

UNIVERSITY OF GHANA, LEGON



**CLIMATE CHANGE AWARENESS AND RISK PERCEPTION IN
GHANA: A CASE STUDY OF COMMUNITIES AROUND THE MUNI-
POMADZE RAMSAR SITE**

BY

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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN
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DECLARATION

This is to certify that this thesis is the result of research undertaken by Sussie Ohene-Asante under the supervision of Prof. Audrey Gadzekpo and Dr. Erasmus H. Owusu, towards the award of the Master of Philosophy degree in Climate Change and Sustainable Development, University of Ghana, Legon



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DEDICATION

To my sweetest and supportive Honey – Kwame Ohene Asante, the joy of my life –
Maame Awurabena Ohene- Asante and my dearest mum, Amma Nyantekyewa.

God richly bless you.



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ABSTRACT

This study investigated the level of awareness and knowledge of climate change, factors influencing risk perception pertaining to climate change and variability, and factors influencing the adoption of adaptation strategies in three communities around the Muni-Pomadze Ramsar site. Primary data were collected through a questionnaire survey, FGDs and in-depth interviews. Descriptive statistics such as frequencies and percentages were employed to assess the level of knowledge and awareness about climate change. The binary logit model was employed to assess both the factors influencing the risk perception and adoption of adaptation strategies. The result shows that 100% of the respondents were aware of the changes in the climate over time. However, they gave different responses regarding changes observed in the various climatic variables. Parameter estimates of the binary logit model for the risk perception revealed that educational level of respondents and rainfall perception were statistically significant. It was noted that as individuals attain a higher educational level, the probability of the individual undertaking a critical analysis to ascertain how risky an activity is, increases; and as rainfall is perceived to be decreasing, the probability of an individual seeing his/her activity to be risky increases. Parameter estimates of the binary logit model for adoption of adaptation strategies also revealed that risk perception level, gender and alternative livelihood activities were statistically significant. The study recommends that the mass media should intensify its function as an educational tool to disseminate climate change information.

Keywords: Awareness, Knowledge, Climate Change, Binary Logit Model

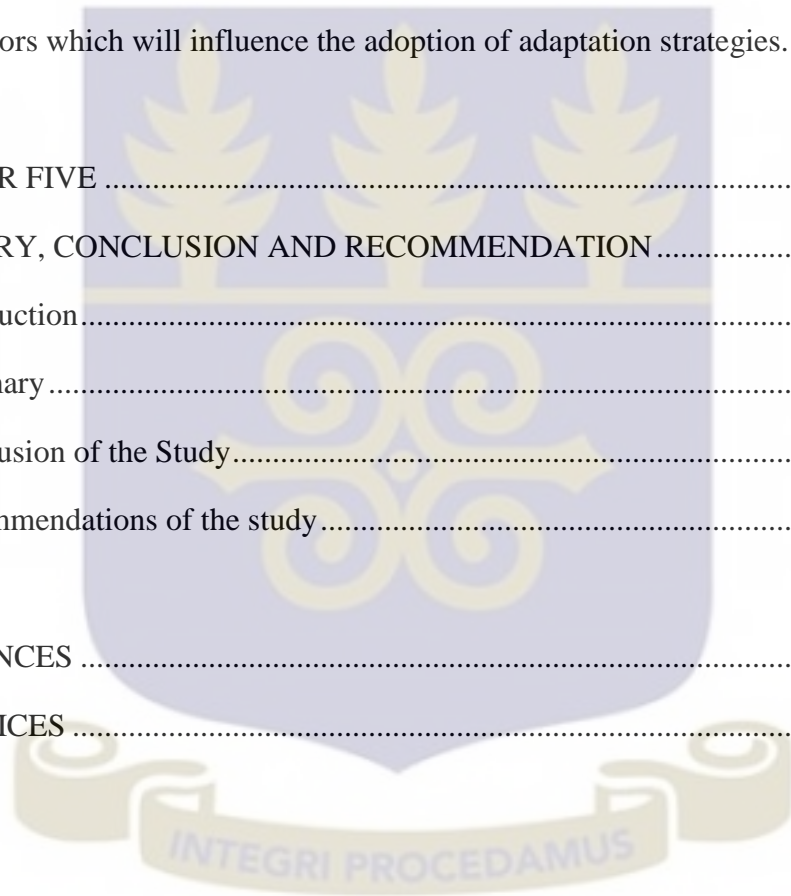
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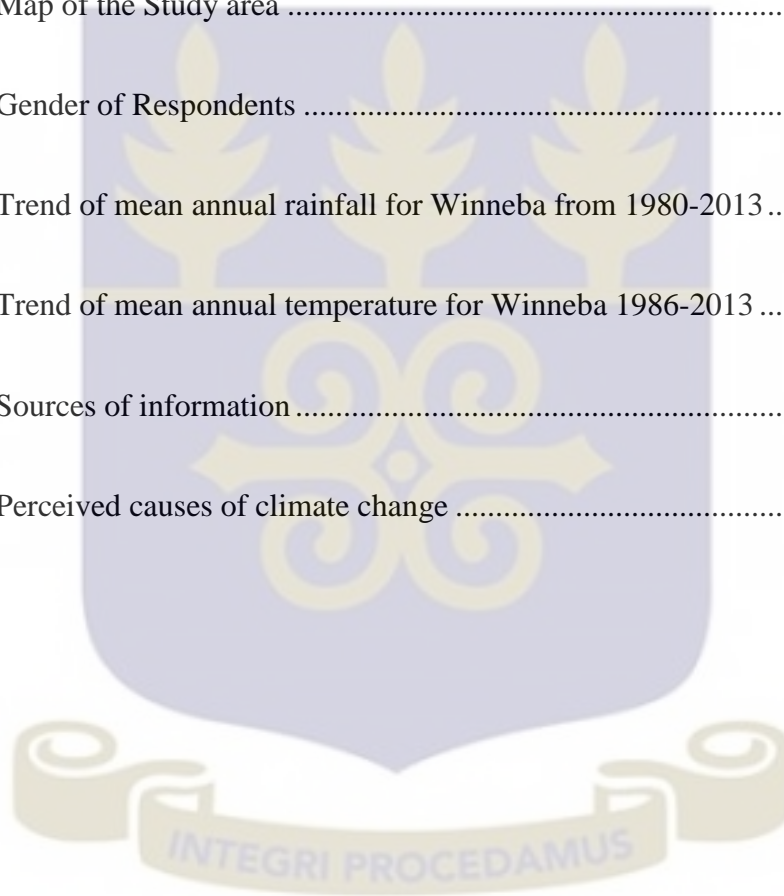
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LIST OF ABBREVIATIONS

UNDP	–	United Nations Development Program
IUCN	–	International Union for Conservation of Nature
AMCEN	–	African Ministerial Council on the Environment
EPA	–	Environmental Protection Agency
UNEP	–	United Nations Environmental Program
UKCIP	–	United Kingdom Climate Impact Program
COIN	–	Climate Outreach and Information Network
IPCC	–	Intergovernmental Panel on Climate Change
FAO	–	Food and Agriculture Organisation
DEFRA	–	Department for Environment, Food and Rural Affairs
UNFCCC	–	United Nations Framework Convention on Climate Change
CRC	–	Coastal Resource Center
CEEPA	–	Center for Environmental Economics and Policy in Africa
WMO	–	World Meteorological Organisation
USAID	–	United States Agency for International Development
USNAS	–	United States National Academy of Science
GMet	–	Ghana Meteorological Agency
NGO	–	Non-Governmental Organisation
GHG	–	Green House Gas
FGD	–	Focused Group Discussion

CHAPTER ONE

GENERAL INTRODUCTION

1.1 Introduction

This introductory chapter provides an insight into the study and includes a background to the study, problem statement, objectives of the study, research questions, the significance and scope of the study. The chapter ends by explaining how the various chapters are organised.

1.2 Background to the Study

Climate change has emerged as one of the most devastating global environmental threats (Pandave et al., 2011). It is a multi-faceted challenge in this present day because of its accompanying changes in weather patterns (Acquah, 2011). This can have serious repercussions for humans, upset seasonal cycles, harm ecosystems and water supply, affect agriculture and food production, and cause sea-levels to rise (Chineke et al., 2015). Climate change is not an occurrence in the distant future, but a phenomenon that is taking place now (Dankelman, 2002). Many reports abound on how climate change is impacting the planet. The Intergovernmental Panel on Climate Change (IPCC) is the main body formed by the World Meteorological Organisation (WMO) and the United Nations Environmental Programme (UNEP), to assess the scientific and technical information about climate change in a comprehensive, transparent, and objective manner. The IPCC has stated clearly that climate change is inevitable, it is real and happening now and the impact will be felt globally.

“In its current fifth assessment report, the IPCC defines climate change as, a change in the state of the climate that can be identified by changes in the mean

and/or the variability of its properties. These changes in the mean and/or the variability persist for an extended period, typically decades or longer” (IPCC, 2013).

IPCC explains further that climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2013). The United Nations Framework Convention on Climate Change (UNFCCC) also defines climate change as:

“a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UNFCCC, 2001).

The UNFCCC thus makes a distinction between “climate change attributable to human activities altering the atmospheric composition”, and “climate variability attributable to natural causes”.

Climate instability has been observed throughout the history of the earth and according to Pidwirny (2006), this instability is described as climate variability. This is a natural occurrence in climate due to variations in the Earth's orbital characteristics, atmospheric carbon dioxide variations, volcanic eruptions and variations in solar output among others. With the onset of industrialisation, however, there has been a phenomenal increase in concentration of all the major greenhouse gases. Pidwirny (2006) argues that human activities are considered to be one of the main causes of the greenhouse effect, and the consequent warming of the globe. This assertion is supported by Hansen et al. (2006),

who postulate that the average global surface temperature has warmed by 0.8°C in the past century and 0.6°C in the past three decades and all these are attributed to human activities. It is also noted in the fifth assessment report of the IPCC that each of the last three decades has been successively warmer at the earth's surface than any preceding decade since 1850. In 2006, the National Research Council produced a report by the United States National Academy of Sciences (USNAS) which proved that the last few decades of the 20th century were actually the warmest in the past 400 years. In fact, in its fourth assessment report, IPCC (2007) further reiterated in its projections that the continuous increase in greenhouse gas emissions will result in a rapid increase of global mean temperatures of $1.4^{\circ}\text{C} - 5.8^{\circ}\text{C}$ by 2100.

According to IPCC (2007), global mean temperatures have seen an increase of 0.2°C each decade and global mean rainfall has also risen up to 2% in the last 100 years, the effect of anthropogenic climate change. In addition to rising temperatures, glaciers are melting and sea levels are rising. In the polar regions for example, glaciers, ice sheets and sea ice have reduced extensively, entirely affecting polar bear habitat and all natural ecosystems (IPCC, 2013).

1.3 Impact of Climate Change on African Countries

IPCC (2007) has revealed that developing countries are more vulnerable to climate change than developed countries because of the predominance of rain fed agriculture in their economies, scarcity of capital for adaptation measures and the lack of economic development and institutional capacity (IPCC, 2007). Other concomitant factors include widespread poverty, human diseases and high population density, which is estimated to

double the demand for food, water and livestock forage within the next three decades (Davidson et al., 2003).

Muller-Kuckelberg (2012) has indicated that the last century has exhibited a rise in temperature to approximately 1°C, measured on the African continent, higher than the global average. In a report compiled by the African Ministerial Council on the Environment (AMCEN), it shows why Africa is at risk as a result of climate change and climate variability. The report states that, by 2050, average temperatures are predicted to increase by 1.5 to 3°C, and will continue further upwards. In all seasons throughout the continent, warming will be higher than the global annual mean warming. Consequently, the drier subtropical regions will become warmer than the other tropics that are moister. The report goes further to say that ecosystems will also be affected and by the 2080s, the proportion of arid and semi-arid lands in Africa is likely to increase by 5-8 per cent. If this occurs, about 25 per cent and 40 per cent of mammal species in national parks in sub-Saharan Africa will become endangered (IPCC, 2007). The impact will affect rainfall leading to major changes in annual and seasonal trends and extreme events of flood and drought. In 2011, a Ghana report by the USAID stated that the above changes are already being experienced in many parts of the continent with rainfall in Africa having been reduced by 20 per cent to 40 per cent with a 4 per cent reduction in the tropical rainforest zones. Juana et al. (2013) have observed that climate change and variability in Africa has the potential of negatively affecting sustainable development efforts if steps are not taken to respond to its negative consequences.

1.4 Climate Change in Ghana

In Ghana, climate change poses an additional stress for a country already struggling with the challenges of environmental degradation and widespread poverty (Neville & Mohammed, 2010). According to the Ghana Agricultural News Digest (2012), evidence abounds that climatic variability is adversely affecting Ghana's natural resources such as land, water, forests and vegetation, as well as human capital. Over the past decades, the Ghanaian climate has become drier and more variable. Climate change is, therefore, expected to have significant impact on key resource-dependent sectors, such as agriculture, fisheries and food production, and consequently on food security (Ghana Agricultural News Digest (2012).

The noticeable adverse impacts of climate change observed in Ghana include sea level rise, temperature increase and rainfall variability. The mean annual temperature from available data have been shown to increase since 1960 by 1°C, however, there is no indication that extreme rain events have been modified. Nonetheless, increase in temperature and accompanying rainfall variability throughout Ghana has been indicated through the historical observation of climate data between 1960 and 2000 by the Ghana Meteorological Agency (GMet) (Neville & Mohammed, 2010). In addition, Owusu and Waylen (2009) have also reported a reducing trend in mean annual rainfall throughout the country. Owusu and Waylen (2012) have also provided evidence that communities in the transition and coastal savannah zones of Ghana are experiencing climatic changes with both the major and minor rainy seasons getting shorter and the length of the growing season decreasing, resulting in reduced ability of farmers to crop more than once in a year in most places.

1.5 Response to the Impacts of Climate Change

Although regional impacts are highly uncertain, long-term human induced climate change is expected to affect average rainfall and temperature, as well as change the severity and frequency of extreme weather and climatic events (IPCC 2007). According to the IPCC, adaptation and mitigation are the suggested strategies to be followed by policymakers in order to slow down the increasingly faster pace of climatic change and minimize the associated estimated impacts. Both mitigation (reducing emissions and increasing carbon sequestration) of the causes of climate change and adaptation (adjusting to the already changing climate while taking advantage of opportunities) to its impacts are important responses in dealing with climate change. It is important to note that, decisions related to these interventions involve activities or choices at all levels of decision-making, from the most local and community (grassroots) level (including families and individuals), to the broadest international levels, involving national governments (Burton, Feenstra, Smith & Tol 1998).

1.6 Climate Change Information: a necessary tool for awareness

A lack of information regarding climate change is seen by some as a critical barrier in dealing with its effects. Some studies have shown that a limited understanding of climate change can restrict people's ability to distinguish between effective and ineffective response strategies (Neville & Mohammed, 2010). In the United Kingdom for example, the United Kingdom Climate Impacts Programme (UKCIP, 2000) has been set up to address the substantial gap between the environmental knowledge or behavioural intent and actual pro-environmental behaviour through education and communication (Kollmuss & Agyeman, 2002; in Sheppard, 2005). In Japan, public opinion surveys

from 1997, 2002, 2006 and 2007 were compared and reported that people's awareness of matters related to the environment is gradually becoming focused on global warming issues (Aoyagi-Usui, 2008; Sampei & Aoyagi-Usui, 2009; Leiserowitz, 2007).

A critical component in the fight against climate change is effective communication. If the right information gets to the right people at the right time, it facilitates accurate decision making and therefore accurate interventions (Corner, 2011). At every level of society – from ordinary citizens and farmers, to the media, civil society organisations (both local and national) and government – the need for accurate and reliable information about climate change is very important (Corner, 2011). When citizens are clear about climate change and its implications on their lives, they can then respond effectively to it. This will help to identify problems, raise awareness, encourage dialogue, and influence behavioural change (Harvey et al, 2012). How individuals and communities think about, interpret, and discuss the drivers and impacts of climate change differently is a matter of concern in order to have effective communication and appropriate strategies for responding to it (Neville & Mohammed, 2010).

Through the dissemination of relevant information, the knowledge and awareness of climate change will in effect determine the factors that explain people's risk perceptions. Understanding people's perceptions and knowledge of weather and climate is critical for effective communication of scientific forecasts with specific communities and social groups (Harvey et al, 2012). According to Ellis (1998), risk is restricted to situations where probabilities can be attached to the occurrence of events which influence the outcome of a decision-making process. Climate risk perceptions consist of both, risk and uncertainty; there is an element of risk from flood and drought events, while climate

change in general is an uncertain event (Weber, Blais & Betz, 2002). Since, individuals make subjective risk analyses known as their risk perceptions, there is a difference between a layperson's estimate of risk and the actual objective risk calculation. The closer one's risk perceptions are to the actual risk level the more near they are to full information, allowing them to make more efficient decisions (Weber et al., 2002).

1.7 Coastal Wetlands Ramsar Site

Wetlands are defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (International Water Management Institute (IWMI), 2014). Wetlands cover 6% of the world's land surface and contain about 12% of the global carbon pool, playing an important role in the global carbon cycle (IPCC, 1996).

Previously, wetlands were seen as unproductive land which were difficult to access, difficult to farm, and the source of disease and flooding. However, this misconception has changed. Wetlands are now widely recognized as valuable that no other ecosystem can be equated to due to the diverse services they provide, and the biodiversity that they support (IWMI, 2014). The importance of wetlands which make them a critical part of our natural environment include: improvement of natural water quality, flood protection, control of shoreline erosion, opportunities for recreation and aesthetic appreciation and other natural products.

They in addition provide habitat for animals and plants and many contain a wide diversity of life, supporting plants and animals that are found nowhere else. Wetlands provide an important range of environmental, social and economic services. Many wetlands are

areas of great natural beauty and many are important to indigenous people. Wetlands also provide important benefits for industry. For example, they form nurseries for fish and other freshwater and marine life and are critical to Australia's commercial and recreational fishing industries (Australian Government Department of Environment, n.d.) as they are especially important as nutrient-rich habitats for fish spawning and nursery (Ntiamo-Baidu & Gordon, 1991). Wetlands are the vital link between land and water.

Ramsar sites are wetlands of international importance, designated under the Ramsar Convention (Association of Local Government Ecologists (ALGE), n.d., para. 1). The Muni-Pomadze coastal wetland where this study was conducted is found near Winneba, in the Central Region of Ghana. The wetland, located about 56 km west of Accra, is an important habitat for wildlife of both local and global conservation significance. It was designated a Ramsar site in 1992 on the basis of its importance for water birds such waders, terns, gulls, herons, egrets, ducks and cormorants (Ntiamo-Baidu et al., 2000). The wetland is also essentially a source of livelihood to communities within and around the site and is particularly important to the local Effutu people, serving as their traditional hunting grounds, especially during their annual “¹Aboakyer” Festival.

1.7.1 Risks of Climate Change to Wetlands

Climate change is recognized as a major threat to the survival of species and integrity of ecosystems worldwide (Hulme, 2005). Climate change will significantly affect wetlands

¹ Aboakyer: is the annual festival of the people of Effutu (Winneba) in the Central Region of Ghana.

through changes in hydrology, direct and indirect effects of changes in temperatures, as well as land use change (Ferrati et al., 2005).

Wetland systems are vulnerable and particularly susceptible to changes in quantity and quality of water supply. Climate change is likely to have its most noticeable effect on wetlands through changes in ²hydrological regimes: specifically, the nature and variability of the hydro period and the number and severity of extreme events (Erwin, 2008). Warmer water from global warming will also alter the species composition and contribute to worsening dead zones and harmful algal blooms, increase incidence of marine diseases, and expansion of harmful invasive species. Floods, droughts and other extreme weather events will modify water flows, leading to more polluted runoff and lower water quality. Stronger hurricanes and storms threaten to damage coastal wetlands, for example as was evident with Hurricanes Katrina and Rita which destroyed more than 100 square miles of Louisiana's coastal wetlands (National Wildlife Federation, n.d).

Global climate change has the potential to completely alter the structure and function of coastal wetlands. Sea level rise threatens to inundate many coastal wetlands, with little room to move inland because of coastal development (Erwin, 2008). Climate change can be expected to act with a range of other pressures, many of which, depending on the region, may pose far greater immediate concern for wetlands and their water resources in the short to medium term (Scientific and Technical Review Panel of the Ramsar

² Hydrological regimes: changes that with time do occur in the rates of flow of rivers and in the levels and volumes of water in rivers, lakes, reservoirs, and marshes. The hydrologic regime is closely related to seasonal changes in climate. In regions with a warm climate, the hydrologic regime is affected mainly by atmospheric precipitation and evaporation; in regions with a cold or temperate climate, the air temperature is a leading factor.

Convention on Wetlands (STRP), 2002). According to Grundling (n.d.), with the impact of climate change, shifting rainfall patterns will have an influence on wetland distribution and wetlands marginalized at present will come under further pressure.

Wetlands in drier regions are likely to receive less rain and will suffer desiccation and fire. Regions that experience drought followed by intense storms and flooding will face problems of increased erosion. This will pose challenges to future wetland management. Furthermore, unpredictable rainfall patterns with prolonged droughts will make wetlands more vulnerable to land use changes (Grundling, n.d.).

In the Muni- Pomadze Ramsar site, current evidence indicates that the degradation of the wetland could be largely attributable to neglect and unsustainable human activities such as bushfire setting, hunting, farming, fuel wood harvesting and estate development. (Ntiamao-Baidu & Gordon, 1991; Ryan & Ntiamao-Baidu, 2000). This is against the background of the wetland being particularly vulnerable to degradation because of its more extensive (98%) dry land coverage (Amatekpor, 1994) than the other coastal wetlands in Ghana. Additionally, with the impact of climate change, the current situation, if allowed to continue, is likely to result in biodiversity loss from the wetland, consequently diminishing both the local and international significance of the “Aboakyer” Festival as well as impacting extensively on fishing and farming which are the main sources of livelihoods (Wuver & Attuquayefio, 2006).

1.8 Statement of the Problem

Climate change is expected to have serious environmental, economic, and social impacts on climate related activities especially on wetlands in Ghana, Africa and the world at

large, particularly on rural farmers and fishers whose livelihoods depend largely on rainfall and temperature. The extent of these impacts depends largely on awareness and the level of adaptation in response to climate change and variability (Ejembi & Alfa, 2012).

A number of environmental studies have been conducted by various researchers at the Muni- Pomadze Ramsar site regarding biodiversity and conservation. These include: Ntiamoa-Baidu & Hollis (1998); Ntiamoa-Baidu (1991); Ntiamoa-Baidu & Gordon (1991); Gordon (1994, 1995); Oteng-Yeboah (1994); Amatekpor (1994); Tumbulto & Bannerman (1995). Recently too, another study has been conducted by Egyir et al. (2015) in the context of adaptive capacity and coping strategies in the face of climate change of some selected towns in the ramsar site.

Knowledge and awareness of climate change, and the perception that people have about it is very important because it has direct implications on how people respond to it. The capacity of both farmers and fishermen to adapt to climate change can be significantly influenced by the level of awareness and perception they have about it in their communities. While attention has been on the environment, biodiversity and conservation studies, little attention has been paid to climate change knowledge, awareness and risk perception concerning the people living around the Muni-Pomadze Ramsar site. Yet, factors that influence the awareness, risk perception level, and the adoption of climate change adaptation strategies are important to look at.

1.9 Objectives of Study

General Objective

The overall objective of the study is to explore the awareness level, risk perception and adoption of adaptation strategies of climate variability/ change among local people living around the Muni-Pomadze Ramsar site.

Specific Objectives

The specific objectives of the study are:

- To assess the awareness and knowledge level of climate variability /change among local dwellers around the Ramsar site.
- Determine the factors that influence peoples' risk perception pertaining to climate change and variability.
- Assess the factors which will influence the adoption of adaptation strategies and consequently lead to proper adaptation measures by the people in the study area.

1.10 Research Questions

The study seeks to answer the following questions:

1. What is the level of awareness of climate change and variability in the study area?
2. What are the factors influencing the risk perception level of climate variability and change among the people in the study area?
3. What are the factors influencing the adoption of climate change and variability adaptation strategies by the people in the study area?

1.11 Justification of the Study

Climate change poses a significant threat to lives and livelihoods in Ghana. Very few studies have been done pertaining to climate change knowledge, awareness and risk perception. This study is significant because it would add to the knowledge of existing literature pertaining to climate change and variability. It will also fill the gap in climate change knowledge and awareness, risk perception and adoption of climate change adaptation strategies. Since climate change is location specific, this study would also give insight to the government, extension officers and non-governmental organizations about the provision of adaptation strategies that are appropriate for the communities.

1.12 Organization of the study

The study is organised into five chapters. Chapter one comprises the background, the statement of the problem, objectives, significance and organization of the study. Chapter two reviews existing literature which is in line with the study objectives. In addition, the theoretical and conceptual frameworks underpinning the study would be discussed. Chapter three is made up of the study area, sampling procedures, sample size, research design, research instruments, field work and administration of data and data analysis. Chapter four presents results from the data obtained using tables and charts and provides a discussion of the analysis of results in relation to the literature reviewed. Finally, chapter five looks at the summary, major findings and conclusion of the study. It also includes recommendations of the study based on the findings which will serve as a guide for policy makers and enhance future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Since this study is intended to explore the knowledge and awareness level, risk perception and adoption of adaptation strategies of climate variability/ change among local people, this chapter discusses a number of key concepts, reviews scholarly works of related literature published in journals, books and on the websites as well as from other grey material. In addition, theoretical and conceptual frameworks underpinning the study are discussed.

2.2 Knowledge and Awareness of Climate Change

Public awareness and knowledge on climate variability and change is crucial in combating climate change and related problems. Knowledge and awareness are important to make the necessary preparations towards the understanding and showing of effective response to one's changing climate. Ajzen (1991) posits "Knowledge is often believed to be a background factor that influences a person's attitude toward a certain behavior". Given the known association between attitude and behavior, Armitage and Connor (2001) opined that knowledge is assumed to influence behaviour through a mediating variable. The idea behind the attitude behavior relationship is that the more people know about and understand the connections between their own behaviour and a range of environmental threats, the more likely it is a person will adjust their behaviour accordingly, (van der Linden, 2014). Quite recently in 2012, the Climate Outreach and Information Network (COIN) conducted a study on public perception of climate change in Europe and North

America, and the results showed that over the past decade, public opinion about climate change has become increasingly well documented. Awareness about climate change is very high, and a number of surveys have shown that the British, European and North American members of the public express substantial concern about it.

Climate change is a critical issue and a sound public knowledge and awareness is required to address the problem (Acquah, 2011). A positive response to climate change will be displayed by how well it is understood by its people. It is very crucial therefore that the needed information is provided. When governments, Non-governmental Organisations (NGOs) and the media are comfortable talking about climate change, they will be able to communicate it effectively to citizens. When citizens understand clearly all about climate change and its implications for their lives, they will respond effectively to it. If people become equipped with the knowledge that weather patterns are changing, and that extreme weather events are more likely to occur, they will be able to debate the issues with their families, communities and governments, and discuss the risks and possible courses of action. This will enable them prepare more effectively for the future (Neville & Mohammed, 2010).

According to Boykoff and Rajan (2007), the media is a prominent and integral source for acquiring information about climate change. The way that information about climate change is framed and communicated can significantly influence the public's knowledge, attitude and perception, (Sampei & Aoyagi-Usui, 2009; Sharples, 2010). The Project for Excellence in Journalism, in 2006 outlined that in many public opinion surveys, television and daily newspapers are used as primary sources of information. In Japan, Aoyagi-Usui (2008) revealed that most of the Japanese public gets its information about

environmental issues from television and daily newspapers. Several European countries, including the Netherlands and United Kingdom, have used the mass media for their national campaigns for Green House Gas (GHG) emission reduction (DEFRA, 2007).

Many people see climate change as a very complex and mysterious global hazard as such it becomes difficult to communicate the concept to various publics (Moser & Dilling, 2004). Leiserowitz (2006) in a study of public perception on climate change has revealed that many people misunderstand the science of climate change and, in particular, are confused about the nature, causes and consequences of climate change. Brechin (2003), also outlined that the depth of understanding of climate change issues depends largely on individual characteristics such as educational level, age, gender, occupation and ethnic origin.

In Africa however, many people are aware of changing weather patterns but are particularly misinformed about global climate change (Taderera, 2010). This is attributed to limited awareness campaigns on one hand and the fact that African countries have got too many problems ranging from poverty to political conflicts on the other hand (UNFCCC, 2007; UNDP, 2007) hence climate change is not a priority issue. Research conducted by Neville and Mohammed (2010) revealed that observable changes in the weather and seasons constitute most Africans' knowledge of climate change even though they live with the impacts of the changing climate in their day-to-day lives. Changes in climate are not noticed in isolation from broader environmental changes. Many people are aware of the deterioration and degradation of the environment and the depletion of natural resources. In fact, the research revealed that many people in Africa generally appear to make little distinction between environmental degradation and climate change,

(Neville & Mohammed, 2010). For most Africans, changes in the weather and seasons form part of the broader changes people have observed over the course of their lifetimes. The research showed again that while most Africans are aware that weather patterns are changing, their understanding of global climate change is limited. Climate change terminology is poorly understood and does not have standard translations in the African languages. It is often literally interpreted as ‘changes in weather’ (Neville & Mohammed, 2010). There is also a limited understanding of the role that rising levels of greenhouse gases play in causing climate change. While awareness of environmental degradation is high, especially among urban dwellers and those in affected communities, it is often not understood in the context of climate change.

To corroborate the above revelation, Ejembi and Alfa (2012) in a study conducted on perceptions of climate change in Africa reported that despite the evidence of a general awareness, there were diverse and mixed views about the causes and indicators of climate change across and within communities in Africa. The impacts of climate variability among African communities are highly differentiated according to land tenure, traditional beliefs, resource availability and gender (Ejembi & Alfa, 2012).

The perception of climate change and variability among farmers and fishers in Ghana cut across all categories of social groups and locations (Yaro, 2013). Climate change and variability is one of the most important problems confronting their activities. In a study conducted among small-scale and commercial farmers, Yaro (2013) reported that both groups of farmers have knowledge about climate change except that commercial farmers have a more in depth understanding of climate change than peasant farmers. The small-scale farmers explain climate change as ‘when the rains are too little or too much which

affect our crop yields’, and the commercial farmers describe it as ‘changes in rainfall and temperature or sunshine within/between growing seasons and years. Their experience of the elements of the weather informs their perceptions of climate change (Yaro, 2013). Each group of farmers is aware of climate change but have their own attribution of its causes which range from natural normality to religious causes. While small scale-farmers attributed social and religious/moral reasons for changing climate, the commercial farmers stated more environmental causes in line with scientific explanations of the causes (Yaro, 2013).

In another study conducted among cocoa farmers in Ghana by Codjoe et al., (2013), it was evident that the farmers, to some extent, are aware of climate change. However, the findings showed that the farmers’ perception of the main causes of climate change include: God’s plan signifying the end of time; usage of heavy machines on land; air and water; deforestation; indiscriminate bush burning before farming or in search of game; farming alongside river bodies and illegal mining. From the responses, there is an indication that these farmers, including many others like them, have the knowledge but as rightly assessed by Neville and Mohammed (2010), the need for more education on the scientific causes of climate change must be done. This means that the campaigns and programmes regarding climate change, and measures to combat it should be intensified for better preparedness.

In effect, improved understanding of public perceptions about global warming can contribute to inform scientific and policy discussions of climate change. Scientists need to know how the public is likely to respond to climate impacts or initiatives, because those responses can attenuate or amplify the impacts. Policy makers need to know what

the public wants, in order to design policies that will be supported or at least tolerated. Both groups need to understand the extent to which people's responses will differ across regions.

2.3 Impact of Climate Change on Rural Livelihood

Agriculture remains the prime source of livelihood for rural communities in Sub-Saharan Africa, providing employment to more than 60 percent of the population and contributing about 30 percent of gross domestic product (Nhemachena & Hassan, 2007). As noted in the fourth assessment report of the IPCC, climate change is likely to have a significant effect on agricultural production in many African countries (Below et al., 2010). With the incidence of long-term changes in rainfall patterns and shifting temperature zones, climate change is expected to significantly affect agricultural production, which could be detrimental to the region's food security due to the fact that their livelihood activities are climate dependent (Nhemachena, 2007). Doss and Morris (2001) said that the perspectives of the indigenous people, the way they think and behave in relation to climate change, as well as their values and aspirations have a significant role to play in addressing climate change.

According to Below et al., (2010), climate change will have significant effect on agriculture and this will also impact significantly on the livelihoods of the rural poor in developing countries since the rural folks are engaged in agricultural activities. Although climate change has substantial effect on agriculture and rural livelihoods, certain agriculture and forestry practices can support climate mitigation whilst improving rural livelihoods (Darko & Atazona, 2013). Some rural livelihood activities such as charcoal production and firewood collection have large environmental cost and can lead to climate

change. In order to help mitigate climate change and improve rural livelihoods, alternative sources of energy like biogas and solar energy which are renewable sources of energy need to be introduced and at a low cost, thereby helping to minimize certain activities that lead to climate change among rural folks.

2.4 Adaptation to climate change

Iddrisa et al, 2012, cited Tol (1998) as explaining adaptation to mean the adjustments in ecological, social, and economic systems as well as response to climatic conditions and their effects. According to the IPCC (2013), adaptation is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects. The United Nations Development Programme (UNDP, 2005) reiterates that adaptation entails a process by which measures and behaviors to prevent, moderate, cope with, and take advantage of the consequences of climate events are planned, enhanced, developed, and implemented. From the point of view of the International Union for Conservation of Nature and associates, (IUCN et al., 2004), adaptation is the ability to respond and adjust to actual or potential impacts of changing climate conditions in ways that cause moderate harm or takes advantage of any positive opportunities that the climate may afford.

Adaptation includes policies and measures to reduce exposure to climate variability and extremes, and the strengthening of adaptive capacity. Adaptive capacity here refers to "the ability of a (human) system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (FAO, 2008). Adaptation can be anticipatory, where

systems adjust before the initial impacts take place, or it can be reactive, where change is introduced in response to the onset of impacts (IUCN et al., 2004).

Adaptation should include local actions taken by the people themselves in response to changing market or environmental conditions. The process of adaptation includes learning about risks, evaluating response options, creating the conditions that enable adaptation, mobilizing resources, implementing adaptations, and revising choices with new learning (IUCN et al., 2004). Adaptation activities can be of different types from the purely technological (such as sea defence construction), through behavioural (such as shifts in choice of food or recreation), managerial (such as changes in farming methods) and policy (such as planning regulations). This is because people's taste and preference has changed due to globalization. (Environmental Protection Agency (EPA) et al., unpubl. data).

2.4.1 Adoption of Adaptation Strategies

Adoption of agricultural technologies in agriculture is considered to be synonymous with the adaptation strategies that farmers undertake in the fight against the adverse effects of climate change (Nhemachena & Hassan, 2007). Gbetibouo (2008) has reiterated that the extent to which the adverse impacts of climate change are felt depends in large part on the extent of adaptation in response to climate change. Without adaptation, climate change would be detrimental to the agricultural sector, but with adaptation, vulnerability can be significantly reduced. Thus, farmers' ability to perceive climate change is a key precondition for their choice to adapt (Gbetibouo, 2008). The capacity of farmers to adapt to climate change can be significantly influenced by the level of awareness about climate

change in their communities. In this regard, Tol (1998) suggests that awareness about climate change has great capacity to drive farmers to improvise local technologies to aid adaptation. Kartz and Brown (1992) and Selvaraju et al. (2006) found some adaptation practices commonly used by farmers in response to climate change to include water harvesting, early planting, deep planting, planting of cover crops, application of mulch to conserve moisture, planting of draught tolerant crops, planting of early maturing crops, alley farming, and enterprise diversification.

Evidence abounds that farmers can adapt to climate change by changing their agricultural practices, which may include planting tolerant crop varieties or changing husbandry practices (Katz & Brown, 1992). Adaptation may also involve blending scientific practices with local/traditional knowledge. Aydinalp and Cresser (2008) indicated that crop productivity will be altered due to weather events and changes in the pattern of pests and diseases. Although several studies have been carried out on farmers adaptation to climate change in developing countries, these studies do not look at the effect of awareness and how it is linked to adaptation to climate change (Badi, 2010; Nhemachena, 2007; Selvaraju et al., 2006).

Maddison (2006) showed that on the surface, African farmers seem very good at detecting climate change, which is a basic precondition for adaptation. He cautions however, that some farmers might agreeably suggest they had witnessed particular forms of climate change when in reality they have not. It is imperative therefore to validate findings by considering whether responses coincide with that of fellow farmers; and the meteorological evidence; before conclusion could be made that African farmers are as perceptive to changes in climate as they claim.

On the whole, there are important differences in the propensity of farmers living in different locations to adapt and there may be institutional impediments to adaptation in certain countries. Although large numbers of farmers perceive no barriers to adaptation, those that do perceive the barriers tend to relate them mostly to poverty and inability to borrow. Maddison (2006) has indicated that adaptation to climate change actually involves a two-stage process: first perceiving that climate change has occurred and then deciding whether or not to adopt a particular measure. He concludes that improved farmer education and provision of free extension advice are some of the factors which would very much quicken and promote adaptation.

Oyekale (2009) asserted that the entire human condition is likely to be affected by climate change due to a decrease in water availability, especially in arid regions and this makes adaptation a necessity. Blaikie et al., (1994) have stated that some social factors influence both the vulnerability and adaptation to climate change. In the same vein, previous studies have highlighted the role adaptation options such as access to credit and extension services play in the recovery from stress and disruption of livelihood (Nhemachena, 2007; Adger & Kelly, 2001). Oyekale (2009) said that through conditions of hazard exposure and vulnerability, poor countries disproportionately suffer climate change disasters. The small-scale farmer still suffers most because of his dependence on rain-fed agriculture and a lack of capacity to diversify. Idrisa et al., (2012) pointed out that farmers react to climate change through adaptation. In an analysis of adaptation to climate change in the drought prone areas of Bangladesh, Selvaraju et al. (2006) found that the main adaptation strategies practiced by small-scale farmers were in the form of

modification of agronomic practices and in the choice of crop varieties that tolerate the new regime.

Apart from farmers, fisheries and fisher folk may be impacted in a wide range of ways due to climate change. Fisheries are exposed to a diverse range of direct and indirect climate impacts, including movement and relocation of human populations; impacts on coastal communities and infrastructure due to sea level rise; and changes in the frequency, distribution or intensity of tropical storms (Daw et al., 2009). The vulnerability of fisheries and fishing communities depends on their exposure and sensitivity to change as well as the ability of individuals or systems to anticipate and adapt.

Adaptation to climate impacts in the fisheries sector includes reactive or anticipatory actions by individuals or public institutions. These range from abandoning fisheries altogether for alternative occupations, to developing insurance and warning systems and changing fishing operations (FAO, 2007a). Governance of fisheries affects the range of adaptation options available and will need to be flexible enough to account for changes in stock distribution and abundance. The capacity to adapt to climate change is not dispersed equally across and within fishing communities. It is determined partly by material resources and more especially by networks, technologies and appropriate governance structures (FAO, 2007a). Patterns of vulnerability of fisher folk to climate change are determined both by this capacity to adapt to change and by the observed and future changes to ecosystems and fisheries productivity. Building adaptive capacity can reduce vulnerability to a wide variety of impacts, many of them unpredictable or unforeseen. The key role for government intervention is to facilitate adaptive capacity

within vulnerable communities (FAO, 2007b). There is a wide range of potential adaptation options for fisheries, but considerable constraints on their implementation for the actors are involved, even where the benefits are significant.

On Ghana's coast, since coastal residents' occupations depend primarily on the marine fishery resource, livelihood vulnerabilities are tied to threats confronting this resource. Vulnerabilities of the marine fishery resource are multi-faceted with or without considerations of climate change. Climate change-related threats often increase pre-existing human induced threats to the system. Potential climate change-related threats confronting the marine fisheries include a potential rise in sea level, increased ocean temperatures, and perhaps most threatening, changes to the seasonal upwelling patterns (EPA, 2003). On the other hand, there are persistent human-induced threats such as increased pressure on the fisheries as a result of a drastic increase in fleet size; changes in water quality from pollution caused by ineffective waste water treatment plants, agricultural runoff, and aerial mosquito spraying; destruction of mangrove, lagoon, and wetland systems that previously played important nursery roles for juvenile fish. Others include a shift towards more destructive fishing practices and a lengthening of the harvest season. These actions reduce the potential for stock recovery; sand harvesting practices coupled with the construction of sea walls or harbors that disrupt near shore currents and interfere with natural sedimentation cycles; and a general lack of management, regulation, or monitoring of any sort within the industry (EPA, 2003; CRC, 2010; Nelson & Agbey, 2005). Stanturf et al. (2011) conclude that, the general outcome of these combined threats is an overall decline in the marine fishery in Ghana.

Adaptation to climate change in Ghana calls for measures that reduce the vulnerability of natural resources and people to its impacts, increase people's ability to adapt to the long-term challenges posed by climate change (their adaptive capacity), and strengthen people's ability to absorb, cope with, and recover from unexpected changes that result from climatic events (resilience) (Ensor & Berger, 2009). Ensor and Berger (2009) suggest two important factors that need to be considered which will promote climate change adaptation. First and foremost is an understanding of the biophysical effects of climate change such as increased drought, unreliable rainfall, rising sea levels and flooding, in specific places. This will give an informed situation of what has already occurred and what is expected to occur. Secondly, an understanding of the nature of social and environmental vulnerability in a given place must also be examined. This will determine how and why people are susceptible to the adverse effects of climate change. It is obvious from the above that adaptation strategies are most likely to be effective if they are developed using a community-based approach that takes into account the local circumstances of specific communities (Stanturf et al, 2011).

Adapting to climate change is vital in order to remain productive and competitive. Adaptation to climate change for food production activities such as farming, livestock rearing and fishing will require a shift to new and appropriate production methods and techniques, in order to counter the ameliorating effects of adverse climatic conditions on land, water and human capital, which are key inputs in food production (FAO, 2010).

2.5 Perspectives on Risk and Risk Perception

Modern society has been preoccupied with the notion of risk (Renn, 2002). Future events are unavoidable but it depends on society to have the intellectual capability and the moral

obligation to shape the future and to protect its members. Risk is a complex variable term, the implications of which people are confronted with daily in the shape of threats and hazards; to others it offers opportunities and challenges (HeinBen, Sautter & Zwick, 2002).

Many definitions have been given to explain risk but in all of it, the underlying factor is that, there is the likelihood of an individual experiencing the effect of danger (Short Jr, 1984). Rayner and Cantor (1987) also define risk as the probability of an adverse effect and the magnitude of its consequence. All risk concepts have one element in common; a distinction between reality and possibility. An issue about the uncertainty of a situation arises when dealing with risk. In that sense, Rosa (2003) defined risk as “a situation or an event where something of human value (including humans themselves) is at stake and where the outcome is uncertain”. Hence, uncertainty is closely related to risk and in many theories of behaviour, psychological uncertainty is assumed to be an important mediator of human responses in situations with unknown outcomes. Uncertainty is a psychological construct. It “exists only in the mind; if a person’s knowledge was complete, that person would have no uncertainty” (Windschitl & Wells, 1996).

Risk means different things to different people. As such, the actions and understandings of people about risks are influenced by their social and cultural ideas and assessment of what the world looks like, what it should or should not be (Boholm, 1998). Risk perception looks at how individuals assess the risky situations they encounter. It is the subjective assessment of the probability of a specified type of accident happening and how concerned one is with the consequences. To perceive risk includes evaluations of the probability as well as the consequences of a negative outcome. Perception of risk goes

beyond the individual, and it is a social and cultural construct reflecting values, symbols, history, and ideology (Weinstein, 1980).

Pidgeon et al. (1992) in defining risk perception, quote from the Royal Society's landmark 1992 report on risk, as 'people's beliefs, attitudes, judgments and feelings, as well as the wider cultural and social dispositions they adopt towards hazards and their benefits.' This definition reflects a complex development of the myriad of studies that have been conducted on the phenomenon of risk perception. Studies of risk perception examine the judgments people make when they are asked to characterize and evaluate hazardous activities and technologies (Slovic, 1987). Slovic (1987) further reiterated that individuals form intuitive judgments about potential risk hazards and these judgments are commonly known as one's risk perceptions. According to Raden-Fessenden and Heath (1987), people base their perceptions upon their personal experiences, knowledge and character.

Social scientists have found that public risk perceptions strongly influence the way people respond to hazards. Public risk perception research was developed in an attempt to explain and close the gap between expert and lay perceptions of risk (Bickerstaff, 2004). This has created a distinction between objective or statistical risk on the one hand and subjective or perceived risk on the other. Objective or statistical risk refers to risk as defined and measured by experts, for example through experimental studies, epidemiological surveys or probabilistic risk analyses. Subjective or perceived risk typically refers to non-expert or 'lay' misperceptions or misunderstandings of that (objective) risk (Bickerstaff, 2004).

Human responses to environmental issues have been broadly categorised as cognitive (related to knowledge and understanding), affective (related to feelings, attitudes, and emotions), behavioural (related to changes in behavior of the viewer), and physiological (biological or physical effects on the observer's body (Zube et al., 1982, as cited in Falaki et al., 2013). Stedman (2004) opined that perception determines the social mental picture of climate change, however, a number of other variables like socio-demographic and socio-economic factors or ideological orientations influence perception and the mental picture of climate change (as cited in Falaki et al., 2013).

Reports from numerous public opinion polls conducted in America since 2000 show that a large number of Americans are aware of global warming. In spite of this circumstantial evidence, Americans continue to regard both the environment and climate change as relatively low national priorities. Paradoxically, they seem concerned about global warming, yet view it as less important than nearly all other national or environmental issues. This goes further to validate the notion that public risk perceptions are influenced not only by scientific and technical descriptions of danger, but also by a variety of psychological and social factors, including personal experience, affect and emotion, imagery, trust, values and worldviews – dimensions of risk perception that are rarely examined by opinion polls (Slovic, 2000).

Risk perception does not always cause individuals to adopt safe behaviors. The simple reason is that perceptions can be biased, and thereby result in distorted risk assessments (Kouabenan, 2002, cited in Sjoberg et al., 2004). Such biases, for example, can lead people to underestimate or overestimate the risks they are facing. This work will use experiences of local peoples' awareness of climate change and climate variability issues.

2.6 Risk Perception Theories

The risk field is a patchwork of many different schools and perspectives. Several theories and frameworks have been developed by various experts and researchers to explain risk perception. These include: Social Amplification, Bayesian Learning, Social Learning and Cultural Theory, among others.

The social amplification of risk shows that how people view risk is influenced by their values, attitudes, social influences and cultural identity. Renn et al. (1992) for example, describe it as how peoples' social and psychological perceptions and beliefs affect their interpretation of events which influences their response to the information received. While the Bayesian learning models assumes that one's risk perceptions depend on the information one has at a certain time (Smith & Johnson, 1988), the social learning theory is based on the idea that learning is not only done by doing, but also by watching (Bandura, 1977). Learning by doing, such as one's experience in dealing with shocks influences their perceptions (Wahlberg & Sjoberg, 2000). An example of learning by watching others is when individuals use local indicators/knowledge to understand how to manage under climate variability (Rees, 2009).

Another group of proponents on the risk theory, the cultural theorists, believe that individuals choose what to fear in order to support their lifestyle (Wildavsky & Dake 1990). Douglas and Wildavsky who advocate this theory classify people as egalitarians, individualists, hierarchists, and fatalists to determine people's risk perceptions. Cultural theorists argue that social values and worldviews also play an important role in risk perception and behavior, (Leiserowitz, 2006). This work is however guided by the social

amplification of risk framework as concepts discussed therein bear some relevance to the study.

2.6.1 The Social Amplification of Risk Framework (SARF)

The basic theoretical ideas for Social Amplification of Risk Framework (SARF) were first developed by Roger and Jeanne Kasperson and collaborators in 1988 (Renn, 2011). The central idea behind the social amplification framework is that an adverse event, in this case an accident or act of terrorism, interacts with psychological, social, institutional, and cultural processes in ways that may amplify (or attenuate) community response to the event (Kasperson et al., 1988). According to this theory, the effects of an accident or act of terrorism sometimes extend far beyond the direct damages to victims, property, or environment and may result in immense indirect impacts. When a mishap occurs, information flows through various channels to the public and its many cultural groups. This information is interpreted largely on the basis of its interaction with the above processes. This interaction, in turn, triggers risk-related behavior. Such behavior, together with the influence of the media and special interest groups, generates secondary social and economic consequences that eventually call for additional institutional responses and protective action (Burns et al., 1993). This study found SARF useful because it provides a heuristic tool for the analysis of risk experience. One can also think of it as a dynamic framework that allows for systematic interpretation of empirical data while attempting integrating differing perspectives on risk.

The concept of SARF was developed at a time when there were only two main approaches on risk perception namely the psychometric model within the psychological

risk concepts and cultural theory among the social science perspectives (Renn, 2011). These two seemed inadequate to capture the complex risk experience of individuals and social entities. There was therefore the need for an integrative theory of risk, hence the development of SARF (Renn, 2011). SARF is also used, more narrowly, to describe the various dynamic social processes by which certain hazards and events seen to be relatively low in risk by experts can become a particular focus of concern and socio-political activity within a society (risk intensification), while other more serious hazards receive comparatively less attention (risk attenuation) (Pidgeon & Barnett, 2013). Examples of significant societal hazards subject to social attenuation of risk perceptions in the past include smoking, radon gas or climate change.

According to Renn et al. (1992), the concept of social amplification is not a theory in the classical sense; however, it provides a conceptual framework for selecting, ordering, and classifying social phenomena, and suggesting theoretical relations that can be investigated empirically. SARF provides a basis for analyzing risk experience, creates a strong background that aids the logical clarification of empirical data and attempts to integrate the existing perspectives on risk (Renn et al., 1992). It is a concept that should be used to define new research areas, generate hypotheses and ideas for studying risk experiences, identify links among different research perspectives, and provide a terminology that allows comparisons of results from varying disciplines and research camps (Renn et al., 1992).

A general perception about the social amplification concept is that how people view risk is influenced by their values, attitudes, social influences and cultural identity (Renn et al., 1992). Thus, when an event occurs, the message is interpreted and individuals respond to

the risk information. The individuals act as an amplification station through their behavioral and communication reactions in response to an event (Renn et al., 1992). Therefore, individual characteristics such as gender or education may influence how individuals' perceive and react. Amplification in this framework denotes both intensifying and attenuating signals about risk. Amplification stations can include both individuals and social units; for example, scientists or scientific institutions, reporters and the mass media, politicians and government agencies, or other stakeholder groups and their members.

Five variables have been used to measure the amplification process and these include: physical consequences, media coverage, individual perceptions, public response and socio-economics (Renn et al., 1992). Physical consequences involve the risk events that expose humans or the environment to physical harm. In relation to this study, these are the adverse effects of changes in climate variables such as temperature and precipitation. Media coverage involves the means through which the events are communicated to the public by way of creating awareness. In this study, the sources of information include radio, television, older fisher folk and farmers, among others. The individual perceptions explore how individuals view the effect of the event and its impact on their livelihood. In relation to this study, individuals perceive climate change as a risk to their livelihoods which are mainly farming, fishing and fish mongering. Public response is about the individual behavior intentions and group mobilization potential. This shows how the public will react to the climatic event in order to adopt some adaptation strategies to mitigate the situation. In this study, people in the study sites have adopted various adaptation strategies to reduce the impact of climate change. In this study the socio-

economics looks at local impacts and loss of livelihoods which generally affects economic activities. Kasperson’s model shows how each of these variables relate with one another (Figure 1).

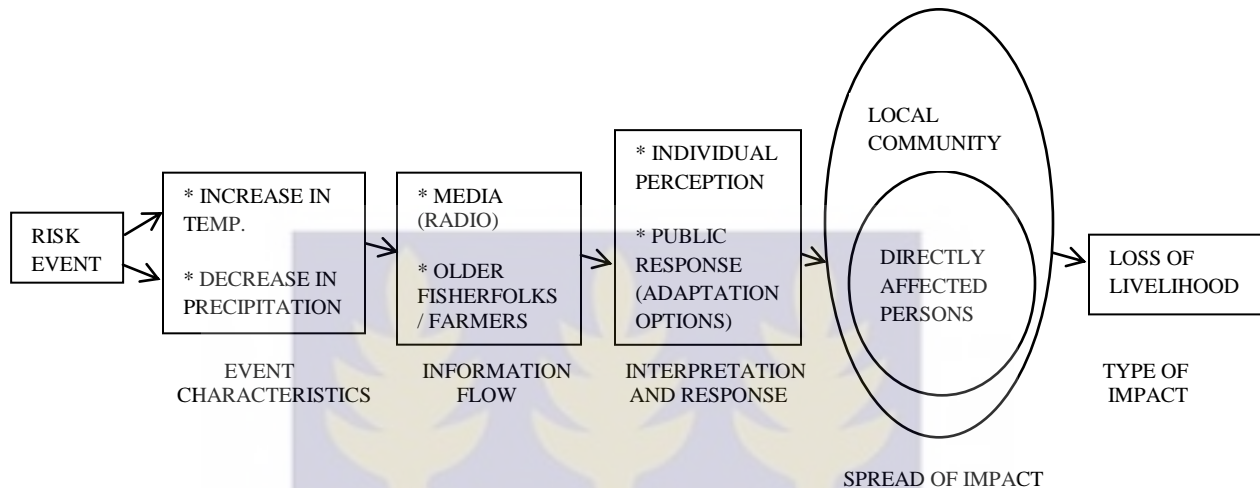


Figure 1: A simplified representation of the social amplification of risk and potential impacts on a local community

Source: Adapted from: Kasperson et al., (1988, p.182)

2.6.2 Arguments over SARF (Strengths and Weakness)

Various authors on the bases of its ontology and account of social processes have criticized the SARF framework. Prominent among them is Wahlberg (2001) who criticized SARF on the grounds that it is not a theory because it lacks most of the features of a theory and in addition, does not generate testable hypotheses. Wahlberg (2001) argues further that, social amplification may be perfectly valid, and its assumptions describe what happens in reality, but unless further assumptions are made which state at least which way a reaction should go under certain circumstances, the framework has no predictive power, and is not possible to verify. This position was also supported by Burns et al. (1993) who argue that founders of the SARF initially described it as only a

framework. However, after five years, they called it a theory and concluded that the framework is sociological instead of psychological.

Before Burns et al. (1993) report, Renn et al. (1992) had asserted that it is hard to know exactly what the framework describes, as it pools different kinds of phenomena under a single name; ‘risk is conceptualized in the framework partly as a social construct and partly as an objective property of a hazard or event.’ This implies that it is not possible to ascertain whether in a given instant, the term social amplification refers to, for example, information, actions by companies, or risk perception by individuals.

From the point of view of this study, the above critiques seem to miss an important point. The approach only tries to offer an overall framework within which work from a range of disciplinary backgrounds and middle-range theories of human cognition and communication, attitude change, the influence of mass media and so on operate, rather than a tightly-defined theory (Renn et al., 1992). In support to Renn et al. (1992), Rosa (2003) categorically states that, the framework implicitly espouses the realist conception of risk that underlies all work that makes a strong objective/subjective distinction. Pigeon and Barnet (2013) also added to the observation made by Rosa (2003) that the main advantage of the framework is that it is clear in bringing into the limelight a necessary tension, often embedded within many social sciences risk studies, that while many hazards are real enough, our knowledge of them can only ever be constructed through social processes.

2.7 Adapting SARF (A Conceptual Framework)

Renn (2011) has suggested that several empirical applications of SARF have been reported, and the results have been used to refine the framework. There are three core areas in this study which are: climate change awareness, risk perception and adoption of adaptation strategies. The diagrammatic representation in figure 2 shows how these core areas are linked together. Climate change poses a significant threat to the environment, agriculture and food security in most developing countries including Ghana, mainly through increasingly variable weather patterns. In particular, rural farmers whose livelihoods depend on the use of natural resources, are likely to endure the most of adverse consequences (de-Graft Acquah & Onumah, 2011). The knowledge and awareness of climate change is therefore very timely. Once there is awareness, the consequences of the situation become obvious, hence the perception of risk. The factors from the point of view of the Social Amplification of Risk Framework (SARF) that amplify the perception of risk include physical consequences, media coverage, individual perceptions, public response and socio-economic impacts. These have already been well-explained in the theoretical framework. To forestall the imminent danger, measures need to be implemented to avert or curtail the gravity of the impact. This brings about the adoption of adaptation strategies.

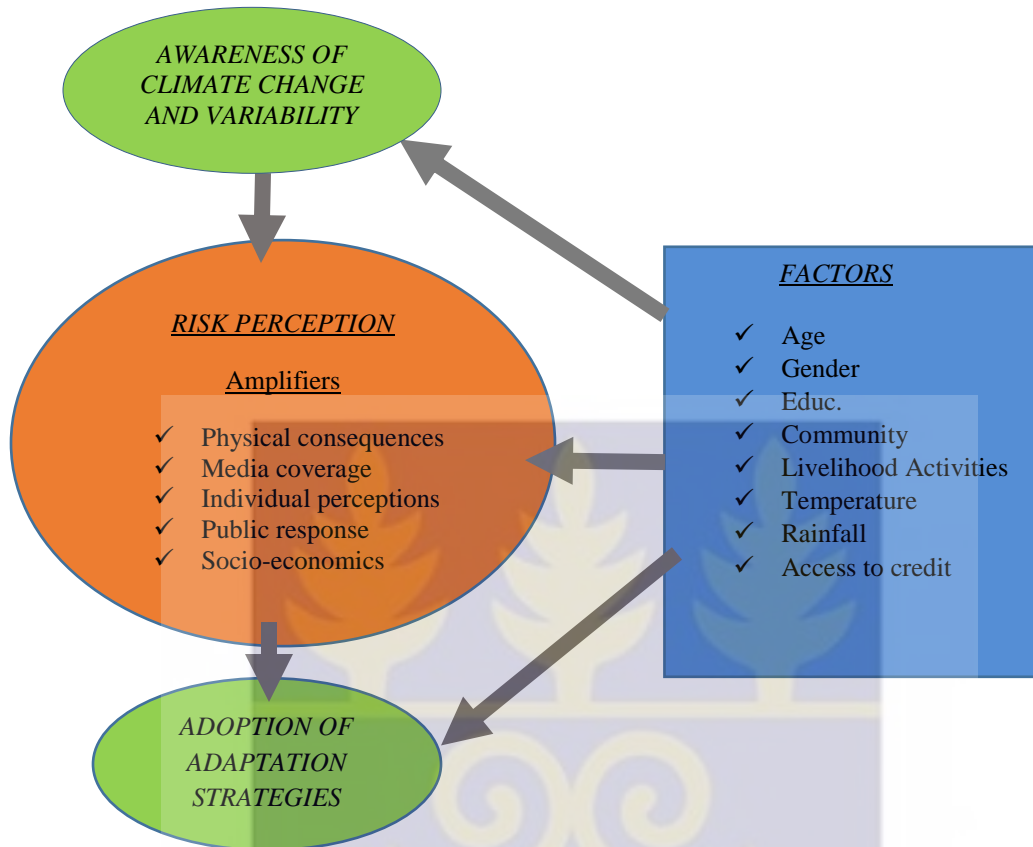


Figure 2: Diagrammatic representation of the conceptual framework of the study

Source: Author's modification of ideas based on SARF.

In addition to the core areas, there are corresponding variables (factors) which link up to each of the core areas. The variables include age, gender, education, adaptation strategies (alternative livelihood activities), community, temperature, rainfall and access to credit (Figure 2). These variables are very essential and may influence awareness and perception levels and then subsequently determine adoption of adaptation measures. For instance, a person's age, gender and educational level could influence their level of awareness as well as their perceptions of risk and in turn, their choice of adaptation options.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter discusses the methodology that was used in the study. It seeks to give an overview of the procedures and techniques that were utilised in a step by step approach in undertaking the study. The chapter therefore describes the study area, explains the research design adopted, the sampling techniques and instruments of data collection used, and also how the data were analysed.

3.2 Research Approach/ Method

The mixed method approach was used in this study. It is a combination of both quantitative and qualitative research methods (Johnson et al., 2007). This method is meant to give a comprehensive report of the result as the mixed method offsets the weaknesses of both methods and draws on the strengths of both. The central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone (Creswell & Plano Clark, 2007). This study investigates climate change awareness and risk perception of people living within the Muni-Pomadze coastal Ramsar site. The mixed method was therefore chosen as the best method to meet the research objectives and answer the research questions. Collection of data for both qualitative and quantitative data was done simultaneously and the results put together for a comprehensive data analysis (Creswell, 2009).

Quantitative data was obtained from both questionnaire survey and secondary source of data consisting of rainfall and temperature records from the GMet. This was to compare with respondents' view on the changes about climate variability/ change they have observed and to assess if the changes are actually due to changes in climate in the communities around the Muni-Pomadze Ramsar site.

The qualitative data was obtained from Focused Group Discussions and In-Depth Interviews. This was meant to supplement the quantitative data and the understanding of people's awareness and risk perception of climate variability/ change related issues.

3.3 Study Area

The Muni-Pomadze Ramsar site is one of the five coastal Ramsar sites in Ghana. It is situated to the west of the coastal town of Winneba in the Central Region of Ghana, approximately 55km from Accra. The site covers an area of 90km² of the watershed (Kyerematen et al., 2014). Two protected areas, the Yenku block A and B Forest Reserves make up 10 per cent of the site and the traditional hunting areas of the Efutu people make up 15 per cent of the site (Ryan & Ntiamoah-Baidu, 2000). The study was carried out in three selected communities located within the site namely; Winneba (specifically Penche Beach and surrounding communities, and the main market), Bewadze and Mankoadze (Figure 3).

The approximate boundaries of the site lie between latitude 5⁰ 19' – 5⁰ 27' and longitude 0⁰ 37' – 0⁰ 41' E. It is bounded by the Gulf of Guinea to the south and extends about 15km inland. To the west, it is bounded by a stream divides the Mankwaafa and Brounye

rivers on one side and the Boaku river on the other. To the east, the stream divides between the Pratu stream and the Ayensu River (Ryan & Ntiamoah-Baidu, 2000).

The site lies within the coastal savannah vegetation zone and has four main habitat types. These are: open water, floodplain grassland, degraded forest, scrub and farmland, sand dune. The floodplain vegetation is typical of the flora found around the lagoons of Ghana and the sandbars usually look bare but where there is vegetation, they are covered by particular species of trees very typical of such places.

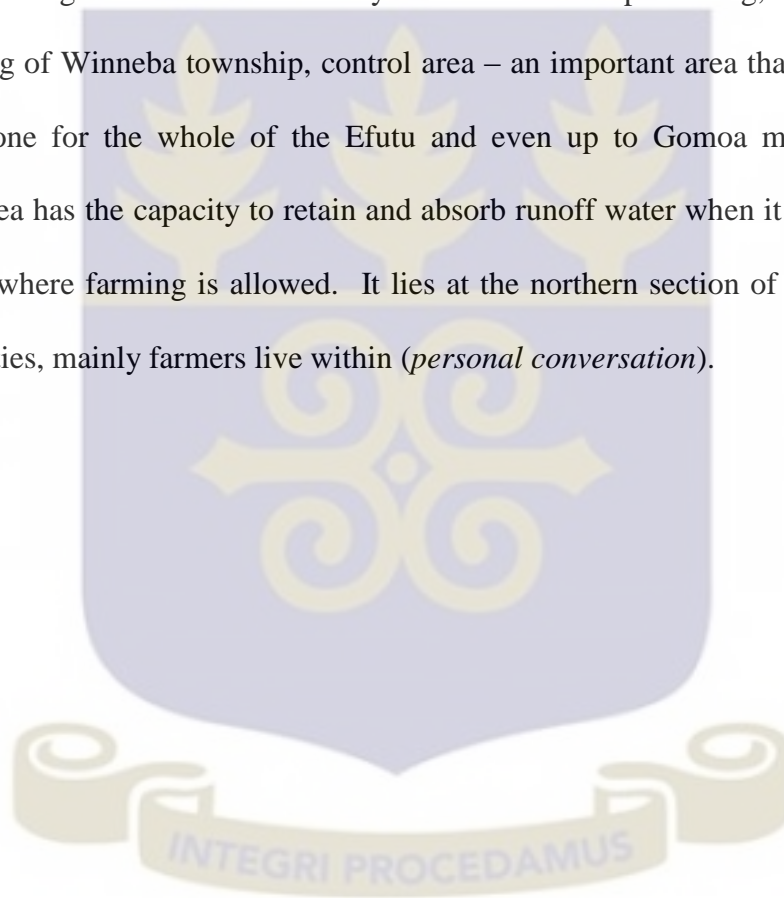
According to the Study of Development Options for Ghana Coastal Wetlands, (SDOGCW) Draft Final Report of 1998, the area is ecologically referred to as Coastal Savannah. The average rainfall is about 730mm to 910mm and there are indications that this is gradually declining. Rainfall occurs in two seasons, the first and main from March to July and the second and minor rains, from September to October.

Socio-cultural and economic characteristics

The communities and settlements in the Muni-Pomadze area form part of the Ramsar site because their settlements are located within the site itself. The Efutu and Gomoa ethnic groups own the northern parts of the drainage area while the Efutu owns the lagoon area (Dadson, 1995 *cited in* Ryan & Ntiamoah-Baidu, 2000). The main occupations of the communities in the vicinity of the Muni-Pomadze Ramsar site are fishing and farming. Within the Winneba and Mankoadze townships, the men are predominantly fishermen and the women are fish processors/retailers, however, there are some people in these two communities who are also farmers. This has led to a depletion of the resources in the various parts of the site due to human intrusion. In Bewadze, both men and women are

mainly farmers but a good number of them are involved in charcoal burning as a secondary occupation. The most common crops cultivated in all the communities include maize, cassava, tomatoes, okro, garden eggs and pepper (Ryan & Ntiamoah-Baidu, 2000).

The site is about 90km² and it is divided into sections. These are: the core area which is around the lagoon where no activity is allowed except fishing, settlement area – comprising of Winneba township, control area – an important area that serves as a flood control zone for the whole of the Efutu and even up to Gomoa municipalities. This control area has the capacity to retain and absorb runoff water when it rains. Lastly, land use area, where farming is allowed. It lies at the northern section of the site and a few communities, mainly farmers live within (*personal conversation*).



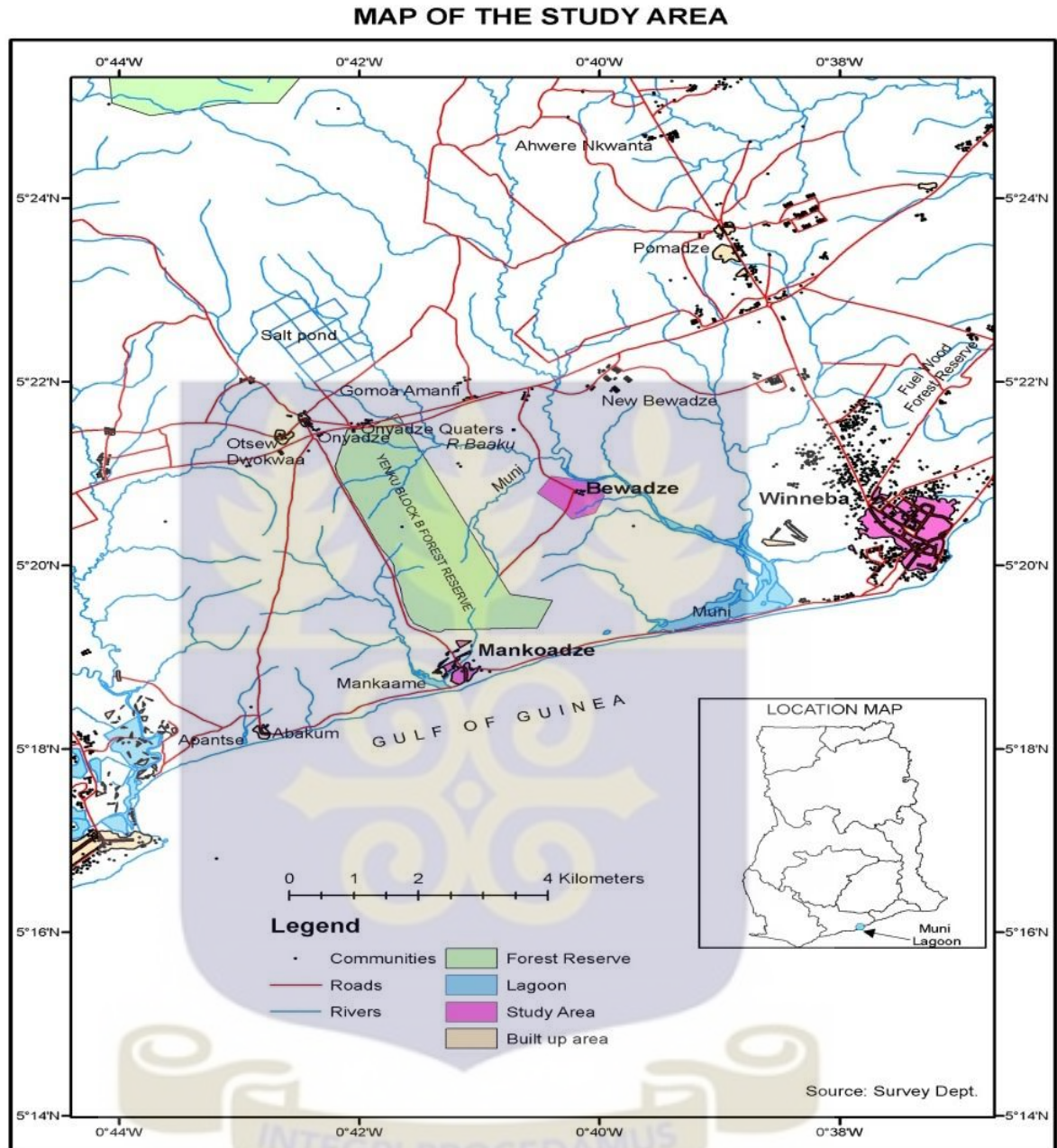


Figure 3: Map of the Study area

3.4 Types and Sources of Data

Both primary and secondary data were accessed in the study. Information derived from the indigenous people was a good source of primary data. Varied sources of secondary data were also used in the study. These included journals, articles, (published and

unpublished), online publications, textbooks, hand-outs, and all forms of grey literature related to the study. In addition, a record of climatic data comprising rainfall and temperature recorded over the past 30 years and relevant to the study were obtained from the Ghana Meteorological Agency to help do a comparative analysis of the climatic changes that have occurred in the area within the time frame.

3.5 Data Collection methods

In order to have comprehensive results for the study, three different methods were employed to collect information from respondents; questionnaire survey, Focus Group Discussions (FGD) and in-depth discussion. In all, five FGDs comprising 8 people in each group were held among women and men's groups in the three surveyed communities to collate their views about knowledge of climate change and climate variability, risk perception and ways through which adaptation options are adopted to cope with the situation. Two of the FGDs were held in Bewadze among leaders of charcoal producers and elderly farmers. In Winneba two FGDs were held with chief fishermen/opinion leaders and market queenmothers and in Mankoadze another discussion was held with the leaders of fish processors/retailers. A total number of 40 people were involved in the discussions and an average time of one hour and twenty minutes was used for each session.

The semi-structured questionnaire was administered one on one to both male and female adults in the communities being studied. This was because many of the respondents could not read well hence the one on one administration. In-depth interviews and personal conversations were conducted with the Wildlife and Forestry Officers in the district.

3.6 Instrumentation/Tools

The instruments used to collect the data for the study included a questionnaire consisting of semi-structured questions. The semi-structured questions were also used to guide the focus group discussions (FGDs). The question types found in the questionnaire were open-ended, close-ended and likert scale questions. The questionnaire entailed 37 questions divided into six sections. Each section sought to answer specific questions related to one of the research questions: Demographic Information; Knowledge and Awareness of the Concepts of Climate Change; Sources and Use of Information; Perceived causes of Climate Change; Climate Risk Perception and Risk Management and Adaptation Strategies. Respondents were also given the option to provide alternative responses to questions where none of the choice of answers given matched what they preferred to give.

3.7 Target Population

According to Williaman (2011), population is a collective term used to describe the total quantity of cases of the type which are the subject of a study. In other words, the study population encompasses the total members of a defined class of people, objects, places or events selected because they are relevant to the particular research.

The towns surveyed were Mankoadze, Winneba and Bewadze. The population for the study comprised the following: men and women whose primary occupation includes farming, fishing or fish processing and retailing. All these were adults, between the ages 25 years and 75 years. A scoping exercise formed the bases of the assumption for this selection criterion; many of the respondents start working at an early age and so even before age 30, many would have worked for an appreciable number of years to acquire

some practical knowledge on their surrounding environment, to be able to tell if any changes have occurred and then explain how they perceive the changes.

3.8 Sampling technique

Different sampling techniques were employed for the survey. Firstly, purposive sampling technique was employed to select the region, the three districts as well as the occupation of respondents (farming, fishing and fish processing/retailing) from each of the communities. Secondly, the snowball sampling technique was employed to select respondents, where each respondent who is within the age range and prescribed occupation for the study is selected and these participants then recommend additional participants.

3.8.1 Sampling size

From the records of the Ghana Statistical Service (2010), the total population of the surveyed towns is 26,839 (breakdown shown in Table 1).

Table 1: Population of study area

No.	Community	Population (25 years and above)
1	Mankoadze	883
2	Winneba	25,533
3	Bewadze	423
	TOTAL	26,839

Source: Ghana Statistical Service (2010 Population Census)

A sample size of 200 was used for the study. The factors mentioned above regarding age and occupation, contributed to the sample size. 100 respondents were selected from Winneba Township due to its large population size and 50 respondents each were obtained from Mankoadze and Bewadze (Table 2). A breakdown of the sample size,

including demarcation for gender is represented in the table below. The selection of equal number of males and females was purely a matter of gender balance.

Table 2: Total number of respondents used

No.	Name of Community	Gender	
		Male	Female
1.	Mankoadze	25	25
2.	Winneba	50	50
3.	Bewadze	25	25
	TOTAL	100	100

3.9 Method of Data Analysis

3.9.1 Analysing Qualitative Data

The recorded information from the focus group discussions (FGDs) and the in-depth interviews were transcribed. The transcribed data was later sorted out in themes to reflect the key research objectives and questions. In the course of discussion and analysis, narratives from the interviews and FGDs were used as direct quotations to buttress some of the points being made. Data from both interviews and FGDs helped to provide further details and explanations to the results obtained from the questionnaire analysis.

3.9.2 Analysing Quantitative Data

3.9.2.1 Estimating Respondents' Level of Awareness of climate variability and change

This was achieved by utilizing descriptive statistics using Statistical Package for Social Sciences version 21.0 (SPSS 21.0) and Microsoft Excel 2013. Frequency tables, charts and chi square tests were largely used to assess this objective. The results obtained from

these tests were triangulated with secondary data (rainfall and temperature scores for the study area) obtained from the Ghana Metrological Services Department which was analyzed using trend analysis.

3.9.2.2 Identifying Factors Influencing Fishers and Farmers Risk Perception Level

The binary logit model was employed in identifying factors influencing fishers and farmers' risk perception level. The binary logit model has the advantage to predict the probability of fishers and farmers' being at risk or not (Gujarati, 2004). The model is specified as:

$$Logit(Y_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_o + \sum \beta_i X_i + \mu_i \dots \dots \dots (1) \text{ (ibid)}$$

where Y_i = dummy for the risk existence which is equal to one (1) and zero (0) if a fisher or farmer faces no risk, X_i = independent variables influencing risk level, β_i = regression coefficients to be estimated, β_o = intercept regression coefficient, P_i = the probability of risk existence and μ_i = error term

For equation (1), Gujarati's (2004) model has been modified to suit the study. Thus, it can be further written as:

$$Logit(Y_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_o + \beta_1 Age + \beta_2 Gen + \beta_3 Edu + \beta_4 Occ + \beta_5 Com + \beta_6 Temp + \beta_7 Rain + \mu \dots \dots \dots (1)$$

Table 3: Summary of explanatory variables for respondents' risk perception level

Variable	Description	Mode of measurement	Expected sign
Y_i	Risk perception	Dummied: Risky =1 not risky = 0	
<i>Age</i>	Age	Years	+/-
<i>Gen</i>	Gender	Dummied: 1 = Male 0 = Female	+/-
E_{du}	Educational level	0= no education 1= Primary 2= Middle 3 = JHS 4 = SHS 5=Tertiary	+
<i>Occ</i>	Alternative livelihood activity	Dummied 1 = Yes 0 = No	+
<i>Com</i>	Community	1 = Mankoadze 2 = Bewadze 3 = Winneba	+/-
<i>Temp</i>	Temperature perception	Dummied: 1 =increasing 2 = decreasing 3= remains stable	+
<i>Rain</i>	Rainfall perception	Dummied: 1 = increasing 2 = decreasing 3= remains stable	+

3.9.3 Explanations for Dependent and Independent Variables

Dependent Variable

Risk Perception

Risk perception is affected by, and responds to the independent variables. People base their perceptions upon their personal experiences, knowledge and character (Radenssenden & Heath, 1987). In relation to this study, the independent variables of age, gender, educational level, alternative livelihoods, temperature and rainfall perceptions are analysed to ascertain their effect on risk perception.

Independent Variable

Age

The study assumes a positive or negative relationship between age and the risk perception. This is due to the fact that previous studies have found mixed results in terms of the effect of age on risk management strategy adoption (Mishra & El-Osta, 2002).

Gender

This study assumes a positive or negative relationship between gender and risk perception about climate change. Due to the fact that irrespective of the sex of an individual, he/she can be risk averse, risk loving or risk neutral.

Educational level

This study assumes a positive relationship between a risk perception and educational level (Fosu-Mensah et al., 2010). This is due to the fact that as the level of education of an individual increases, the individual is able to undertake a critical analysis which facilitate his decision of whether an activity is risky or not and so is climate change related activities.

Alternative livelihood activities

This study assumes a positive relationship between risk perception and alternative livelihood activities. Due to the fact that when an individual is involved in several income generating activities which is climate related the individual perceives he/she is at risk.

Temperature Perception

The study assumes a positive relationship between the temperature perception in the previous years and risk perception. Due to the fact that if an individual is exposed to high levels (degrees) of temperature in his/her locality in some years past, the individual perceives his/her activities to be risky.

Rainfall Perception

The study assumes a positive relationship between the rainfall perception in the previous years and risk perception. This is due to the fact that if an individual is exposed to extreme amount of rainfall in his/her locality in some years past, the individual perceives his/her activities to be risky.

Marginal Effect Estimation

The marginal effect is a measure of the change in the probability of an event occurring as a result of a unit change in the value of the explanatory variable *ceteris paribus* (Gujarati, 2004). In a linear regression model, the regression coefficients can be interpreted as a marginal effect, however, in non-linear regression models such as probit, Tobit and logit models, coefficients cannot be interpreted as marginal effect. This is because marginal effects are non-linear functions of the regression coefficients (Gujarati, 2004). According to Gujarati (2004), the marginal effect in the logit model is given by $\beta_i P_i (1 - P_i)$, where β_i is the regression coefficient of the i^{th} explanatory variable and P_i is the probability of the event Y_i occurring.

3.9.4 Identifying Factors Influencing Farmers and Fishers Adoption of Climate Change Strategies

The binary logit model was employed in assessing the factors influencing the adoption of climate change adaptation strategies. It has the advantage to predict the probability of fishers or farmers adopting the climate change adaptation strategies or not (Gujarati, 2004). The model is specified as:

$$\text{Logit}(Y_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \sum \beta_i X_i + \mu_i \dots \dots \dots (2) \text{ (ibid)}$$

where Y_i = dummy for adoption which is equal to one (1) if a fisher or farmer adopts climate change adaptation strategies and zero (0) if a fisher or farmer does not, X_i = independent variables influencing adoption, β_i = regression coefficients to be estimated, β_o = intercept regression coefficient, P_i = the probability to adopt and μ_i =error term

For equation (2), Gujarati’s (2004) model has also been modified to suit the study. Thus, it can be further written as:

$$\text{Logit}(Y_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_o + \beta_1 A_{cre} + \beta_2 Risk_i + \beta_3 E_{du} + \beta_4 Com_{ty} + \beta_5 Ag_s + \beta_6 Alt_i + \beta_7 Gen + \mu \dots\dots\dots(2)$$

Table 4: Summary of explanatory variables for factors influencing adoption of adaptation strategies

Variable	Description	Mode of measurement	Expected sign
Y_i	Adoption	Dummied: adopt =1 do not adopt = 0	
A_{cre}	Access to credit	Dummied: have access = 1 no access =0	+
Ag_s	Age	Years	+/-
E_{du}	Educational level	1 = primary 2 = middle school 3 = JHS 4 = SHS 5 = Tertiary	+
Com_{ty}	Community	1 = Mankoadze 2 = Bewadze 3 = Winneba	+
Alt_i	Alternative livelihood activities	Dummied: Yes=1 No =0	+
Gen	Gender	Dummied: 1 = Male 0 = Female	+/-
$Risk_i$	Risk level	Dummied: 1 = Risky 0 = Not risky	+

3.9.5 Explanations for Dependent and Independent Variables

Dependent Variable

Adoption of Adaptation Strategies

Some social factors influence both the vulnerability and adaptation to climate change (Blaikie et al., 1994). Previous studies have also highlighted the role adaptation options

such as access to credit and extension services play in the recovery from disruption of livelihood (Nhemachena, 2007; Adger & Kelly, 2001). This study finds out the effect of access to credit, age, educational level, alternative livelihood activities, gender, and risk level on the adoption of adaptation strategies.

Independent Variable

Access to credit

This study assumes a positive relationship between the access to credit and adoption of climate change adaptation strategy (Fosu-Mensah et al., 2010). It is based on the argument that some of the indigenous strategies come with a cost and so when a farmer or fisherman gets access to credit it facilitate the adoption process. This expectation was also supported by Yirga (2007) based on the research on adoption of agricultural technologies indicating that there is a positive relationship between the level of adoption and the availability of credit.

Age

The study assumes an ambiguous relationship between the adoption of climate change adaptation strategies and age (Maddison, 2006). It hypothesized that as an individual increases in age, that individual will either adopt a strategy or be used to the old method of farming.

Community

A fisherman or farmer will adopt a coping strategy when climate information is available in the community or when there is the existence of a social group which disseminates information to their members and also when the populace gets access to extension visits. The other side is that when a community is lacking all the aforementioned the probability

of an individual adopting the coping strategy is very low, therefore the study assumes an ambiguous relationship between the community in which the fisher or farmer lives and the adoption of adaptation strategies.

Educational level

Higher level of education is believed to be associated with access to information on improved technologies and productivity consequences (Norris and Bati, 1987). Evidence from various sources indicates that there is a positive relationship between the education level of the household head and the adoption of improved technologies (Igoden et al., 1990; Lin, 1991) and adaptation to climate change (Maddison, 2006). Fishermen or farmers with higher levels of education are therefore more likely to better adapt to climate change. Based on this, the study assumes a positive relationship between adoption of climate change adaptation strategies and educational level of an individual (Fosu-Mensah et al., 2010).

Alternative livelihood activities

This study assumes a positive relationship between the adoption of adaptation strategies and alternative livelihood activities. According to (Knowler & Bradshaw, 2007), the adoption of agricultural technologies requires sufficient financial well-being.

Gender

This study assumes an ambiguous relationship between the gender and the adoption of climate change and variability adaptation strategies. Male-headed households are often considered to be more likely to get information about new technologies and take risky businesses than female-headed households (Asfaw & Admassie, 2004). Tenge et al. (2004) argued that female-headed households may have negative effects on the adoption

of soil and water conservation measures because they have limited access to information, land and other resources due to traditional social barriers.

Risk level

This study assumes a positive relationship between the risk level and the adoption of climate change adaptation strategies. Due to the fact that when an individual believes that the changes in climate are detrimental to their activities it will motivate them to adopt the adaptation strategies.

Marginal Effect Estimation

The marginal effect is a measure of the change in the probability of an event occurring as a result of a unit change in the value of the explanatory variable *ceteris paribus* (Gujarati, 2004). In a linear regression model, the regression coefficients can be interpreted as a marginal effect, however, in non-linear regression models such as probit, Tobit and logit models, coefficients cannot be interpreted as marginal effect. This is because marginal effects are non-linear functions of the regression coefficients (Gujarati, 2004). According to Gujarati (2004), the marginal effect in the logit model is given by $\beta_i P_i (1 - P_i)$, where β_i is the regression coefficient of the *i*th explanatory variable and P_i is the probability of the event Y_i occurring.

3.10 Limitation of the study

This study was constrained by time, finances and the availability of secondary data on mean annual temperature, rainfall and storm.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter is in two parts. The first part covers a description of all the results of the data obtained for this study. It has been divided into various sections in order to help address each objective. The write-up includes tables and charts that give graphical representation of the data. The key responses derived from the focus group discussions and in-depth interviews are indented and interspersed with the results obtained from the survey. The second part comprises an in-depth discussion of the results in line with what has been said in literature.

4.2 Section A: Demographics

This section deals with the demographic characteristics of the respondents who participated in the study. Tables and charts that give vivid descriptions of the data obtained are included. Respondents who participated in the survey were sampled from three communities: Winneba, Bewadze and Mankoadze all in the Central Region of Ghana.

4.2.1 Gender of Respondents

A total of 200 respondents were included in the study. In Bewadze and Mankoadze, 25 respondents representing 12.5 per cent for each community were males. The same number and percentage were females (Figure 4). In Winneba, 50 respondents representing 25.0 per cent were males and the same representation were females. The purpose of this equal number of male and female selection was purely for gender balance.

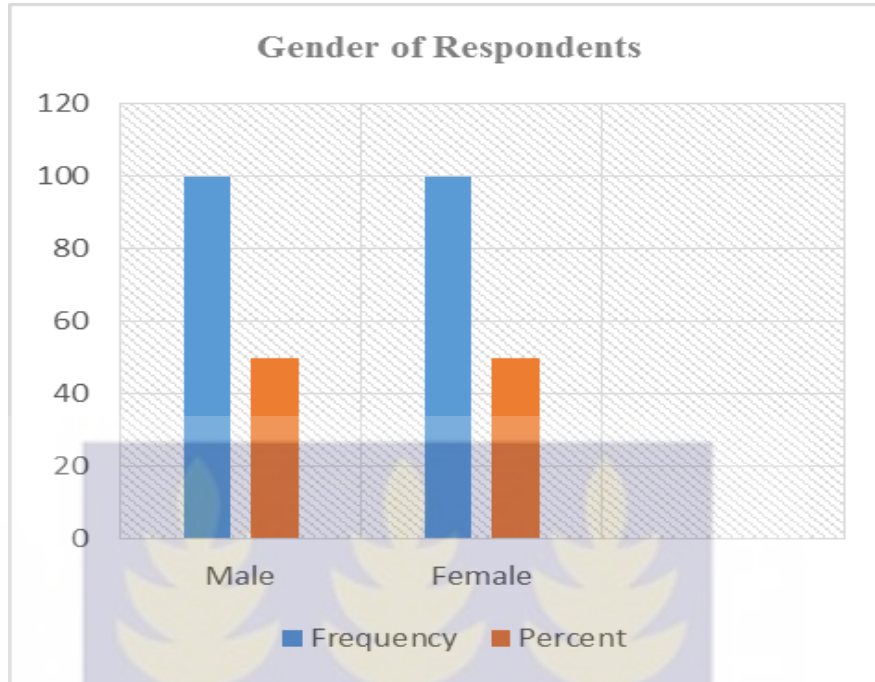


Figure 4: Gender of Respondents

4.2.2 Age of Respondents

The age of respondents involved in the study ranged from 26 years to 75 years. Some of the respondents started working for a living early in their teens such that at the age of 26, some had worked for about 10 years and were therefore capable of providing the needed information. The ages have been classified as 26-35, 36-45, 46-55, 56-65 and 66-75 respectively. The age range of 56-65 years formed a majority of the respondents. On the other hand, the least group of respondents were found between the age ranges of 26-35 years. The detailed graphical representations of the ages are shown below in table 5.

4.2.3 Occupation of Respondents

The occupation of respondents was in two categories. The first category was the primary/main occupation. These were farming, fishing, and fish processing/retailing. Farmers formed the bulk of the respondents, 84 respondents representing 42.0 per cent.

This is because there were farmers in all the three communities, with the majority being in Bewadze, which is predominantly a farming community. The details are found in table 5. The secondary occupations of most respondents were: charcoal production, trading, carpentry, masonry and painting. Not every respondent though had a secondary occupation. A total of 115 respondents, representing 57.5 per cent had secondary occupations and 85 respondents, representing 42.5 per cent were not into any secondary occupation. The breakdown of the secondary activities as found in table 5 is as follows: 22.5 per cent (45) respondents were engaged in trading activities and 15 per cent (30) respondents were charcoal producers. Those engaged in carpentry work were 20 respondents, representing 10.0 per cent of the respondents whilst 15 respondents representing 7.5 per cent were painters by profession and only 2.5 per cent respondents (5) were masons.

Table 5: Demographic Characteristics of respondents (a)

Variable	Categories	Survey respondents (%)
Age (years)	26-35	14 (7.0%)
	36-45	30 (15.0%)
	46-55	66 (33.0%)
	56-65	70 (35.0%)
	66-75	20 (10.0%)
Level of education	No formal education	40 (20.0%)
	Primary School	105 (52.5%)
	Middle School	20 (10.0%)
	Junior High School	15 (7.5%)
	SHS/Vocational/Technical	40 (20.0%)
Primary occupation	Farming	84 (42.0%)
	Fishing	60 (30.0%)
	Fish processing/retailing	56 (28.0%)
Secondary occupation	Painting	15 (7.5%)
	Masonry	5 (2.5%)
	Carpentry	20 (10.0%)
	Trading	45 (22.5%)
	Charcoal production	30 (15.0%)
	Not applicable	85 (42.5%)

4.2.4. Occupation, Educational level and Gender of Respondents

The gender and primary occupation of the respondents in the three study areas as shown in table 6 indicated that, the total number of farmers were 85 of which 40 were male and 45 were female. Sixty respondents being all males were fishers and 55 females were fish processors/ retailers. A general observation from the field showed that many of the respondents had a low educational background with majority of them stopping school at the primary level, (table 6). Out of the total number of 200 people sampled, a larger number of males, 60.0 per cent as against 45.0 per cent females, completed primary education, 5.0 per cent males and 15.0 per cent females attained middle school level, another 5.0 per cent of males and 10 per cent females reached the JHS level. At the SHS, 15.0 per cent males as against 5.0 per cent females reached that level. Finally, 15.0 percent males and as high as 25.0 percent females never had any form of formal education.

Table 6: Demographic Characteristics of respondents (b)

Variable	Sex of respondents				Total	
	Male		Female			
	Freq.	%	Freq.	%	Freq.	%
Primary occupation						
Farming	40	20.0	45	22.5	85	42.5
Fishing	60	30.0	0	0.0	60	30.0
Fish processing/retailing	0	0.00	55	27.5	55	27.5
Total	100	50.0	100	50.0	200	100.0
Level of Education						
Primary	60	60.0	45	45.0	105	52.5
Middle School	5	5.0	15	15.0	20	10.0
Junior High School	5	5.0	10	10.0	15	7.5
Senior High School	15	15.0	5	5.0	20	10.0
No School	15	15.0	25	25.0	40	20.0
Total	100	100	100	100	200	100

4.3 Section B: Knowledge and Awareness of Climate Change

This section looked at respondents' knowledge and awareness of climate change. The purpose was to find out whether they have heard about climate change and observed any changes in the climate variables, their sources of information, and what they perceive to be the causes of climate change.

4.3.1 Awareness of climate change

To define respondents' understanding of the concepts of climate change, they were first asked whether or not they had ever heard about climate change by indicating which climatic variable or extreme weather event they had noticed significant changes in over the past five years, five years was given for the purposes of recall, so that accurate responses could be given. All of the respondents, representing 100 percent in the three communities, said that they had indeed noticed changes in rainfall, temperature and windstorms, but of varying degrees (Table 7).

Table 7: Awareness of climate change

Heard of climate change?	Yes		Total	
	Freq.	%	Freq.	%
Community				
Mankoadze	50	25.0	50	25.0
Bewadze	50	25.0	50	25.0
Winneba	100	50.0	100	50.0
Total	200	100.0	200	100.0
Noticed changes in climate variability?				
Rainfall	55	27.5	55	27.5
Temperature	75	37.5	75	37.5
Drought	15	7.5	15	7.5
Wind storms	40	20.0	40	20.0
Flooding	15	7.5	15	7.5
Total	200	100.0	200	100.0

Respondents had also experienced extreme climatic events of drought, and flooding. In all, 27.5 percent (55) had noticed changes in rainfall, 37.5 percent representing 75 respondents, had observed changes in temperature and 20.0 percent (40) had also noticed changes in windstorms. Concerning extreme weather events of drought and flooding, the same number and percentage of respondents, 7.5 percent (15) in each case, had observed some changes in the occurrence of drought and flooding.

4.3.2 Awareness of Changes in Climate Variables by Age, Community, Gender, and Primary Occupation

To further ascertain respondents' knowledge and awareness of changes in climate and its variables, Pearson chi-square tests were conducted to find out if there were any significant differences between the choice of climate variable (*which are dependent variables*) and age, community, gender and type of primary occupation (*independent variables*). As much as one can identify differences in the percentages from the table below, all the chi-square results indicated that the *p* value is less than 0.05, thus, there is a significant difference between the dependent and independent variables. This is also an indication that there are differences in the independent variables of age, community, gender and primary occupation and the chosen dependent climate variables of rainfall, temperature, drought, windstorms and flooding. These are shown in Table 8.

Table 8: Changes in climate variables

	Rainfall		Temperature		Drought		Wind Storms		Flooding		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
<hr/>												
Age												
26-35	0	0.0	10	13.3	0	0.0	5	12.5	0	0.0	15	7.5
36-45	5	9.1	10	13.3	5	33.3	5	12.5	5	33.3	30	15.0
46-55	20	36.4	15	20.0	10	66.7	15	37.5	5	33.3	65	32.5
56-65	25	45.5	30	40.0	0	0.0	15	37.5	0	0.0	70	35.0
66-75	5	9.1	10	13.3	0	0.0	0	0.0	5	33.3	20	10.0
Total	55	100.	75	100.	15	100.	40	100.	15	100.	200	100.
	0	0	0	0	0	0	0	0	0	0	0	0
Chi square (X²)value of 56.346, df (16), P value of 0.000												
Community												
Mankoadze	15	27.3	20	26.7	5	33.3	5	12.5	5	33.3	50	25.0
Bewadze	30	54.5	15	20.0	5	33.3	0	0.0	0	0.0	50	25.0
Winneba	10	18.2	40	53.3	5	33.3	35	87.5	10	66.7	100	50.0
Total	55	100.	75	100.	15	100.	40	100.	15	100.	200	100.
	0	0	0	0	0	0	0	0	0	0	0	0
Chi square (X²)value of 61.871, df (8), P value of 0.000												
Gender												
Male	25	45.5	50	66.7	5	33.3	20	50.0	0	0.0	100	50.0
Female	30	54.5	25	33.3	10	66.7	20	50.0	15	100.	100	50.0
									0	0	0	0
Total	55	100.	75	100.	15	100.	40	100.	15	100.	200	100.
	0	0	0	0	0	0	0	0	0	0	0	0
Chi square (X²)value of 25.455, df (4), P value of 0.000												
Occupation												
Farming	50	90.9	25	33.3	10	66.7	0	0.0	0	0.0	85	42.5
Fishing	0	0.0	40	53.3	0	0.0	20	50.0	0	0.0	60	30.0
Fish processing/retailing	5	9.1	10	13.3	5	33.3	20	50.0	15	100.	55	27.5
									0	0	0	0
Total	55	100.	75	100.	15	100.	40	100.	15	100.	200	100.
	0	0	0	0	0	0	0	0	0	0	0	0
Chi square (X²)value of 150.162, df (8), P value of 0.000												

4.3.3. Description of Rainfall Level and Temperature Intensity

Since respondents were positive about changes they had observed in the climatic variables, they were asked to specifically describe the changes they had noticed in rainfall level and temperature intensity. Rainfall and temperature were chosen because they were the only variables on which data was available from the Ghana Meteorological Services

(GMet). For rainfall level, respondents had three options of responses: increasing, decreasing and don't know from which to make a choice. Based on the data gathered from the communities pertaining to the changes that had occurred in the rainfall level, 30 percent of the respondents in both Mankoadze, and Bewadze and 40 percent in the Winneba community perceived the level to be increasing in the last 5 years. 24.1 percent of the respondents in the Mankoadze community said the rainfall amount had been reducing over the last 5 years, 20.7 percent from Bewadze and 55.2 percent from the Winneba community also said same.

For temperature, respondents had two indicators (increasing and decreasing), from which their choice would indicate how they perceive the rate of changes in temperature intensity. Interestingly, by age, community, gender and primary occupation, all the respondents that is, 100 percent indicated that temperature was increasing. The outcome of all the responses is presented in table 9.

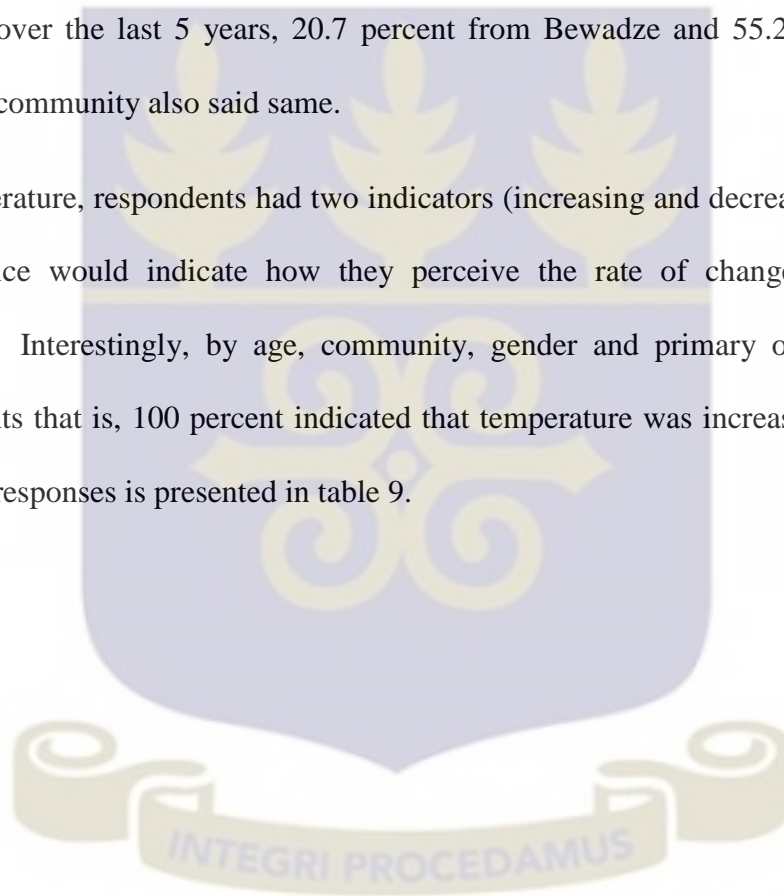


Table 9: Changes in rainfall

Variable	Increasing		Decreasing		Do not know		Total	
	Freq.	%	Freq	%	Freq.	%	Freq	%

Age								
26-35	10	20.0	5	3.4	0	0.0	15	7.5
36-45	0	0.0	30	20.0	0	0.0	30	15.0
46-55	10	20.0	50	34.5	5	100.	65	32.5
						0		
56-65	200	40.0	50	34.5	0	0.0	70	35.0
66-75	10	20.0	10	6.9	0	0.0	20	10.0
Total	50	100.0	145	100.	5	100.	200	100.
				0		0		0
Community								
Mankoadze	15	30.0	35	24.1	0	0.0	50	25.0
Bewadze	15	30.0	30	20.7	5	100.	50	25.0
						0		
Winneba	20	40.0	80	55.2	0	0.0	100	50.0
Total	50	100.0	145	100.	5	100.	200	100.
				0		0		0
Gender								
Male	35	70.0	60	41.4	5	100.	100	50.0
						0		
Female	15	30.0	85	58.6	0	0.0	100	50.0
Total	50	100.0	145	100.	5	100.	200	100.
				0		0		0
Primary Occupation								
Farming	20	40.0	60	41.4	5	100.	85	42.5
						0		
Fishing	20	40.0	40	27.6	0	0.0	60	30.0
Fish processing/retailing	10	20.0	45	31.0	0	0.0	55	27.5
Total	50	100.0	145	100.	5	100.	200	100.
				0		0		0

4.3.4 Trend analysis of rainfall and temperature

A trend analysis was performed on the climate data obtained from GMet and figure 5 depicts the fluctuations in the mean annual rainfall. It is ascertained that there exist wide variations in the rainfall level across the years. From 1980 to early 1983 rainfall levels remained constant; during the late 1983 to early 1984 the rainfall reduced drastically. It increased again from the late 1984 to 1987. The rainfall levels showed severe fluctuations from early 1988 to early 2010. From the year 2011 to 2013 a sharp decline in the mean annual rainfall occurred.

The individual was aware of the changes that were occurring in rainfall in the last five years as majority of the respondents from table 9, said the rainfall level has been decreasing. This implies that the trend analysis from the secondary data is in agreement with the awareness level of the respondents.

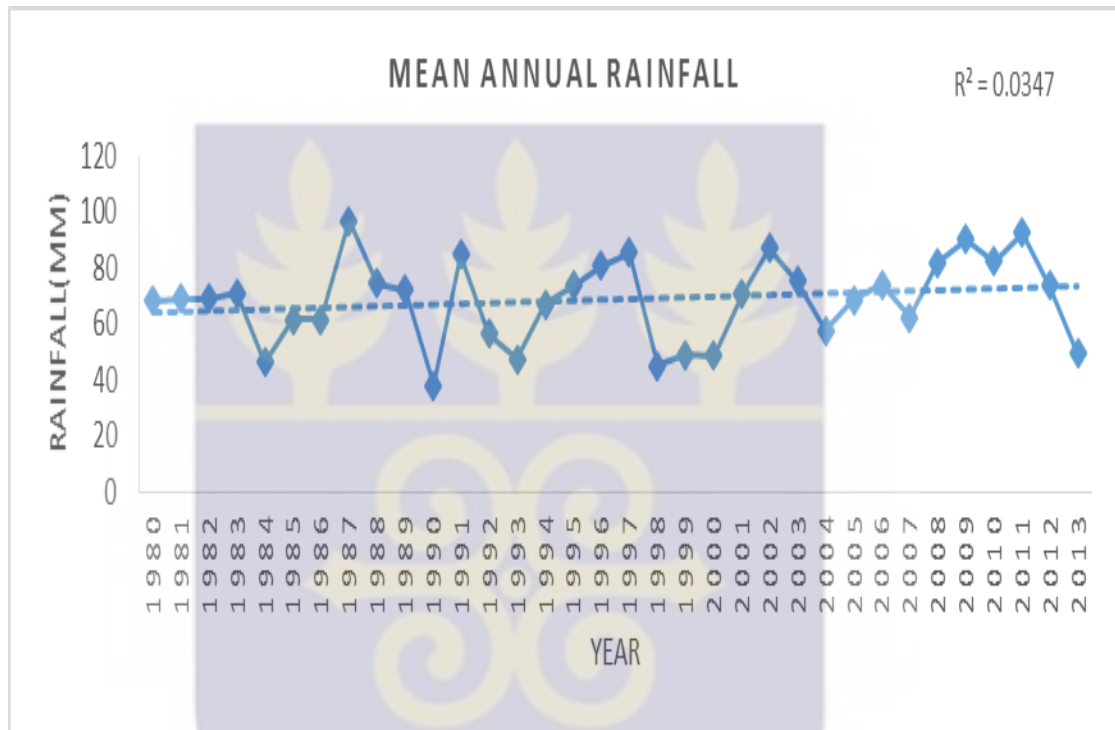


Figure 5: Trend of mean annual rainfall for Winneba from 1980-2013

Figure 6 below shows the fluctuations in the mean annual temperatures. It can be established that there has been some level of deviations in the temperature intensity over the years. From 1986 to early 1988, the temperature intensity remained somehow constant until late 1988 when it showed a slight upward movement. During the early 1992 to early 1993 the temperature reduced significantly. It showed a slight upward trend again from the late 1993 to 1998. There were some fluctuations from the early 1998 to early 2007. The late 2007 to 2008 exhibited a decline in the intensity but from 2009 to 2013, there was an upward trend. Based on the data gathered from the communities

regarding the perceived changes that had occurred in the temperature intensity, all the respondents said they have observed that the temperature intensity has been increasing.

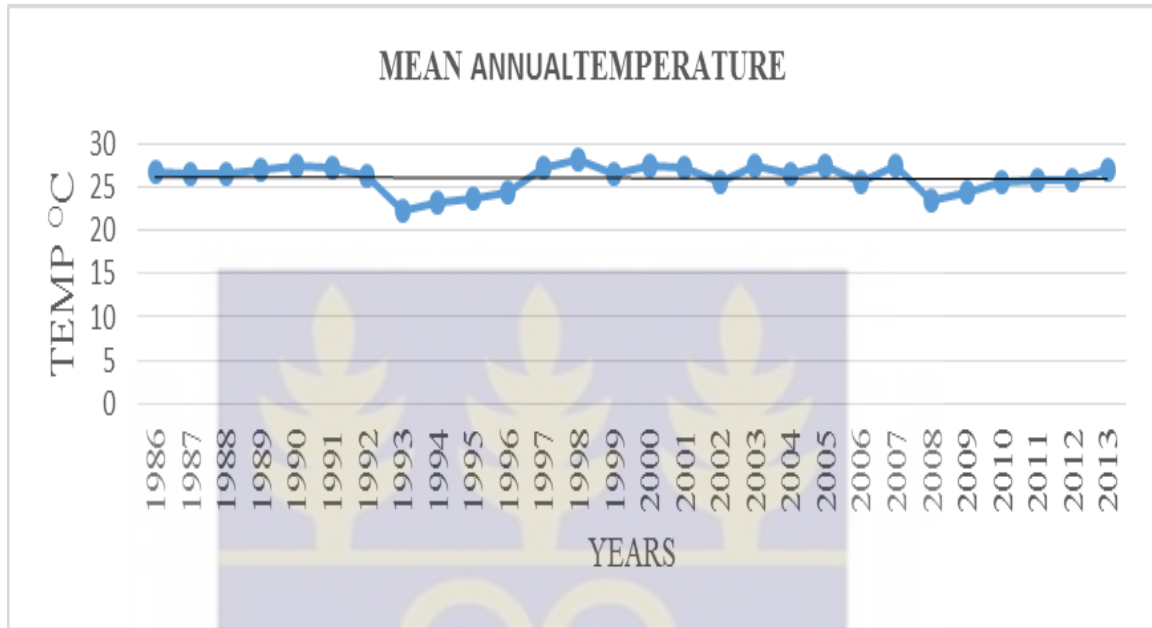


Figure 6: Trend of mean annual temperature for Winneba 1986-2013

4.3.5 Sources of Information

Having shown in their responses that there is some level of knowledge and awareness of the concepts of climate variability/change, respondents were then asked about the sources of information or media through which they heard about weather conditions and climate change. Sources that respondents mentioned included radio, television, older fishermen and local information services. Radio formed the highest source of information and as many as 54 percent (108) respondents indicated it as the source through which they heard about it. 23 percent (46) of respondents heard it on television and 12 percent (24) had heard it from the local information services whilst 11 percent (22) had heard it from older

fishermen (Figure 7). Focus group discussion revealed the reason why older fishermen could be a source of information and one fisherman responded:

“Our older fishermen have never been to school but they know the weather more than some of us who have some form of formal education. I cannot explain how they do it but they can just look into the sky and predict that, that particular day could or could not be favourable for fishing. If it is a positive report, anyone that goes fishing will definitely come home with a good catch. If on the other hand the report is not a positive one and you don’t heed their advice, you will have yourself to blame. Some people have even lost their lives and some their canoes by not heeding their advice”.

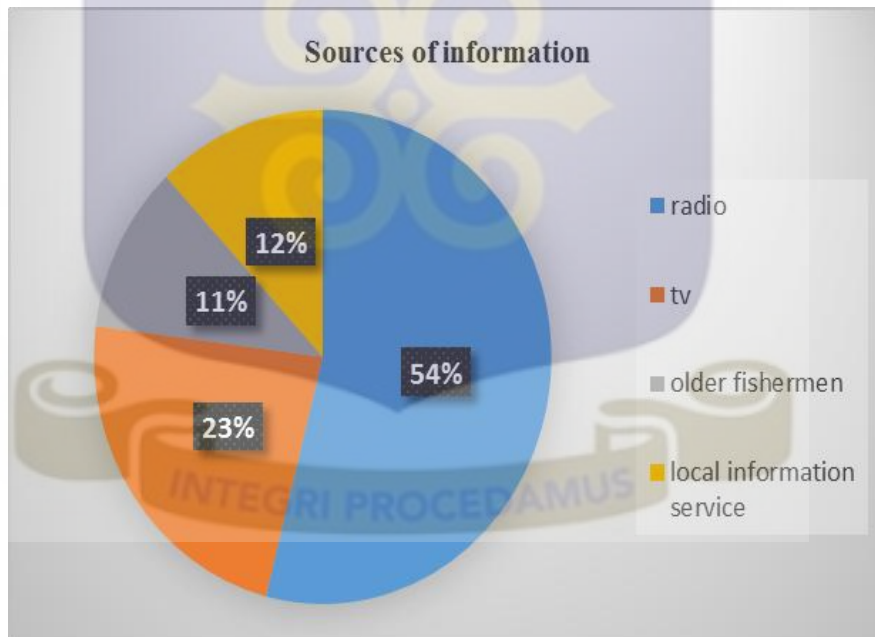
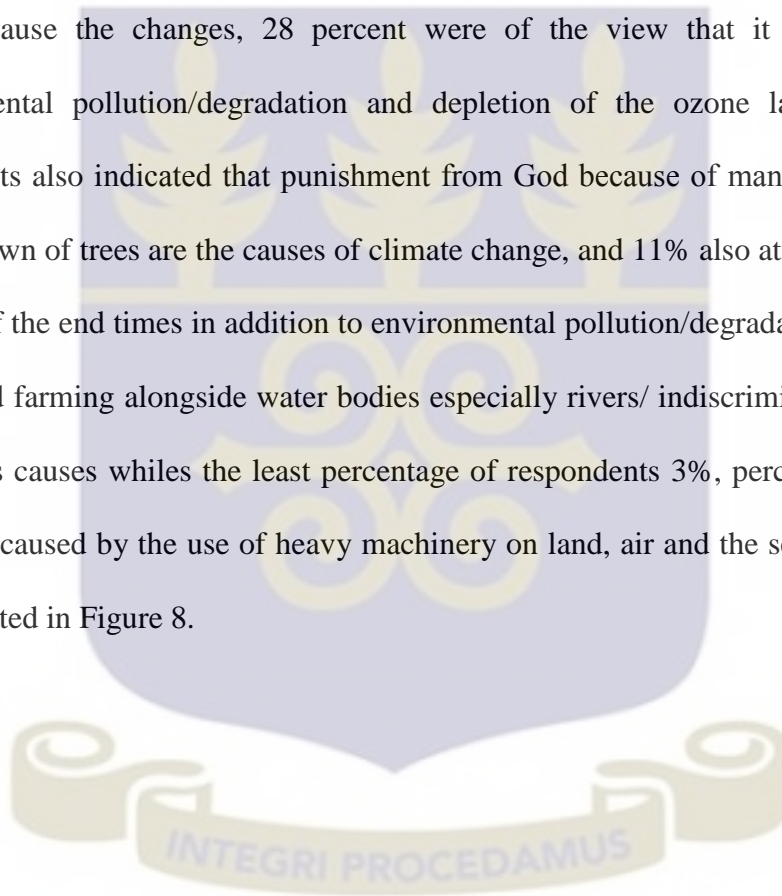


Figure 7: Sources of information

4.3.6 Perceived causes of climate change

Based on the changes that they have noticed in rainfall and temperature, respondents were asked to give the possible factors that they perceive could have led to these changes. A myriad of responses were given as perceived to be the causes of climate change. Respondents mostly gave more than one answer as the cause. Majority of respondents from the survey, that is, 34 percent said that indiscriminate cutting of trees and bush burning cause the changes, 28 percent were of the view that it is as a result of environmental pollution/degradation and depletion of the ozone layer, 15% of the respondents also indicated that punishment from God because of man's wickedness and cutting down of trees are the causes of climate change, and 11% also attributed the causes to signs of the end times in addition to environmental pollution/degradation. Another 9% mentioned farming alongside water bodies especially rivers/ indiscriminate cutting down of trees as causes while the least percentage of respondents 3%, perceived that climate change is caused by the use of heavy machinery on land, air and the sea. The responses are presented in Figure 8.



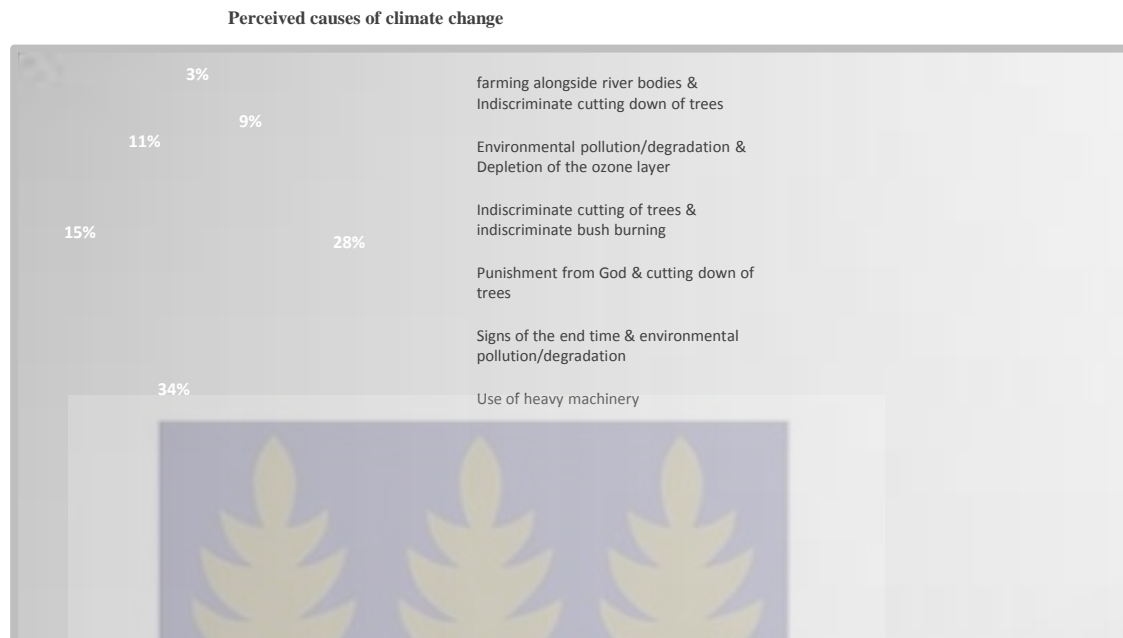


Figure 8: Perceived causes of climate change

4.4 Assessing the factors influencing respondents' risk perception level

Table 10 presents the binary logit regression estimation of the factors influencing risk perception level of an individual. It can be inferred that only educational level and rainfall perception were both statistically significant at 5% (0.05) significance level. This implies that these variables had an influence on risk perception in the study area. Variables such as gender, age of the respondent, alternative livelihood activities, community and temperature perception were not statistically significant. This suggests that per the empirical study these variables did not have any influence on risk perception.

Additionally, table 10 indicates that the coefficient of the education, which is 0.035, implies that as an individual attains a higher educational level, the log of odd (probability) of the individual undertaking a critical analysis to ascertain how risky an

activity is, increases by 0.035. This result confirms the *a priori* expectation of the study. The coefficient of rainfall perception which is 0.034 implies that the log of odd of an individual seeing his/her activity to be risky increases by 0.034. This also confirms the *a priori* expectation of the study, which is positive.

Table 10:. Binary Logit regression results for objective 2

	PARAMETERS	STANDARD ERROR	SIGNIFICANCE
GENDER	0.198	0.166	0.555
AGE	-0.069	0.104	0.676
EDUCATION	0.219	0.117	0.035**
ALT. LIVELIHOOD ACTIVITIES	0.091	0.205	0.438
COMMUNITY	0.165	1.169	0.419
TEMPERATURE PERCEPTION	0.942	0.182	0.420
RAINFALL PERCEPTION	0.227	1.073	0.034**
CONSTANT	-3.515	2.027	0.083*

From the table *, **, represents 10% and 5% significant levels respectively.

F-statistic 2.44 Prob>F 0.000 R-squared = 0.054 Adjusted R-squared = 0.077 observations 200 Log likelihood ratio = 229.739

4.5 Identifying the factors influencing the adoption of adaptation strategies

Table 11 presents the binary logit regression estimation of the factors influencing the adoption of climate change adaptation strategies. It can be inferred that risk perception level, gender and alternative livelihood activities were statistically significant at 1% (0.01), 1% (0.01) and 5% (0.05) significance levels respectively. This implies that these variables had an influence on the adoption of adaptation strategies in the study area. Variables such as access to credit, age of the respondent, educational level and community were not statistically significant. This suggests that per the empirical study these variables did not have any influence on adoption of adaptation strategies.

The parameter of the risk perception of 0.004 implies that as the perception of an individual pertaining to the risky nature of climate change increases by a unit it reduces the log of odd of adopting the climate change adaptation strategies by 0.004, this result violates the *a priori* expectation which assumed that there is positive relationship between the risk perception and adoption of the strategies. The coefficient of the gender which is 0.007 implies that the log of odd of adopting climate change adaptation strategies increases by 0.007 as the gender in the communities increases by one male. The coefficient of the alternative livelihood activities which is 0.07 implies that as the individual engages in an alternative livelihood activity, the log of odd of adopting the climate change adaptation strategies increases by 0.07.

Table 11: Binary Logit regression results for objective 3

	PARAMETERS	STANDARD ERROR	SIGNIFICANCE
RISK PERCEPTION LEVEL	-1.021	0.359	0.004***
ACCESS TO CREDIT	0.147	0.383	0.700
GENDER	0.964	0.358	0.007***
AGE	-0.161	0.162	0.321
EDUCATION	0.21	0.099	0.833
COMMUNITY	-0.333	0.216	0.124
ALT. LIVELIHOOD ACTIVITIES	0.387	0.213	0.07*
CONSTANT	1.971	0.876	0.024**

From table 18, *, **, *** represents 10%, 5% and 1% significant levels respectively. F-statistic 2.125
 Prob> F 0.000 R-squared = 0.081 Adjusted R-squared = 0.113 observations 200 Log likelihood = 233.882

4.6 Discussion of Results

4.6.1 Level of Awareness and Knowledge of Climate Variability /Change among Local Dwellers around Muni-Pomadze Ramsar Site.

Acquah (2011) reported that climate change is a critical issue and sound public knowledge and awareness is required to address the problem. From the survey, it was

obvious that local dwellers living around the Muni-Pomadze Ramsar site are aware of climate change and variability although their understanding of it is limited compared to the technical definition given by both the IPCC and the UNFCCC. Local dwellers living around the Ramsar Site related their understanding of climate change and variability to changes in climatic conditions such as rainfall, temperature and extreme weather events. This knowledge and awareness could be attributed to their geographical location and experiences of changes in weather patterns such as erratic rainfalls; severe drought and extreme weather events such as flooding and wind storms. This is in consonance with Neville and Mohammed (2010)'s statement that observable changes in the weather and seasons constitute most Africans' knowledge of climate change. This is also in agreement to Leiserowitz's (2006) study on public perception of climate change which revealed that many people misunderstand the science of climate change and, in particular, are confused about the nature, causes and consequences of climate change. In addition, Codjoe et al. (2013) from a study conducted on cocoa farmers' awareness and perception of climate change confirmed the responses received from respondents' on the field that the farmers indicated an awareness of climate change by relating to changes they had observed, but however lacked the scientific knowledge about the causes.

As much as evidence abounds that the respondents have observed some changes in the climate and its variables such as temperature and rainfall, some of the reasons that were given as accounting for these changes do not really relate to climate change (for example, punishment from God and environmental degradation). This is similar to what Neville and Mohammed (2010) observed. According to Neville and Mohammed (2010),

“Many Ghanaians do not understand the science of climate change, although they have noticed changes in the weather and seasons. They tell rising temperatures, extended periods of drought and increasing variability in seasonal rainfall, however, most people do not connect these with global climate change. Furthermore, many understand climate change to mean changes in the weather or seasons and those that have some familiarity with the concepts often lack sufficient knowledge to explain them with reference to greenhouse gases”.

Codjoe et al. (2013) showed that by the farmers' perception, the main causes of climate change include: God's plan signifying the end of time, usage of heavy machines on land, air and water, deforestation, indiscriminate bush burning before farming or for hunting, farming alongside river bodies and illegal mining. These responses are similar to what was received from the field of study. Respondents' views from this study on the causes of climate change and variability were varied and diverse. Some of the causes were attributed to punishment from God because of man's wickedness, signs of the end times and environmental pollution/degradation. Others mentioned farming alongside water bodies especially rivers, indiscriminate cutting down of trees and the use of heavy machinery on land, air and the sea. Except for God factor, responses from the communities indicated that they were aware that human activity was the cause of climate change. More importantly, respondents had a fair knowledge about the importance of trees in the environment and this was evident from the way in which many of the respondents combined the indiscriminate cutting of trees with other causes. From the focused group discussions most of the respondents gave similar reasons but some were of the view that increased population is another cause. Similar findings have been

documented in Sekyedumase district in the Ashanti Region of Ghana wherein about 63 per cent of the farmers attributed the cause of climate change to deforestation, 18.9 per cent to bush burning, 3.3 per cent to increased population and 8.9 per cent to other factors (Fosu-Mensah et al., 2010).

The sources through which information about climate change is disseminated leading to knowledge acquisition and awareness creation are very vital in climate change education. Boykoff and Rajan (2007) have expressed that the media is a prominent and integral source for acquiring information about climate change. The way information about climate change is framed and communicated can significantly influence the public's knowledge, attitude and perception (Sampei & Aoyagi-Usui, 2009; Sharples, 2010). Most of the respondents from this study representing a total of 77.0 percent identified their source of knowledge about climate change as either radio or television. Being mostly rural communities, 12 percent of the respondents' indicated that knowledge and awareness information was provided by the local information service whilst 11 percent of respondents' showed information was provided by older folks in occupations same as theirs. It is indicative from the responses that the community members have access to information.

The study further investigated whether age, gender, community and occupation would influence respondents' awareness level. It was observed from the analysis performed that, as much as one can identify differences in the percentages of the factors (Table 8), all the chi-square results indicated that the *p* value is less than 0.05, thus it can be deduced that there is a significant difference between respondents' awareness level and each independent variable. This suggests that depending on the independent variable such as

age, community, gender and primary occupation, there were differences in their level of awareness on the independent variables of rainfall, temperature, drought, windstorms and flooding.

4.6.2 Factors that influence peoples' risk perception pertaining to climate change and variability.

Literature makes it clear that risk means different things to different people therefore people's actions and understandings of risk are influenced by their social and cultural ideas (Boholm, 1998). For one to perceive risk there is the need to encounter a risky situation. Climate change/ climate variability is seen as a risky situation because of the adverse impacts it has on lives and livelihoods. It is seen to be one of the most essential problems confronting farming and fishing activities (Yaro, 2013). The perceptions farmers and fishers have about climate change/ variability cut across all types of social groups and locations. The findings from the survey showed that the level of education and rainfall perception influence risk perception of respondents. The gender of respondents, age, alternative livelihood activities, community and temperature perception were however not statistically significant. Meeting the *apriori* expectation of the study, it was noted that as an individual attains a higher educational level, the probability of the individual undertaking a critical analysis to ascertain how risky an activity increases; and as rainfall is perceived to be decreasing, the probability of an individual seeing his/her activity to be risky increases. This is in conformity to Fosu-Mensah et al. (2010) who pointed out that many factors including, the level of education, gender, age, access to extension services and credit influence farmers perception of climate change. Contrary to Fosu-Mensah et al. (2010), however, gender, age, alternate livelihood activities,

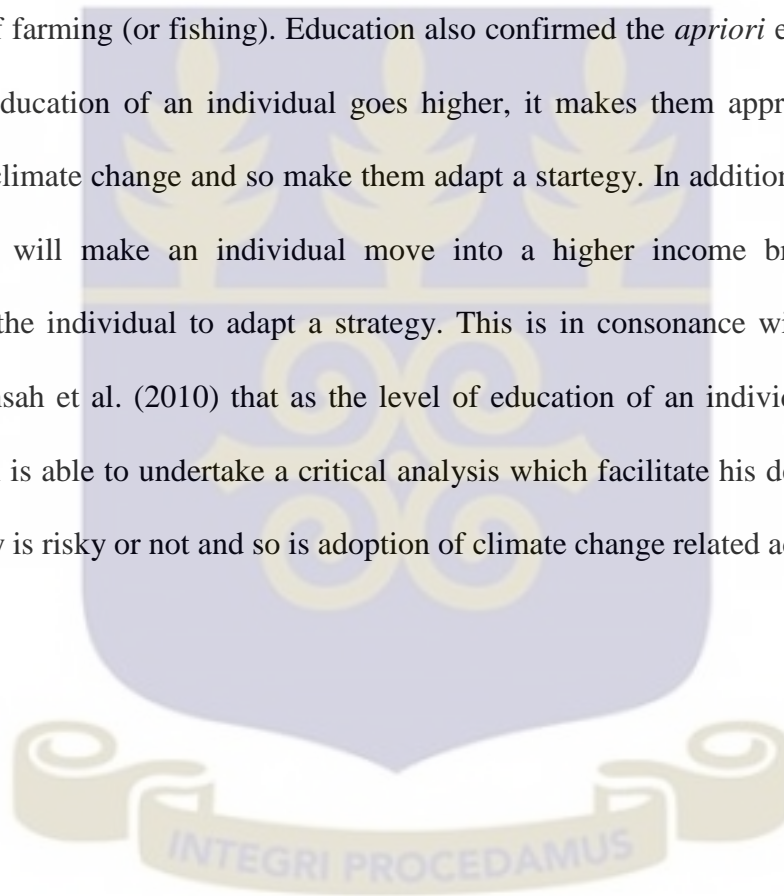
community and temperature perception in the analysis did not influence risk perception. This might be due to the fact that the study was on the perception of climate change and not on risk perception as this study sought to find.

4.6.3 Factors which will influence the adoption of adaptation strategies.

An understanding and preparation of effective response towards a changing climate is very crucial. From literature, it has become clear that adoption of agricultural technologies is directly linked to adaptation strategies that farmers and fishers undertake in the fight against the adverse effects of climate change (Nhemachena & Hassan, 2007). Climate change could really have negative consequences on agriculture if there is no adaptation but with adaptation, vulnerability can be significantly reduced. Farmers' ability to perceive climate change therefore is a prerequisite for their choice to adapt (Gbetibouo, 2008). The capacity of farmers to adapt to climate change can be significantly influenced by the level of awareness about climate change in their communities. According to Fosu-Mensah et al. (2010), the level of education, gender, age, soil fertility, farm size, farming experience, land tenure, access to extension services and credit influence farmers' perception and adaptation.

The results presented indicate that risk perception of the individual, gender and alternative livelihood activities are statistically significant in influencing the adoption of adaptation strategies. It was also indicated that access to credit, age and education were not statistically significant. Although access to credit was not significant, it confirmed the *apriori* expectation. Access to credit had a positive relationship on adoption of climate change adaptation strategies. This implies that if an individual gains access to credit, it facilitates the adoption of climate change strategies which makes the individual less

vulnerable. This is in conformity with Yirga (2007) who reported that there is a positive relationship between the level of adoption and the availability of credit. The age assumed a negative direction but the *apriori* expectation was ambiguous. This implies that as an individual advances in age, they become used to the old ways of doing things so they do not see the need to adopt adaptation strategies. This is also consistent with Maddison (2006) who stated that an individual will either adopt a strategy or be used to the old method of farming (or fishing). Education also confirmed the *apriori* expectation. As the level of education of an individual goes higher, it makes them appreciate the adverse effect of climate change and so make them adapt a strategy. In addition, a higher level of education will make an individual move into a higher income bracket which will motivate the individual to adapt a strategy. This is in consonance with the findings of Fosu-Mensah et al. (2010) that as the level of education of an individual increases, the individual is able to undertake a critical analysis which facilitate his decision of whether an activity is risky or not and so is adoption of climate change related activities.



CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The chapter presents a brief summary of the key findings, main conclusions and policy recommendations based on the findings of the study.

5.2 Summary

As a global phenomenon that has emerged, and after decades of research, scientists are no longer in doubt that climate change is one of the devastating environmental threats. Climate change / variability is predominant in Africa and it is greatly affecting climate dependent activities such as farming and fishing. In Ghana, climate change poses an additional stress for a country already struggling with the challenges of environmental degradation and widespread poverty (Neville & Mohammed, 2010).

Over the past decades the climate of Ghana has become drier and more variable and wetlands in drier regions of Ghana are already facing the risk of climate change and are particularly vulnerable to degradation. Past empirical studies have revealed that risk perception level influences the adoption of climate change /variability adaptation strategies. The lack of information on climate change is a critical barrier in dealing with its effects. Through the dissemination of relevant information, the knowledge and awareness of climate change will in effect determine the factors that explain people's risk perceptions. Thus, the overall objective of the study was to explore the awareness level, risk perception and adoption of adaptation strategies of climate variability/ change among local people living around the Muni-Pomadze Ramsar site.

Three different methods were employed to collect information from respondents; questionnaire survey, Focus Group Discussions (FGD) and in-depth discussion. Firstly, purposive sampling technique was employed to select the region, the three districts as well as the occupation of respondents from each of the communities. Secondly, the snowball sampling technique was employed to select respondents, where each respondent who is within the age range and prescribed occupation for the study is selected and these participants then recommend additional participants. A sample size of 200 was used for the study.

In determining respondents' level of awareness of climate variability and change, descriptive statistics using SPSS 21.0 and Microsoft Excel 2013 was utilized. The results showed that all of the respondents were aware of the fact that climate has changed overtime in the study area. The local dwellers living around the Ramsar Site, where the study was conducted, however related their understanding of climate change and variability to changes in climatic conditions such as rainfall, temperature and extreme weather events. As much as evidence abounds that the respondents have observed some changes in the climate and its variables such as temperature and rainfall, some of the reasons that were given as accounting for these changes do not really relate to climate change. Analysis of existing rainfall data shows a sharp decline in mean annual rainfall in Ghana since 2011 and an upward trend in mean annual temperature since 2009.

The binary logit model was employed in identifying factors influencing fishers and farmers' risk perception level. The findings from the survey showed that the level of education and rainfall perception influence risk perception of respondents. The gender of respondents, age, alternative livelihood activities, community and temperature perception

were however not statistically significant. The binary logit model was also employed in assessing the factors influencing the adoption of climate change adaptation strategies. The results presented indicate that risk perception of the individual, gender and alternative livelihood activities are statistically significant in influencing the adoption of adaptation strategies.

5.3 Conclusion of the Study

This study concludes that awareness levels of the respondents about climate change in the three surveyed communities were high. All the respondents indicated that they have heard about climate change. In addition, they were able to indicate observed changes in temperature and rainfall patterns. These findings suggest however that response varied from the communities and occupations. A lot of the respondents however perceived that climate change comes about as a result of indiscriminate cutting of trees and bush burning which cause environmental degradation and pollution, and did not understand the science of climate change. Majority of the respondents who had heard about climate change and variability heard it through the mass media having the radio as the highest source of information on climate change when compared with other mass media.

The factors affecting the risk perception level of the respondents were observed to be educational level and rainfall perception with the level of education being the most important factor influencing climate change risks perception. The factors observed to statistically influence the adoption of climate change / variability adaptation measures were, risk perception, gender and alternative livelihood activities.

5.4 Recommendations of the study

Findings indicate that people are aware of climate change but cannot attribute and explain the real causes of the changes. It was also found out that people's major source of information is the radio. The government, NGOs and the appropriate stakeholders can thus consider using the radio as an educational tool to disseminate information on climate change and its effects. This is because it reaches these rural people, especially those whose livelihood are solely climate dependent. This will go a long way to increase the level of climate awareness in the communities and the increase in relevant climate information will in turn influence their perception of risk as well as adopting the required adaptation measures.

Additional findings show that risk perception and education affect the adoption of climate change adaptation strategies. It is therefore recommended that trained personnel should educate the populace about the risks associated with climate change as well as coping strategies that can be employed to help curb the adverse effects of climate change/variability on their livelihoods. Lastly, the existing policy that discourage the indiscriminate cutting down of trees and bush burning in Ghana should be strengthened and enforced as trees and vegetations enhance the sequestration of carbon which in turn helps mitigate the effect of climate change.

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APPENDICES

APPENDIX 1

CLIMATE CHANGE AWARENESS AND RISK PERCEPTION IN GHANA: A CASE STUDY OF COMMUNITIES AROUND THE MUNI-POMADZE RAMSAR SITE RESEARCH QUESTIONNAIRE

I'm an MPhil student of the University of Ghana studying Climate Change and Sustainable Development (CCSD). As part of my dissertation, I am undertaking this study to find out the level of awareness and risk perception of climate change among selected communities around the Muni-Pomadze Ramsar Site. The questionnaire will further look at how the risk is managed and adaptation services that are available to enhance the livelihood of inhabitants in the selected communities as well as the relationship between the Ramsar site and the communities and some of the benefits the various communities derive from it.

Your assistance is kindly requested in answering this questionnaire. Please feel free to contribute any vital information you deem significant to this enquiry. Your input is extremely valued as the findings of this study would help provide effective policy and strategy design on climate change awareness creation efforts as well as good adaptation strategies which would enhance livelihoods.

Please be reminded that your participation in this research is entirely voluntary. Further, this research does not require for you to reveal your identity and responses will be treated in a confidential manner.

Thank you for your time and ideas.

I hereby consent to being voluntarily participatory to this study.

Please select the appropriate response from the options provided or supply the necessary information.

SECTION A: DEMOGRAPHICS

1. What is your sex?

1	Male	[]
0	Female	[]

2. How old are you?

3. For how long have you lived in this area?

4. Occupation:

i. What is your main/primary occupation?

1. Farming	[]	5. Fish Processing/Retailing	[]
2. Hunting	[]	6. Charcoal burning	[]
3. Trading	[]	7. Logging	[]
4. Fishing	[]	8. Any other, please specify.....	

ii. How many years have you been engaged in your main/primary occupation?

iii. What is your secondary occupation?

iv. How many years have you been engaged in your secondary occupation?

5. Educational Level:

i. How many years did you spend in school?

ii. What is the highest level of education you have obtained?

0 No education		4. Senior High School	[]
1. Primary school	[]	5. Any other (please specify)	
2. Middle school	[]	
3. Junior High School	[]		

6. Are you the head of your household?

 Yes [] No []

7. What is the number of dependents in your household?

SECTION B: KNOWLEDGE AND AWARENESS OF THE CONCEPTS OF CLIMATE CHANGE

8. Have you ever noticed any significant changes in the weather in the past 5 years?

1 Yes []	0 No []
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9. Please indicate whether in your experience you have seen or noticed any changes in the following climate variables over the past 5 years.

10.	1. rainfall []	4. drought []
	2. temperature []	5. strong winds []
	3. precipitation []	6. flooding []

How would you generally describe rainfall levels of this area over the past 5 years?

1. increasing []	2. decreasing []	3. no change []
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11. How would you generally describe the rainfall pattern in this area over the past 5 years?

1. increasing []	3. no change []
2. decreasing []	4. don't know []

12. How would you generally describe the temperature pattern in this area over the past 5 years?

13.	1. increasing []	3. no change []
	2. decreasing []	4. don't know []

What changes have you observed in the temperature intensity in this area over the past 5 years?

1. increasing []	3. no change []
2. decreasing []	4. don't know []

14. How would you describe the incidence of storms in this area over the past 10 years?

1. increasing []	3. no change []
2. decreasing []	4. don't know []

15. Have you ever experienced the effects of drought on your productivity?

1 Yes []	0 No []
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16. How often over the past 10 years have you experienced drought on your productivity?

17. Which month(s) in the year do you normally experience drought?

18. Have you ever experienced flooding on your productivity?

1 Yes []	0 No []
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19. How often in the past 10 years have you experienced floods?

20. Which month(s) in the year do you normally experience flooding?

SECTION C: SOURCES AND USES OF INFORMATION

21. What is your main source of information on the weather?

22. From which of the following other sources do you hear or receive information concerning the weather conditions? (e.g. rainfall, sunshine, storms, drought, flooding, wind, etc)

1. Radio	[]	5. Agriculture Extension Officer(s)	[]
2. Television	[]	6. Adaptation Projects	[]
3. District information Service	[]	7. Newspapers	[]
4. Local Information Service	[]	8. Any other source (please specify).....	

23. Which of the sources (that you have indicated) do you trust most?

24. To what extent do you pay attention to the information which you receive?

SECTION D: PERCEIVED CAUSES OF CLIMATE CHANGE

25. If the rainfall and temperature patterns have changed as you indicated, what do you think could be the possible factor(s) that have led to these changes?

1. Rainfall:

2. Temperature:

SECTION E: CLIMATE RISK PERCEPTION

26. Do you perceive your activities to be risky due to climate change? 1 = Yes 0 = No

27. Suppose some areas in the country are experiencing less rainfall, increasing temperatures with long periods of drought, more storms leading to frequency of floods, and strong winds; to what extent will you agree with each of the following statements?

Perception	Strongly agree	Agree	Not Sure	Strongly disagree	Disagree
a. This situation will create risks for people					
b. This situation will be a threat to the community in which these occurrences are taking place					
c. This situation will be a serious threat to Ghana's development					
d. The government needs to take appropriate action concerning these issues					
e. The media has a great responsibility in contributing to address these issues					
f. The seriousness of these issues could be exaggerated					

28. Over the past 5 years, which year did you have the highest productivity yield/catch/income?

29. Over the past 5 years, which year(s) did you have the lowest productivity yield/catch/income?

30. Which of these climatic variables do you perceive to be responsible for the changes to your yield/ catch/income?

31.	1. rainfall	[]	4. drought	[]	To
	2. temperature	[]	5. strong winds	[]	
	3. precipitation	[]	6. flooding	[]	

what extent do you feel you are at risk of being affected by the changes in the weather which could lead to a decline in your productivity?

1. very high 2. high 3. moderate	4. very low 5. low
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32. Suppose there is some change in any of the variables mentioned above, for example temperature, such that during the past fishing /farming season it became twice as warm as it is, to what extent will your catch/yield / income decrease? (Answer to be given in percentages).

33. When you think about the impact of the climatic changes mentioned above, which of the following are you most concerned about? The impact(s) it/they will have on:

1. me and my family	[]	5. non- human nature	[]
2. my local community	[]	6. not at all concerned	[]
3. Ghana as a whole	[]	7. Any other please specify	
4. people all over the world	[]	

SECTION F: RISK MANAGEMENT AND ADAPTATION STRATEGIES

34. Do you adopt any adaptation strategy? 1 = Yes 0 = No

35. Considering the factors listed above, which of the following practices have you adapted over the past 5 years to cope with the changes to increase your productivity?(More than one option is allowed)

1. use of crop varieties	[]	7. mixed cropping	[]
2. tree planting	[]	8. planting climate resistant crops	[]
3. soil conservation	[]	9. planting in rows	[]
4. irrigation	[]	10. changing planting dates	[]
5. alternative livelihood activities	[]	11. any other strategy (please	
6. mulching	[]	indicate).....	

36. How helpful have these strategies been to your source of livelihood?

37. Which group (s) or organization (s) introduced you to the adaptation practices?

38. What capacity do you need to adapt to the adverse impact of the climatic changes?

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39. Are these capacities being met?

1 Yes []	0 No []
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SECTION G: CREDIT

40. Do you get access to credit?

1 Yes []	0 No []
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41. If yes, from which source?

1 = Microfinance [] 2 = Rural Bank [] 3 = Credit union []

4 = Family/friends [] 5 = Others (Please specify).....



APPENDIX 2

FOCUS GROUP DISCUSSION GUIDE

CLIMATE CHANGE AWARENESS AND RISK PERCEPTION IN GHANA: A CASE STUDY OF SELECTED COMMUNITIES WITHIN THE MUNI- POMADZE RAMSAR SITE

SECTION A: CLIMATE CHANGE AWARENESS, UNDERSTANDING AND KNOWLEDGE OF THE CONCEPTS OF CLIMATE CHANGE

1a. Have you noticed any changes in any of the following variables in your locality over the past five years?

- (i). rainfall pattern (ii). temperature levels

1b. What have you noticed?

2. Have you experienced the incidence of any of the following in your area over the past five years?

- (i). flooding (ii). drought (iii). wind storm (iv). rampant sea erosion

3. How often have you experienced this/these incidence(s) in the last five years?

SECTION B: PERCEIVED CAUSES OF CLIMATE CHANGE

4a. What do you think could be some of the possible factors that have led to these changes in the climate variables and the resulting incidences you have talked about?

4b. What major activities do you think may have caused these changes in this area?

SECTION C: SOURCES AND USES OF INFORMATION

5. From which sources do you get information on climate change?

6. Which of the sources (that you have mentioned) has really helped in your understanding of climate change and why?

SECTION D: CLIMATE RISK PERCEPTION

7. How will you explain risk? Please support your explanation with examples.

8. In your productivity, what do you think could be described as a risk? Please explain with examples.

9. Do you see the changes in the climate variables and the resultant incidences as a threat to your productivity/ source of livelihood?

10. How is climate change or recent changes in rainfall affecting economic activities in this area?

SECTION E: RISK MANAGEMENT AND ADOPTION OF ADAPTATION STRATEGIES

11. What practices have you put in place to help you cope with the current changes so as to increase your productivity? (Give as many practicable examples as possible).

12. Have these practices been helpful? In what way(s)?

13. Which group(s) or organization(s) introduced you to the adaptation practice(s)?

14. Do you get support from other sources (e.g. credit facilities, seeds for planting, training, etc)?

15. Do you think that climate change could be beneficial? Why do you say so?

