain life-saving techniques.

The Upper East Region is bedevilled with a mirage of teething challenges; it is ranked the second poorest in the country, and lags in basic infrastructure. In spite of the challenges opportunities abound in the region ranging from tourism, tomato production, guinea fowl rearing, mining, raw material for quarry industry, excellent handicraft; ceramics, basketry, leather works, among others.

The occurrence and management of natural disasters is often difficult and requires the pooling of both human and material resources of all stakeholders so as to reinforce each other in the pursuit of a sustainable solution to the dilemma. Flood disaster triggers precarious situations of food insecurity and poverty as NADMO and the other stakeholders appear overwhelmed by the risk.

The critical element in the set of activities associated with flood-loss reduction in the short to medium term is advance preparedness response. Central government, regional and district assemblies should have mechanisms in place to allocate, reserve and bring in the resources needed when disaster strikes. A strategy should also be put in place to quickly solicit for external support even internationally when the local level response will not be sufficient.

Constructional measures in flood disaster management are expensive engineering techniques of checking the flow of water that causes flood; deepening of water basins or channel improvement, construction of defence walls, and dykes however they are worth trying in the long run given the resources.

Flood disaster should be tackled to rescue the masses from the undesirable and ultimate effect of displacement, disruption of social and economic activities, loss of lives and diversion and dissipation of development funds. Failure to arrest and manage floods and other related disasters will lead to an entrenchment of inefficiencies; poor service delivery, high cost /fallen standards of living, and deepening of poverty.

A sustainable flood adaptation management strategy or coping mechanism should be integrative and informed by iterative learning about the ecosystems and the earlier management success and failures. It should create linkages across scales professions, local, regional, national and international thereby selling local problems to wider audience for appropriate redress.

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APPENDICES

Appendix I Questionnaire

Department of Planning

College of Architecture and Planning

Kwame Nkrumah University of Science and Technology, Kumasi

This Research Instrument is designed to collect Data for a special Study on the Topic

Sustainable Management of Flood Disaster in the Upper East Region

A. Questionnaires For: Households

Date of Interview: day...../month...../2011 |_|_|_|

Name of Community:|_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Age of respondent: |_|_|

2. Sex of respondent (a) Male [ ] (b) Female [ ]

3. Household status a) husband [ ] b) wife [ ] c) child [ ] d) Tenant [ ]

4. Ethnic origin (specify).....

5. Educational status (a) basic [ ] (b) Secondary [ ] (c) Tertiary [ ] No schooling [ ]
(d) Others (specify)…….....……...

6. Occupation (a) Agricultural [ ] b) Trading [ ] c) Services [ ]

e) Other (specify)…….....….....……....

7. Length of stay in community.....

(8) Has your household suffered from any flooding since you have been living here?

Yes [ ] No [ ]

(b) If yes why are you still living here? (give reasons).....

(c) When was the last flood experience? .....

(d) How often does flood happen in a year? Once [ ] Twice [ ] severally [ ]

(9a) How does the flood affect your household?

i. Socially (Education, Health, water).....

ii. Economically (livelihood).....

iii. Physically (property damage).....

iv. Others (specific).....

(10a) Have you ever receive any official relief support in times of floods? Yes [ ] No [ ]

(b) If yes, from which agency (ies)?.....

(c) What does your household do in times of floods? .....

(d) How do you cope with the floods?.....

(11). What in your view are the causes of flooding in the community?

Heavy rainfall [ ] Environmental degradation [ ] Spilling of Bagre dam [ ]

All the above [ ] None of the above [ ]

(12a) Has your household taken any steps to reduce the impact of flooding? Yes [ ] No [ ]

(b) Comment on your answer.....

(c) As a community have you taken any steps to reduce flood occurrence?

Yes [ ] No [ ]

(d) How/ why not? .....

(13a)Are you aware of any activity by NADMO in managing flood disaster?

Yes [ ] No [ ]

(b) If yes what are they?.....

(14a) Has there been any forum to discuss disaster management in the community?

Yes [ ] No [ ]

(b) If yes who led the process?.....

(15a) Has authorities stopped any economic activity in the community because of flooding? Yes [ ] No [ ]

(b) If yes:

When? .....

What activity.....

(16a) Are you satisfied with the NADMO's handling of the flood disaster in the community? Yes [ ] No [ ]

(b) Give reasons for your answer.....

(17a) Are you aware of any procedure to site facilities in the community? Yes [ ] No [ ]

(b) If yes are the procedures being followed? Yes [ ] No [ ]

(b) If No why not?.....

(18a) Do you farm near any water body in the community? Yes [ ] No [ ]

(b) Do others farm along the river tributaries in the community? Yes [ ] No [ ]

(c) If yes why do you/ they farm along the rivers?

(d) Does farming along rivers affect the river in any way? Yes [ ] No [ ]

(e) If yes state how? .....

(19) Why should the flood problem be tackled?.....

(20) How do you think the problem of flooding can be addressed in the community at the following levels?

Community/Household.....

District.....

Regional/Central Government.....

(21a) Will you move out of the community as the flood problem persists? Yes [ ] No [ ]

(b) If no why? .....

Thank you

Department of Planning
College of Architecture and Planning
Kwame Nkrumah University of Science and Technology, Kumasi

This Research Instrument is designed to collect Data for special Study on the Topic

Sustainable Management of Flood Disaster in the Upper East Region

A. QUESTIONNAIRES FOR: National Disaster Management Organisation

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]

2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|

(3a) What are the common disasters in the region?

i.....
ii.....
iii.....
iv.....

(b) Which of the disasters is the most notable? .....

(c) How frequent is this notable disaster?

[ ] regularly [ ] annually [ ] others (specify)

(d) What is/are the cause's flood disaster in region/district?

1st.....
2nd.....

3rd.....
4th.....

(e) How many people are affected by flood annually on the average? .....

(4a) Do you think land use activity can be blamed for flood occurrence? Yes [ ] No [ ]

(b) If yes how?.....

(5a) Do you have any particular regulations for economic activities in flood prone areas in the region/district Yes [ ] No [ ]

(b) If yes are they being enforced? Yes [ ] No [ ]

(c) if no give reasons for your answer .....

(6a) Do you have any programmes/projects aimed at reducing the incidence of flooding in the region/district? Yes [ ] No [ ]

(b) If yes name them.....

(7) What specific actions do you take in flood disaster prevention and management?

.....

(8a) Are you adequately resourced to carry out your constitutional mandate?

Yes [ ] No [ ]

(b) If No in what areas are you challenged?

i. Human resource.....
ii. Financial resource.....
iii. Logistic and equipment.....
iv. Others (specify).....

(9) What measures are being considered to address the above challenges?

.....

(10) Do you collaborate with other bodies in flood disaster prevention and management?

Yes [ ] No [ ]

(b) If yes name the agencies/bodies?

.....

(c) How will you rate the level of collaboration?

[ ] Excellent [ ] Very good [ ] Good [ ] Fair [ ] Poor [ ] Very poor

(11a) Do you (NADMO) involve communities in disaster management activities?

Yes [ ] No [ ]

(b) If yes at what level? .....

(c) How do you rate the level of participation of the people?

Very high [ ] High [ ] Average [ ] Low [ ] very low [ ]

(d) What account for this level of participation?

.....

(e) If no why not?.....

(12a) How will you rate the level of coping capacity of the people?

High [ ] average [ ] low [ ] poor [ ]

(b) What account for this level?

.....

(c) How will a community report flood disaster?

.....

(d) Who does the impact assessment?

NADMO [ ] DA [ ] Community leaders [ ] individuals [ ] others (specify).....

(13a) Why should the flood problem be addressed?

.....

(14a) Does the availability of disaster relief affect the adoption of other disaster prevention methods? Yes [ ] No [ ]

(b) If yes should disaster aid be stopped to prevent further development of flood prone areas? Yes [ ] No [ ]

(c) Give reasons for your answer.....

(15) What management plan do you have in place for the victims before, during and after flood disaster?

a. Prevention.....

b. Management.....

c. Rehabilitation.....

(16a) Is there any relationship between flood disaster and poverty in the region?

Yes [ ] No [ ]

(b) If yes how will you describe the relationship above?.....

(17a) Do district assemblies consider disaster related issues in the MTD Plans?

Yes [ ] No [ ]

(b) If No why not.....

(18) What do think will form the best strategy for flood disaster management?

i. .....
ii. .....
iii. .....

(19) Please state any other thing worthy of note.....

Thank you

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Sustainable Management of Flood Disaster in the Upper East Region

A. Questionnaires For: Meteorological Service Department (MSD)

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]

2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|

3. What is the average annual rainfall for the region?.....

4. What is the distribution pattern?

5. What specific responsibilities do you have in flood disaster prevention? .....

6. What is the medium of disseminating weather information? Fora [ ] radio [ ] TV [ ] others (specify).....

7. Is the agency adequately resourced to carry out its mandate? Yes [ ] No [ ]

(b) If no what areas are you challenged? Human [ ] (ii) Financial [ ] iii) Logistics [ ], (v) Others (specify).....

8a) Are you aware of any programmes/projects designed to reduce the incidence of floods? Yes [ ] No [ ]

(b) If yes what are they?
.....

(9a)Do you collaborate with other agencies in flood prevention and management?
Yes [ ] No [ ]
b) What are the areas of collaboration?
(c) If yes name the institutions
.....
(10a) Are you satisfied with the level of collaboration? Yes [ ] No [ ]
(b) If no why not?.....

(11) Why does the Upper East suffer perennial flooding in the opinion of your institution?
.....

(12) What measures are being taken to address them?
.....
(13a) Is there any relationship between flood disaster and the poverty in the region?
Yes [ ] No [ ]

(b) If yes how will describe the relationship?
.....

(14) What in your opinion will form the best strategy to prevent the incidence of floods in the region?
.....

Thank you

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This Research Instrument is designed to collect Data for special Study on the Topic

Sustainable Management of Flood Disaster in the Upper East Region

A. Questionnaires For: Ministry of Food and Agriculture (MoFa)

Date of Interview: day...../month...../2011 |_|_|_|

Time of Interview: ..... am ☐ pm ☐

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|
1. Sex of respondent (a) Male [ ] (b) Female [ ]

3. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|
(3a) What are the common disasters in the region?

i.....
ii.....

iii.....
iv.....

(c) How frequent is the flood disaster- (i) monthly, (ii) quarterly, (iii) annual (iv) bi-annual

(d) What are the causes of flood disaster in region/district in order of importance?

(Torrential rains, spilling of Bagre dam, land degradation/desertification, loss of river bed, climate change)
1st..... 2nd ..... 3rd.....
4th ..... 5th.....
(e) How many people are affected annually on the average by flood? .....

(4a) How does flood disaster affect agriculture production in the region?
.....
(5) What is the cost of flood on agriculture production in the region in terms of:
a. Farms destroyed.....
b. Animals lost.....
c. Others.....

(6) How does flooding affect irrigation programmes in the region?
.....
(7) Does the flooding aid agriculture production in any way? Yes [ ] No [ ]
(b) If yes in what way?

(8a) What in the opinion of MoFA causes flooding in the region?

(b) How do the farmers cope after they lose their farms and animals to water?

.....

(c) Does flood disaster post any food security threats in the region? Yes [ ] No [ ]

(d) What in MoFA view form the best strategy to dealing with flood disaster in the region?.....

(9a) Do you have any particular regulations for economic activities in flood prone areas in the region/district Yes [ ] No [ ]

(b) If yes are they being enforced? Yes [ ] No [ ]

(10a) Are you aware of any programmes/projects aimed at reducing the incidence of flooding in the region/district? Yes [ ] No [ ]

(b) If yes name them.....

(11) What specific actions do you take in flood disaster prevention and management?

.....

(12a) Are you adequately resourced to carry out your mandate? Yes [ ] No [ ]

(b) If No in what areas are you challenged?

i. Human resource.....
ii. Financial resource.....
iii. Logistic and equipment.....
iv. Others (specify).....

(13) What measures are being considered to address the above challenges?

.....

(14) Do you collaborate with other bodies in flood disaster prevention and management?

Yes [ ] No [ ]

(b) If yes name the agencies/bodies

.....

(c) How will you rate the level of collaboration?

i. Excellent. (ii) Very good. (iii) Good. (iv) Fair. (V) Poor. (Vi) Very poor

(15a) Do you involve communities in the activities of the organisation? Yes [ ] No [ ]

(b) If yes at what level?

.....

(c) How do you rate the level of participation of the people?

Very high [ ] High [ ] Average [ ] Low [ ] very low [ ]

(d) What account for this level of participation?

.....

If no why?

.....

(16a) How will you rate the level of coping capacity of the people?
High [ ] average [ ] low [ ]
(b) What account for this level?
.....
.....
(c) Who does the impact assessment on farms destroyed? NADMO [ ] MoFA [ ]
Community leaders [ ] individuals [ ] others (specify).....

(17a) Why should the flood problem be addressed?
.....
(b) What would form a strategy for managing and preventing of flood disaster?
.....

(18) What management plan do you have in place for the victims before, during and after flood disaster?

i. Prevention plans.....
ii. Management plans and.....
iii. Rehabilitation plans.....

(19a) Is there a relationship between flood disaster and poverty in the region?

Yes [ ] No [ ]

(d) How will you describe the relationship above?
.....

Thank you

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Sustainable Management of Flood Disaster in the Upper East Region

A. Interview Schedule For: Hydrological Service Department (HSD)

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]
2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|
3. Give a brief account of the flood disaster situation in the Upper East region;
4. What in the view of the organisation are the probable causes and impact?
5. What is the state of the rivers and water bodies in the region
6. What steps has the outfit taken any steps to curb the perennial flooding? Is the outfit challenged in any way?
7. Do you collaborate with any institution/department in finding a solution? If so in what ways and how effective is the collaboration?
8. Does flood disaster have any relationship with poverty levels in the region and how will you describe the link
9. Do stakeholders in disaster management adopt effective planning and implementation of plans? RCC, DAs
10. What would form a sustainable management plan for the recurrent flood disaster?
11. Any other thing worthy of note concerning flooding?

Thank you

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Sustainable Management of Flood Disaster in the Upper East Region

A. Interview Schedule For: Water Resources Commission/Volta Basin Authority

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]
2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|
3. Give a brief account of the flood disaster situation in the Upper East region;
4. What in the view of the organisation are the probable causes and impact of floods?
5. What is the state of the rivers and water bodies in the region-(interference on river courses, managing of buffers among others?
6. Have the outfit taken any steps to curb the perennial flooding?
   (b) Is the outfit challenged in any way?
7. Do you collaborate with any other institution/department in finding a solution?
   (b) If so in what ways and how effective is the collaboration?
8. Does flood disaster have any relationship with poverty levels in the region and how will you describe the link?
9. Do stakeholders in disaster management adopt effective planning and implementation of plans if any?
10. What would form a sustainable management plan for the recurrent flood disaster?
11. Any other thing worthy of note concerning flooding?

Thank you

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Sustainable Management of Flood Disaster in the Upper East Region

A. Interview Schedule For: Builsa District Assembly (DPCU)

Date of Interview: day...../month...../2011
Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]

2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|

3. Give a brief account of the flood disaster situation in the Upper East region;

   (How it comes about, the times and frequency of occurrence in a year, areas and people most vulnerable to the disaster)

4. What in the view of the organisation are the probable causes?

5. What is the general drainage system situation in the district (interference on river courses, farming along river banks among others?

6. Have the Assembly taken any steps to effectively tackle the perennial flooding? Providing for disaster planning and implementation?

   (b) Is the outfit challenged in any way?

   (c) How does flood disaster impact on the implementation of development programmes for the district

7. Do you collaborate with any other institution/department in finding a solution?

   (b) If so in what ways and how effective is the collaboration?

8. Does flood disaster have any relationship with poverty levels in the region and how will you describe the link?

9. Do stakeholders in disaster management adopt effective planning and implementation of plans if any?

10. What would form a sustainable management plan for the recurrent flood disaster?

Thank you

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Sustainable Management of Flood Disaster in the Upper East Region

A. Interview Schedule For: Regional Coordinating Council (RPCU)

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]
2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|
3. What is the general disaster situation in the region?
4. What account for the destructive flood disaster in the region?
5. Have the RCC taken any steps to mainstreaming disaster planning and implementation in MTDPs?
6. Does flood disaster impact on the implementation of development programmes in the region?
7. Any challenges in that direction?
8. Efforts in collaborating with other institution/department in mitigating the disaster?
9. Does flood disaster have any relationship with the poverty levels in the region and how is the link?
10. What would form a sustainable management plan for the persistent flood disaster?
11. Any other thing worthy of note concerning flooding?

Thank you

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Sustainable Management of Flood Disaster in the Upper East Region

A. Interview Schedule: Environmental Protection Agency

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]
2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_||_|
3. What is the general environmental situation in the region?
4. What role has EPA in environmental management and flood disaster?
4. Does flood disaster occurrence related to environmental issues?
5. Is EPA challenged in any way?

12. Do you collaborate with any other institution/department in mitigating the disaster?
13. Does flood disaster have any relationship with the poverty levels in the region and how is the link?
14. What would form a sustainable management plan for the persistent flood disaster?
15. Any other thing worthy of note concerning flooding?

Thank You

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Sustainable Management of Flood Disaster in the Upper East Region

A. Interview Schedule: Town and Country Planning (Sandema)

Date of Interview: day...../month...../2011

Name of Respondent: (Optional) |_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_||_|

1. Sex of respondent (a) Male [ ] (b) Female [ ]

2. Official position |_||_||_||_||_||_||_||_||_||_||_||_||_|

3. Has the district got a land use plan and do prospective developers go by the plans?

4. Have the department taken any steps to deal with?

5. Is the outfit challenged in any way?

6. Does flood disaster impact on the implementation of development programmes in the district?

7. Do you collaborate with any other institution/department in mitigating the disaster?

8. Does flood disaster have any relationship with the poverty levels in the region and how is the link?

9. What would form a sustainable management plan to reduce flooding in the built environs?

10. Any other thing worthy of note concerning flooding?

Thank you

Appendix II:

Structural flood mitigation works suggested by Sabah State Water Resources Master Plan (1995)

Mitigation dams are constructed to reduce downstream water level through reducing water discharges. Levees and dikes are considered the most economical measure, and are built of earth or concrete bunds to protect existing development in flood-prone areas. Bypass flood channels are constructed to redirect water away from areas at risk, and reducing the water levels along the mainstream in the protected area during flood events. Channel improvements are made to increase the capacity of river channel through widening, deepening or realigning the channel, and through the clearance of obstructions along the riverbanks and bed. Flood diversion channels have the same function as bypass flood channels, except that these structures do not rejoin with the original stream.

Retarding basin (detention basin) is a small dam that provides temporary storage for flood water thus delaying downstream discharges and flood levels. On-site detention is a method that has the same function as retarding basin, except that it is installed in private properties. Flood proofing is a method of protecting critical structures and services such as water supply and treatment plants for reducing future damages.

Appendix III: Flood management options in Mozambique

Modify the flood	**Modify the damage susceptibility (flood plain management)**	**Modify the loss burden (redistributive losses)**	**Do nothing**
Flood protection (channel Phase)	Land use regulation and changes	Flood insurance	Bear the loss
Dykes	Statutes	Tax writeoffs	
Floodwall	Zoning ordinances	Disaster relief	
Channel Improvement	Building codes	Volunteer private activities	
Reservoirs	Sub-division regulations	Government aid	
River diversion	Government purchase of land and property	Emergency measures	
Water shed treatment (Land Phase)	Subsidised relocation	Removal of persons and property	
Modification of cropping practices	Flood proofing	Flood fighting	
Terracing	Permanent closing of low level windows	Rescheduling operations	
Bank stabilisation	Waterproofing interior		
	Land elevation and fill		

Source: Wisner (1979)

Appendix IV (a): Floods disaster in Upper East Region in 2007

District or Municipality	No of household	No of collapsed houses	No. of IDPS			Total no. of IDPS	No. of Deaths
			Children	Women	Men		
Tanlensi – Nabdam	15,296	1,924	3,244	2,163	1,082	6,489	2
Guru- Tempane	3,907	1,087	11,776	2,001	1,906	15,683	6
Bawku West	3,047	600	8,693	4,853	3,445	16,991	1
Builsa	***49,650***	***5,969***	***4,705***	***3,898***	***2,799***	***11,402***	***5***
Bawku East	6,000	1,800	6,000	2,500	1,500	10,000	13
Kassena – Nankana	15,839	6,491	22,008	10,609	10,588	43,205	3
Bongo	1,929	783	1,252	867	386	2,505	1
Bolgatanga	3,297	590	1,480	706	911	3,097	2
Grand Total	98,965	19,244	60,158	27,597	22,617	109,367	34

Source: NADMO, Upper East Regional Secretariat Second and third quarterly report – 2007

Appendix IV (b): Effects of flood by district, communities and households in 2009

District	**No. of communities Severely affected**	**No. of Households Severely affected**
Garu Tempane	22	1,088
Bawku Municipal	26	1,438
Bawku West	42	1,977
Talensi Nabdam	12	936
Bolgatanga	35	616
Bongo	15	742
Kassena Nankana	13	806
Builsa	76	1,453
Total	241	9,056

Source: MoFA reports 2009

Appendix V: Age and Sex Structure of the Population of Builsa District

Age Group	Total	%	Male		Female	
			Total	%	Total	%
TOTAL	83,261	100	40,867	100	42,394	100
0-4	11,497	13.8	5,851	14.3	5,646	13.3
5-9	13,864	16.7	7,178	17.6	6,686	15.8
10-14	9,795	11.8	5,562	13.6	4,233	10.0
15-19	7,365	8.8	3,953	9.7	3,411	8.1
20-24	5,267	6.3	2,359	5.8	2,907	6.9
25-29	5,693	6.8	2,407	5.9	3,286	7.8
30-34	4,487	5.4	1,803	4.4	2,684	6.3
35-39	4,358	5.2	1,943	4.8	2,415	5.7
40-44	4,135	5.0	1,869	4.6	2,266	5.3
45-49	3,906	4.7	1,846	4.5	2,060	4.9
50-54	3,081	3.7	1,279	3.1	1,802	4.3
55-59	2,144	2.6	983	2.4	1,161	2.7
60-64	2,415	2.9	993	2.4	1,422	3.4
65-69	1,639	2.0	803	2.0	836	2.0
70-74	1,512	1.8	816	2.0	696	1.6
75-79	827	1.0	485	1.2	342	0.8
80-84	661	0.8	371	0.9	289	0.7
85+	616	0.7	365	0.9	252	0.6

Source: GSS/PHC 2000, Projected (DMTDP 2010-1013)

Appendix VI (a): The effect of the 2007 floods on the Builsa district

Effect	**Name of place/facility**	**Number**
Number houses destroyed (public& private)	Whole district	8,052
Acreage of farm lands destroyed	Agriculture	6000 hectares
Kinds and quantity of livestock affected swept way/killed	Swine	200
	Goats	1200
	Sheep	900
	Poultry	5,000
No of dams severely damaged emptying them)	Balansa, Kalijiisa, Sinyansa, Kadema, Gbedema,	5
Effects of flood on water and sanitation	Boreholes	145
	HDW	238
Effect of flood on educational infrastructure	schools destroyed	15

Source: NADMO/MoFA, Reports 2007

Appendix VI (b): Flood disaster damage to road transport infrastructure in Builsa (2007-2010).

Culverts	**location**	**Extent of Damage**	**Population Affected**
Bachonsa road	Bachonsa	Completely collapsed	660
Doninga road	Doninga	Completely collapsed	1,703
Sandema – Kori road	Kori	Completely collapsed	5770
Wiaga central- Clinic	Wiaga	Completely collapsed	4,921
Wiaga – Kadema	Kadema	Completely collapsed	6,061
Kandema – Chansa	Chansa	Completely collapsed	2368
Kadema – Fumbisi	Kadema	Completely collapsed	6,103
Wiaga – Gbedema	Gbedema	Completely collapsed	7,850
Gbedema – Kanjarga	Kanjarga	Completely collapsed	9,169
Siniensi-Kaasa	Kaasa	Completely collapsed	859

Source: NADMO 2010.

Appendix VII (A): Effect of flood on small dams and dry season farming in UE/R (2009)

District	No. of communities Severely affected	No. of Households Severely affected	No. of Broken or damaged dams
Garu Tempane	22	1,088	6
Bawku Municipal	26	1438	3
Bawku West	42	1,977	0
Talensi Nabdam	12	936	2
Bolgatanga	35	616	1
Bongo	15	742	7
Kassena Nankana	13	806	5
Builsa	76	1,453	7
Total	241	9056	39

Source: MoFA reports 2009.

Appendix VII (b): Effect of flood on small scale dams in the Builsa district 2010.

Community	Dam	Effect	Affected Population
Balansa	Balansa	Partly damaged	600
Sinyansa	Sinyansa	Partly damaged	246
Gbedema	Gbedema	Partly damaged	954
Kalijiisa	Kalijiisa	Partly damaged	200
Kadema	Kadema	Partly damaged	415
Kaasa	Kaasa	Partly damaged	859
Kpalinsa Dam	Kpalinsa	Partly damaged	158
Luisa Dam	Luisa	Partly damaged	295
Yisobsa Dam	Yisobsa	Partly damaged	467

Source: MoFA, reports 2010.