UNIVERSITY OF CAPE COAST

FLOODING RELATED CHALLENGES OF LAGOON SETTLEMENTS: A CASE STUDY OF KETA, GHANA

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BY

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MARCH, 2018

DECLARATION

Candidate's declaration

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

Signature:……..... Date:…….....

Candidate's Name: Oliver Nortsu

Supervisors' declaration

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

Signature:……..... Date:.....

Supervisor's Name: Professor Kwabena Barima Antwi

ABSTRACT

Floods occur when a body of water rises to overflow land which is normally not submerged. The causes and socio-economic effects of flooding in the lagoon settlement basin have been investigated in this research. The Keta Lagoon floods its banks and as a consequence leads to destruction of lives and properties. This study aimed at investigating the effects of lagoon flooding on communities along the Keta lagoon, as an environmental hazard on life, property and the socio-economic activities of residents. The study adopted descriptive research design and employed both primary and secondary data and used convenient sampling technique to administer 395 questionnaires. Four (4) key informants were purposely selected from related institutions. The study found out that the causes of flooding in the Keta lagoon settlement basin were both natural and artificial. Climate change contributed to the natural cause of flooding through increase in annual and seasonal rainfall at least, over the last thirty years. Rise in rainfall led to increase in the discharge of the Keta lagoon. The man-made causes of flooding in the Keta lagoon include poor land use, unplanned development of settlements, and indiscriminate disposal of refuse into and on the banks of the lagoon. The socio-economic effects of floods in the basin include loss of life and property as well as financial and health problems faced by inhabitants of the basin. Also, the actions and inactions of concerned institutions have encouraged the haphazard development of settlements in the basin. The resettlement of communities in the Keta Lagoon basin and the enforcement of laws which protect the environment and its inhabitants as well as the proper disposal of refuse were key recommendations made as a solution to the problem.

KEY WORDS

Basin

Flash flood

Flooding

Hazard

Lagoon

Submerged

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DEDICATION

To my wife Sarah Nkrumah Nortsu and daughter Amanda Tsoekie Kotoe,

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CHAPTER ONE

INTRODUCTION

Background to the Study

The world has experienced several hazards from past decades up till now. These hazards have taken various forms including earthquakes, volcanic eruptions, tsunamis, tornadoes, hurricanes, landslides and floods. In all these environmental hazards, huge financial losses are incurred and in some cases, precious human lives are lost.

> *"Flooding is the most common environmental hazard worldwide, after disease and transport accidents (Smith, 2004). This is because of the widespread geographical distribution of river floodplains and low-lying coasts and their long-standing attractions for human settlement. Every year, floods claim around 20,000 lives and adversely affect at least 20 million people worldwide, mostly through homelessness" (Smith).*

The issue of flooding has been of profound interest to humanity especially in recent years, where the effects of climate change is believed to have compounded the changing weather conditions in many places. This is believed to have led to varying resultant effects of extended periods of either torrential rain or severe drought or extreme heat conditions in different parts of the world. Flooding is now a global issue which has attracted a considerable measure of attention from academia, the media and other international discourse.

Flooding has been defined in various ways. It is believed to be a natural and inevitable process which occurs when a lagoon's channel cannot

hold all the water supplied to it by its watershed (Geology Labs On-Line, 2007). An all embracing definition is that given by Ayoade (1988:p. 230) as: "A flood is said to occur when a body of water rises to overflow land which is normally not submerged". When a river floods in the lower part of its basin, water spills out over its channel onto the floodplain.

On the global scale, the socio-economic effect of flood is phenomenal. A recent example is the floods in the United Kingdom which left thousands of people displaced and without clean water and electricity for several weeks. According to a United Nations Regional Coordinator in Dakar, the worst flooding in 30 years that battered West Africa from July, 2007 caused more than 210 deaths and affected more than 785,000 people (Tschakert, Sagoe, Ofori-Darko, & Codjoe, 2009). According to the UN Office for the Coordination of Humanitarian Affairs (Agence France-Presse [AFP], 2007), in a press conference, we are now in the after-crisis, with the end of the rains. Today, the issue is to evaluate the impact at the medium and long-term, notably to evaluate the expanse of the area affected by the rains, the livestock losses and mobilise funds to distribute them to the sectors needed.

It was also noted that the catastrophic rains hit almost half of all African countries, causing a total of more than 350 deaths with hundreds of thousands of people affected. According to a statement distributed by UN Office for the Coordination of Humanitarian Affairs (OCHA), the most affected countries are Nigeria, with 68 deaths and 50,000 affected, Ghana, counting 56 deaths and 332,000 affected, 46 dead in Burkina Faso and 92,979 affected by the floods, and Togo, with 23 deaths and 120,000 affected, of which 11,483 have been displaced (AFP).

Many of the world's cities were built around lagoon and rivers. This situation is not different in Ghana where historically and for economic purposes, towns and major cities were built along river banks. The issue of flooding in Ghana has become more and more prominent over the years. During periods of flooding, human lives have been lost in Ghana with thousands of people displaced. A good example is the floods in Northern Ghana which destroyed properties worth millions of Ghana cedis with the attendant problems of loss of life, displaced people and the emerging adverse health implications, especially the threat of the outbreak of epidemics.

Classrooms, which were supposed to be used to educate children, were turned into makeshift shelters for the displaced people while the National Disaster Management Organisation (NADMO) was struggling to provide adequate food and other aid for the flood victims. Mr. Kwamena Bartels, the then Minister of the Interior indicated that the Ghana government had so far approved 610, 000 Ghana Cedis for the acquisition of additional relief items to supplement the NADMO's strategic reserve (Ghana News Agency, September, 16, 2007).

In parts of Accra including Gbawe, Odawna, Avenor and Alajo, severe flooding is an almost annual affair damaging property and taking priceless lives (Oppong, 2011). So many reasons have been assigned to the causes of these floods but it seems year in year out, nothing is done about it and history repeats itself. These reasons include haphazard urban development and poor sanitation leading to choked waterways and gutters.

Keta is a town in the Volta Region of Ghana and the capital of the Keta Municipal Assembly (KMA, 2014). Keta is the sixty-third most populous

settlement in Ghana in terms of population, with a population of 23,207 (GSS, 2012). Parts of the town were devastated by sea erosion between the 1960s and 1980s. In 1784, Fort Prinzenstein, like most slave trade forts, was built by the sea's edge. However the sea had retreated by about 600 ft. by 1907. Since then Keta has been subject to sustained erosion. The Bremen Factory and Coconut plantation, which were close to the high water mark in 1907, had been swept away by the see by 1924. The erosion has now advanced as far as Queen Street and started to wear away the Fort. Keta Lagoon is the largest lagoon in Ghana with a water area of 300 km^2. This is located in a larger wetlands protected area of 1200 km^2. It is a stopping point for a large number of migratory birds and provides a breeding ground for sea turtles. Keta Lagoon, also called Anlo-Keta lagoon, is the largest of the over 90 lagoons that cover the 550 km stretch of the coastline of Ghana. This lagoon is 126.13 km in length (Environmental Protection Agency [EPA], 2004). It is located in the eastern coast of Ghana and separated from the Gulf of Guinea by a narrow strip of sandbar. This open salty water is surrounded by flood plains and mangrove swamps. Together they form the Keta Lagoon Ramsar site which covers 1200 $km^{2.}$

There are seasonal inflow of sea water during high tide from the Gulf of Guinea and regular inflow of rivers. The rivers which drain into the lagoon include the Aka, the Tordzi River and Belikpa stream which enter the lagoon from the north. The lagoon is surrounded by many settlements. The towns include Anloga, Woe, Keta and Kedzi to the south, Anyako and Anlo Afiadenyigba to the north, Kodzi, Alakple and Tregui to the west and Denu and Adina to the east (Keta Municipal Assembly [KMA], 2014).

Over the years population growth, extensive human activities and climate change all contributed to reduce the volume of water in the lagoon which appears to be drying up. The lagoon became part of the daily existence of the people of Anlo land. In 1992 the Keta Lagoon was placed on the list of Wetlands of International Importance by the Ramsar Convention on Wetlands, and in 1999 work began on measures to limit further erosion and to control flooding of the coastal region. The problem of flooding in the world, in Africa and specifically in Ghana and Keta to be precise needs to be recognised and tackled before the situation gets completely out of hand. The thrust of this study is to investigate this very pressing problem of flooding and its socio-economic effects.

Statement of the Problem

According to Smith (2004), flood-related deaths and homelessness are concentrated in Less Developed Countries and Ghana is no exception. The effects of flooding can never be overemphasized as homes are flooded annually (Adams, 2008). Basements are submerged by water to as high as window level. The associated health problems coupled with the exposure to dangerous reptiles such as snakes is life threatening. Moreover, the danger of staying in such buildings is a critical life endangering escapade (Appeaning-Addo & Adeyemi, 2013).

In the Keta area, buildings including residential facilities, carpentry shops and even churches are located very close to the bank of the Keta Lagoon. And these buildings easily get flooded during the flood period so residents construct wooden bridges from the main streets to their homes in an effort to cope with the floods. But, these bridges which have been constructed

without any technical advice, are weak and hence threating the lives of the residents who use them. At certain places, big stones have been laid on the ground to provide access to their buildings. Due to the poor nature of their coping strategies, residents are sometimes completely prevented from moving out of their homes or visiting their homes for 3 to 4 days when the lagoon overflows its banks.

Moreover, lack of appropriate drainage systems is one of the biggest challenges of flood prone areas (Appeaning-Addo & Adeyemi, 2013). It is evident that the existing drains in these flood prone areas are unable to contain flood waters during and after torrential rains and as such residents have to put in place other temporary drains especially to redirect flood waters from their properties (Appeaning-Addo & Adeyemi).

Apparently, some of these gutters have also been partially blocked with refuse; the issue of sanitation thus arises and probably contributes to flooding in the study areas. When communities around the Keta Lagoon are flooded by water from the river, normal life is invariably disrupted. Time and resources must be devoted to manage the situation in order not to lose valuable property and human life. This precarious situation of distress and insecurity prevails until the flood waters recede. And hence, this study sought to investigate flooding related challenges of Lagoon settlements in the Keta areas.

Objectives of the Study

The general objective of this study was to investigate the effects of Lagoon flooding on communities along the Keta Lagoon, as an environmental hazard on life, property and the socio-economic activities of residents.

The specific objectives were to:

i. Identify the causes of flooding in communities along the Keta Lagoon.

ii. Asses the environmental and socioeconomic effects of Lagoon flooding in these communities.

iii. Investigate the coping mechanisms of flood victims with the lagoon flood situation.

Research Questions

i. What are the causes of flooding in communities along the Keta Lagoon?

ii. What are the environmental and socioeconomic effects of Lagoon flooding in these communities?

iii. How do flood victims cope with the lagoon flood situation in the area?

Significance of the Study

A lot of research on flooding have been conducted in other parts of the country providing vast information for town and country planning. However, more research needs to be conducted particularly in Keta to bring to bear the causes and the effects of flooding on the socioeconomic lives of the people. This research is an applied urban geographic research that provides reliable information on the causes and effects of flooding in urban areas. This would facilitate urban planning in the town of Keta.

In recent years, talk of climate change has taken centre stage in a lot of global conferences. Scientists have warned against the extreme weather conditions that will accompany climate change with the resultant effect of the rise in global temperatures.

A research of this nature will provide important insight into the real challenges of flooding especially in cities and the need to find lasting solutions

instead of ad hoc measures to solve the problem especially with the challenges of climate change looming. The Growth and Poverty Reduction Strategy II (GPRS II) indicates the vital role that the natural and built environments play in achieving long-term growth and development. It draws attention to the need therefore for amenable, efficient, safe and healthy built environments for growth and development. Finding lasting solutions to the recurrent hazard of flooding is very necessary in achieving such an appropriate environment to ensure national growth and development.

Information provided in this research could also serve as a basis for further research into the problem of flooding in Keta and other parts of the country.

Scope of the Study

The research considered the case of flooding as it occurs in communities along the Keta Lagoon. The communities chosen were Dzelukope, and Kedzi in the Keta Municipality. These communities were chosen because after reconnaissance visits to them and enquiries from related authorities and departments, it was discovered that they are the most affected whenever the Keta Lagoon exceeds its carrying capacity, overflows its banks and floods its basin.

Organization of the Study

The work has been organized into five different chapters. The first chapter provides the introduction of this study. It proposes the extensive construction inherent in this study. Thus, it provides adequate background of information to allow the reader understand the reason behind the study and what the researcher intends to accomplish by undertaking the study. The

chapter will give an overview of the whole study. Chapter two of the work reviews earlier research related to the research topic with specific reference to the research objectives. It presents extracts from books, journals and collected works that are helpful in carrying out this work and justifying key conclusions and recommendations. Chapter three also provides details of how data was collected, organized and analysed. It covers the varied techniques and tools used to collect and analyse data to gain valid results. Chapter four provides research findings and analysis obtained through the methodology outlined in chapter three. Finally, chapter five provides a summary of findings, conclusions from the study and recommendations for users of the research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

Many researchers worldwide have studied the nature and effects of environmental hazards on humans, animals and the earth's structure in general. In spite of these numerous studies, the problems associated with environmental hazards especially flooding, which is a major challenge yet to overcome is still with us. This section of the study is devoted to review the existing literature on flooding in the world and particularly in Ghana. A critical look at the nature, causes and effects of flooding as well as techniques of mitigating flood hazards have been considered.

Definitions of Flooding

Flooding like many other environmental hazards is a natural and inevitable process which occurs when a river's channel cannot hold all the water supplied to it by its watershed – i.e. the area the river drains (Geology Labs On-Line.org). When this occurs in the lower part of a watershed, water spills out onto the floodplain which is a flat plain immediately adjacent to the river channel that has been built by river (fluvial) processes. As previously indicated flat areas that lie above floodplains are called terraces and often reflect some past climate conditions.

The Microsoft Encarta Dictionary (2007), simply defines flooding as the 'state of being under water, which is the situation that results when land that is usually dry is covered with water as a result of a river overflowing or heavy rain.' Flooding is thus essentially the situation whereby water inundates an area usually for a period of time for various reasons. The consequences of

flooding on the socioeconomic activities of society are usually preventable although in this case, most victims prefer to taking the option of 'cure instead of prevention' leaving a huge burden on the state (Amoani, Appeaning-Addo, & Laryea, 2012).

Types of Flooding in Urban Areas

Urban areas are generally towns with relatively large population sizes and more vibrant local economies. In Ghana, an urban area would have a population of more than 5000. Keta is the second largest town in Volta Region after the capital Ho. The October 2006 report by Action Aid on climate change, urban flooding and the rights of the urban poor in Africa designates flooding in urban areas into four main types. These are localised flooding, flooding caused by small streams in urban areas, major rivers and wet season flooding in low land and coastal cities. (Action Aid, 2006).

First is the localised flooding which occurs several times a year in slum areas. Alhassan, Gabbay, Arguello, and Boakye-Boaten (2010) attributes this type of flood to the few drains and the highly compacted ground with pathways between dwellings becoming streams after a heavy downpour of rain. Unfortunately, the situation is worsened by the filth (waste and debris) which blocks the few drains.

Secondly, in most urban areas, there can be found small streams which can quickly increase in volume after heavy rain. Unfortunately, relatively small culverts are provided by city authorities as passageways for these streams (Attippoe, 2014). Although these culverts may seem appropriate in size relative to the normal water volume of such streams, changes in the urban area and storm intensity over time usually lead to higher flows that exceed the

capacity of the culverts (Oppong, 2011). These channels in most cases are also filled with debris making them smaller over time

The third type of urban flooding consists of lagoon like the Keta Lagoon of Keta which flow through urban areas. Flooding in such areas is also influenced by land use changes and engineering works up stream (ILGS, 2012). Urban growth leads to expansion of land use over the flood plains of these major rivers leading to major socioeconomic losses as well as loss of human life anytime these rivers overflow their banks and inundate the flood plains (Darteh, 2010).

Although in some developed countries, levees have been raised artificially, there is always the risk that these may be breached causing massive urban flooding (Nelson, 2008). A very bad flood covering 160,000 acres on Canvey Island which killed 300 people in Essex in 1953 led to the formation of a committee by the government of the United Kingdom to look into the phenomenon of flooding (Environment Protection Agency, 2009).

It was through this that the Thames Barrier was built at Woolwich Reach. This consists of nine concrete barriers with a large metal gate between each. This large metal gate can be raised when need be to guard against flooding. The Barrier has since 1982 been raised 25 times apart from monthly tests. In Sierra Leone for example, the Action Aid (2006) report indicates that the situation of flooding has worsened over the years as was noted earlier days, water used to come with low power, now it comes with heavy force that sometimes brings fishes from the sea to our rooms ... Isatu Fofanah, Kroo Bay, Freetown, Sierra Leone (Action Aid, 2006).

The fourth type of lagoon flooding occurs in lowland and coastal towns where wet season flooding could prevail in some areas for eight or more weeks due to the combination of rain and river water leading to a rise in the levels of water in swamps which under normal circumstance would have been naturally submerged during certain times of the year (Nelson, 2007). Storm waves also contribute in some cases to lowland and coastal flooding (Appeaning-Addo, 2009). The general terrain in Keta is not undulating in nature as can be observed from topographical maps of the area. There are thus some really low lying areas where communities have developed in flat land. This is one major cause of lagoon flooding in such areas where lagoon waters flow through and inadequate drains are common.

Other Types of Flooding

Flooding is the most lethal and destructive of all natural hazards, affecting both industrialized and developing countries alike (McGuire, Ford, & Okoro, 2007). This rather strong assertion draws attention to the serious problem of lagoon floods and the urgency with which this phenomenon must be handled and/or managed. Floods affect people from all walks of life and countries, from the developed Northern countries to developing Southern countries. The most powerful nations of the world experience floods too. Thus, the issue of lagoon flooding is a major global issue needing urgent attention and solutions. Lagoon flooding can also be grouped broadly into those resulting from overflowing lagoon waters and those arising from coastal inundation by the sea. Another type of floods (which will not be elaborated in this research) is ice-jam floods (McGuire et al).

Flash Floods

This type of flood is very dangerous especially because of its sudden occurrence. Lagoon flash floods as defined by Plummer and McGeary (1993), are local, sudden floods of large volume and short duration, often triggered by heavy thunderstorms. A lagoon flash flood can also be defined as a sudden and often destructive surge of water down a narrow channel or sloping ground, usually caused by heavy rainfall (Action Aid, 2006). Abott (1996), simply defines lagoon flash floods by briefly describing how it occurs.

According to him large convective thunderstorms can build up in a matter of hours and quickly set loose the terrifying walls of water known as lagoon flash floods. Steep topography helps thunderstorms build and then provides the rugged valleys to channelize the killer floods. It is thus clear that this type of flood easily takes residents by surprise; especially in areas where little or no technology exists to predict the possibility of a lagoon flash flood occurring in order to alert communities likely to be affected. An unfortunate example is the flash flood which occurred in Istanbul, Turkey killing 23 people (International Federation of Red Cross and Red Crescent [IFRC], 2010). In all three definitions of flash floods, the issue of heavy thunderstorms or heavy rainfall is raised alongside that of timing.

Topography also contributes to the occurrence of lagoon flash floods since the steep slope of the lagoon channel enhances this sudden rush of water down the lagoon channel leading to flooding as it approaches areas of gentle slope along the river channel. An example of lagoon flash floods occurred in 1976 in north-central Colorado along the Big Thompson Lagoon when ‘strong winds from the east pushed moist air up the front of the Colorado Rockies,

causing thunderstorms in the Steep Mountains' (Plummer & McGeary, 1996). The heavy down pour led to the lagoon volume swelling up to four times the previously recorded volume increasing the river's velocity to 15miles per hour during the night of July 31, 1976. By the next morning, the flood was over leaving behind 139 dead and 5 missing people with damages exceeding 35 million US$ (Plummer & McGeary). Lagoon flash floods may be occurring along the Keta Lagoon although there are no records to verify this assertion. However, during a reconnaissance survey in March, 2013, a resident at Atokor whose house is located just a couple of yards from the Keta claimed that some floods took them by surprise causing them to be cut off from the town for days without adequate supply of food and water.

Causes of Floods

The causes of flooding can be classified into two broad areas. These are natural causes and human causes of flooding (http://www.geocities.com). Natural causes of lagoon flooding simply refer to those causes of flooding which do not have any direct human influence (EPA, 2009). On the other hand, human causes of lagoon flooding include all flooding caused by the actions or inactions of humans; there is therefore a direct human influence (Action Aid, 2006).

Nelson (2008), mathematically present it as follows:

$Q = A \times V$

Where Q = Discharge (m3/sec)

A = Cross-sectional area: width x average depth (m2)

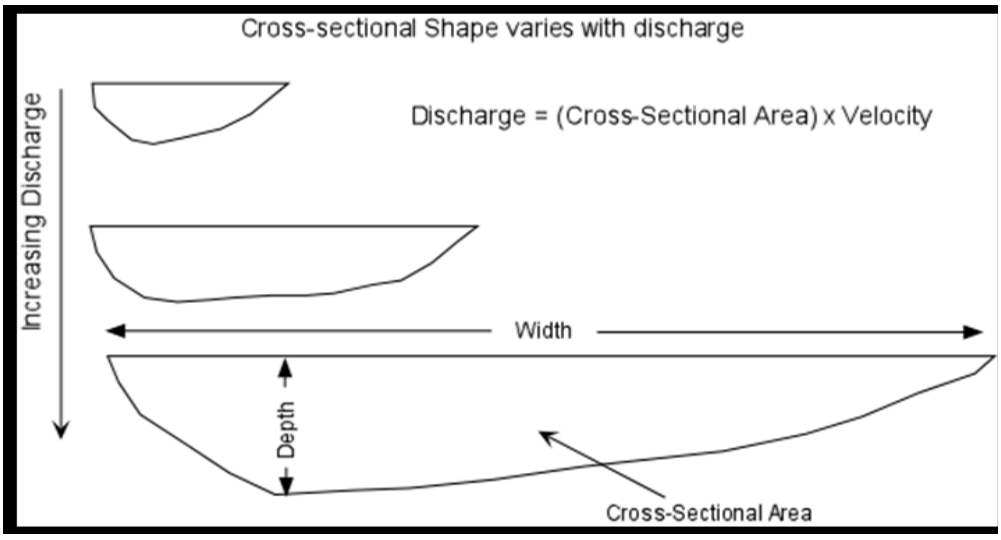
V = Average velocity (m/sec)

Discharge – The discharge of a stream is the amount of water flowing at any point in a given time.

Average Velocity – The average velocity is the time it takes a given particle of water to traverse a given distance. Cross-sectional Area – The cross-sectional area is illustrated in the figure 1.

From Figure 1, as discharge increases downstream, so does the width and depth of the lagoon. Thus, the cross sectional shape will change with the stream becoming deeper and wider, thereby influencing the cross-sectional area. It is also worthy to note from the diagram that the deepest part of channel occurs where the lagoon velocity is highest. The lagoon must adjust its velocity and cross sectional area in order to form a balance as the amount of water in a stream increases.

Discharge increases are caused by factors which include rainfall and tributary lagoon. More water is added to increase discharge through groundwater seeping into the stream. The velocity and cross-sectional area increase gradually over time as water in the lagoon increases. However, after a heavy downpour of rainfall, if these factors are unable to adjust adequately to accommodate more water, the lagoon cannot accommodate all its discharge leading to it overflowing its banks and thereby flooding its floodplains. Although the floodplain is the area that is first inundated, lagoon flooding may move beyond this area.



In Figure 1: Cross – sectional Shape and Discharge Variations

Source: Nelson (2008)

The first natural cause of lagoon flooding is the incidence of heavy rainfall (Anokwa, Martin, & Muff, 2005). This is a generally common cause of lagoon flooding. Heavy rainfall raises the water level of lagoon and rivers as well as other water bodies beyond the carrying capacity of the channels subsequently leading to the overflowing of excess water first onto the immediate floodplains and later, beyond (Appeaning, Lloyd, Amisigo, & Ofori-Danson, 2011). This is a common cause of lagoon flooding in Ghana, and Keta to be specific. The Keta Lagoon which is a major water draining the town centre usually cannot contain all the water in its channel after a heavy downpour of rain thereby causing flooding. It is worth noting that this is reinforced by the influence of human activities. This is based on information retrieved through interactions with communities along the Keta lagoon during a reconnaissance survey in March, 2013.

The nature of relief is also a natural cause of lagoon floods. Flooding is prevalent in low lying areas or lowlands. Since rivers flow more slowly in

such areas, if the water volume increases abruptly or suddenly, floods occur. In the Keta municipal for example, the terrain is generally not undulating flat land. Most communities along the Keta lagoon which get flooded lie in the Lagoon valley (Keta Municipal Assembly [KMA], 2014).

Coastal Flooding occurs by virtue of the fact that the sea level at a point in time is higher than the adjoining coastal area. Thus, lagoon flooding occurs because land lying close to the sea can be submerged by sea water during high tides, tsunamis or storms. Under such circumstances, low lying coastal areas are flooded. A typical example is that which occurred on the 5th of September, 2008 in parts of the Keta municipality in the Volta region of Ghana through high tidal waves (which is reinforced by rising sea levels). About 500 residents were displaced at Dzita and Atorko when the lagoon and sea water took over their homes leading to the eventual collapse of some houses (KMA).

Human Causes of Lagoon Floods

It has always been said that some floods have 'human finger prints'! The activities of man have led to major changes in the nature of the earth's natural systems (Alhassan et al., 2010). Some of these changes reinforce the incidence of flooding resulting in serious consequences on man and the environment in general. The following are some of the human causes of floods.

Population Pressure

Population pressure is perhaps the overriding human cause of lagoon floods in the world. With world population increasing so rapidly, the need for resources and other basic necessities such as food, water and shelter is putting

pressure on nature (Attipoe, 2014). It is very difficult at this rate for resources to regenerate quickly enough to meet the ever increasing needs of the world's teeming population. Forests are quickly vanishing due to the need for wood for furniture and to provide shelter as well as the need for land to be used to cultivate food as well as cash crops (Attipoe, 2014). The need to grow more food especially in developing countries has led to over cultivation and over grazing as previously discussed. Lagoon Flood plains have been reduced so much that farms can be found close to Lagoons and streams (Oppong, 2011).

Erosion is intensive and this has led to silting of lagoon beds, raising of lagoon beds and consequent flooding at the least opportunity given that there is a heavy down pour or steady rainfall over some hours! Population pressure has also led to the development of settlements so close to rivers and streams with the resultant dumping of refuse in such water bodies as can be found along the Keta lagoon in Keta Municipality. Stories recounted by residents close to the lagoon during a reconnaissance survey in March 2013 indicated that people dump refuse and even defecate into the river impeding the smooth flow of discharge during heavy rainfall. These water bodies overflow their banks very often flooding homes and destroying property while causing the displacement of many people.

Effects of Lagoon Flooding

The effects of lagoon flooding are many and in most cases very fatal. Most of the time, loss of life and property as well as livelihoods top the list of the negative effects of flooding (Karley, 2009). The consequences of lagoon flooding have generally been negative in nature. This is especially so in situations where human settlements have developed on the flood plains of

lagoon and rivers (Darteh, 2010). When lagoon floods occur in urban areas, a lot of people are rendered homeless with water taking over their homes and destroying a lot of their properties. Such people now become a burden on the state which must ensure that adequate food, water and make shift shelters as well as blankets are provided for such victims. It is surprising but understanding that most of these flood victims are almost always continually staying at those flood prone areas.

However, the reasons were numerous such as social, economic, and at times religious (Attipoe, 2014). In September 2007, the then President John Agyekum Kufuor announced a five million Ghana cedi support for the three Northern regions and parts of the Western region hit by flooding. Two hundred thousand Ghana cedis (GHS 200,000.00) out of this money was to be used to procure relief items for the victims (Ghana News Agency, 2007). Unfortunately, the National Disaster Management Organisation (NADMO) which is in charge of such victims in Ghana is unable to provide for all the victims because of inadequate resources making it incumbent on government and other corporate organisations to help. Ghana as a developing country cannot afford to use scarce resources annually to manage environmental hazards such as floods. There is therefore the need for more research to provide more information to direct policy toward reducing the consequences of this annual ritual to its barest minimum.

Another disastrous effect of lagoon flooding is the considerable loss of life in dire situations. Children and women are often the victims of such floods. A case in point is the discovery of a dead body at Kedzi, a suburb of Keta close to the bank of the Keta Lagoon in 2006 as reported by a resident in

the area. Lagoon floods can also lead to massive destruction of infrastructure such as bridges, roads and drains. It can also cut off access to other parts of the community or town. In areas such as Keta, this phenomenon can occur when major roads are taken over by water or bridges are submerged in flood water. It makes such routes impassable for a while. In the Northern parts of the country where socio economic infrastructure is either limited or absent in villages, communities can be isolated for days without access to other communities and relations (Adams, 2010).

Last but not least; lagoon flooding can lead to the outbreak of epidemics such as malaria and cholera in communities along flooded areas (Centre for Research on Epidemiology of Disasters [CRED], 2011). This is made even worse by the generally poor sanitation situation in majority of these communities. Also, lagoon flood waters carry debris and sewage into homes. A situation witnessed at Alajo in Accra where mosquito larvae were reported to increase after floods (Darteh, 2010).

It was further said that, at the onset of the floods, these larvae are flushed out but when floods recedes more of the larvae are created to worsen the situation. As Nelson (2007), puts it, 'with higher velocities, streams are able to transport larger particles as suspended load. Such large particles include not only rocks and sediment, but, during a flood, it could include such large objects as automobiles, houses and bridges'. A reconnaissance survey to Atokor (a community found along the Keta lagoon) in March 2013, revealed that reptiles and other insects are also carried into homes exposing people to all sorts of infections. One resident claimed she found a big snake in her house days after recession of the floods. Socioeconomic activities usually slow down

or grind to a halt depending on the intensity of floods leading to loss of productive man hours.

Notwithstanding the negative effects, there are countless benefits associated with floods. Usually the alluvium deposits provides nutrients the growth of plants (Oppong, 2011). The growth of plants further protect the land against silting and erosion while it also forms embankments along its course. Farming communities that live along such rivers enjoy bumper seasons by growing crops in such in the flood plains after flood recedes (Bolt, Horn, Macdonald, & Scott, 1975). Some alluvial deposits also contain precious minerals such as gold which people collects either during or after floods (Appeaning-Addo, 2009). This is common in Ghana in areas where streams or rivers run over the Birimian rocks surfaces (Oppong).

Other Effects of Floods

The effects of lagoon flooding as a hazard can be divided into three according to (Nelson, 2008). These are the primary, secondary and tertiary effects. He explains primary effects of floods as those which occur due to direct contact with flood water while secondary effects occur because of the primary effects. On the other hand, tertiary effects are the long term changes that take place as are result of flood hazards.

Primary effects of lagoon floods

The primary effects of floods are perhaps the most common since it is evident during and immediately after the flood waters recede. The damage caused usually calls for instant harnessing of resources to come to the aid of victims. Nelson (2008), enumerates some of the primary effects of flood hazards as follows:

As previously noted, higher velocities enable streams to transport larger particles as suspended load. These include rocks and sediments as well large objects like trees, automobiles, houses and bridges. Lagoon flood water can cause massive erosion leading to collapse of buildings, bridge structures and levees. Along the coast of Ghana, many homes collapsed during the 2007. Most of these buildings were mud houses and easily got washed away during the lagoon floods.

According to Adams (2008), another primary effect of lagoon floods is the destruction and loss of personal effects and other properties when lagoon flood waters enter human built structures. Furniture, floors and walls can be damaged even with minor flooding. Personal effects such as pictures, documents and other machines like mowing machines and air conditioners can be damaged and in some case washed away by the fast moving flood waters (Adams). Lagoon flood waters also destroy farmlands often washing away crops and stored produce. Livestock and pets usually drown and are carried away.

People who get caught up in the rushing lagoon flood waters often drown. This could be because of the many impediments in the way of the flood waters or the larger suspended load such as cars and trees also being carried along by the flood waters. Lagoon floods which occurred in the lower part of Volta region of Ghana led to eight deaths (Kenneth, K [ghanaweb.com 25th May, 2010]).

Secondary effects of lagoon floods

Secondary effects of lagoon flood hazards occur because of the primary effects (Nelson, 2007). These are generally the disruption in service

delivery such as, disruption of gas and electricity supply and disruption of transportation systems (Appeaning-Addo, & Adeyemi, 2013). Disruption of transportation systems occur when bridges are broken and parts of roads washed away (Oppong, 2011). Some communities may be extremely difficult to reach leading to shortages in food and medical supplies which may result in disease and other health effects especially in developing countries such as Ghana (Nelson).

Tertiary effects of lagoon floods

These refer to the long term effects of lagoon flood hazards. These effects usually occur over time but could be more permanent in nature and more difficult to remedy (Nelson, 2008). For example, location of lagoon channels could change due to flooding. New channels may develop leaving old channels dry. Nelson (2007), also mentions that disruption of business activities could lead to loss of jobs. However, according to Oppong (2011), the aftermath of such hazards usually witness a boom in the construction industry with some jobs also being created.

Again, wild habitats and farmlands may be destroyed. Corruption is usually rife during such times if proper supervision of aid activities is not done (Oppong, 2011) as relief funds are misused. Most often insurance rates are also increased due to lagoon flood hazards due perhaps to the need to pay affected victims their compensation and/or replace damaged properties (Nelson, 2008). These are some of the tertiary or long term effects of flood hazards.

All these effects are applicable to the Keta lagoon basin although some may be more prominent than others. The tertiary effects of lagoon flooding in

Keta are not very visible yet. However, the primary effects of flooding are very obvious in the Keta Lagoon basin to the extent that some buildings have been abandoned due to their structural defects brought on by flood water. Flood water deposits so many materials (usually dangerous) into the various communities making life uncomfortable to residents. The secondary effects are also evident in the Keta Lagoon basin since members of the communities are sometimes cut off from the rest of the town for days while electricity and water supply are also disrupted.

Mitigating Lagoon Floods

According to McGuire et al., (2007), many countries have adapted several means of lagoon flood control. These include desilting of drains and dredging of water bodies, destruction of buildings blocking water ways, reforestation exercises, proper town and country planning and the putting up of levees and other barriers (Musa & Usman, 2013). In Ghana, many of these activities have been undertaken to prevent and control the causes and effects of lagoon flooding especially in the coastal areas (Nelson, 2008). Lagoon flood response or control are grouped into two main categories namely engineering approach to flood control and then a regulatory approach designed to reduce vulnerability to flooding (Nelson, 2007).

Engineering approach

According to the Institute of Local Government Studies [ILGS], (2012), the engineering approach incorporates the use of channel modifications, dams, retention ponds, levees, dikes and floodwalls and flood ways. Channelization helps enlarge the cross-sectional area enabling the channel to carry the higher discharge during floods (ILGS, 2012). In Ghana,

efforts are made to dredge lagoons which are liable to flooding or those blocked with debris (Darteh, 2010). A reconnaissance visit in March, 2013 to communities located near the Keta Lagoon such as the Atokor showed clear signs of dredging in parts of the Keta lagoon channel. Residents confirmed that the Keta Municipality had facilitated the dredging of parts of the river over the past three years. Sediments and debris from the river bed has been deposited on the banks of the lagoon, creating some form of levees to help hold back flood waters. Unfortunately, these embankments may be gradually washed back into the lagoon during heavy downpour of rain. As is stressed that the use of levees, dikes and floodwalls which are structures built along the sides of the channel is thus another way of mitigating floods (Hualou, 2011).

Regulatory approach

According to Oppong (2011), this approach incorporates floodplain building codes, zoning, buyout programmes and mortgage limitations. Floodplain building codes guarantees only structures which withstands high flood velocity and high enough off the ground are permitted in flood prone areas. The zoning however, involves laws that restrict construction and habitation of floodplains in such areas and use for other purposes (ILGS, 2012).

According to Attipoe (2014), this approach demands proper urban planning; unfortunately planning is big problem in Ghana especially in major urban centres such as Accra and Kumasi where buildings are haphazardly situated. The Kumasi Metropolitan Assembly (KMA) under the stewardship of the then mayor, Mr. Maxwell Kofi Jumah in 2003 presented a proposal through Cities Alliance in an effort to prepare a City Development Strategy

(CDS) for the metropolitan region of Kumasi. The expected impact and result of this project was to produce ‘a CDS programme.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter presents the methodology that was employed for the study. It is made up of the profile of the study area, research design, the target population, and the sampling technique(s) that was employed. The chapter also deals with the sample that was used in the study, the data collection method that was employed, and the instrument that was used in data collection. The chapter also looks at how the data collected was analysed, ethical concerns and fieldwork challenges.

Profile of the Study Area

Keta Municipal, with Keta as the capital lies within Longitudes 0.30E and 1.05E and Latitudes 5.45N and 6.005N (see Figure 2). It is located east of the Volta estuary with a total surface area of 1,086km2, out of which 30 per cent is covered by water bodies (Figure 2). Keta Lagoon is the largest and it's about 12 km at its widest section and 32km long whereas the remaining land area is only 724km2 a situation creating constraints on access to land for development (KMA, 2014). The area is generally a low-lying coastal plain with the highest point being 53 metres above sea level around Abor in the north. The lowest point is along the coast around Vodza, Kedzi and Keta township ranging between 1-3.5 metres below sea level which is a necessary condition for the annual flooding of the lagoon areas (KMA s). The Municipality falls within the Dry Coastal Equatorial Climate with an annual average rainfall of less than 1,000mm (Acheampong, 1987). The amount of rainfall reduces from the north to the coastal parts (Acheampong,

1987).

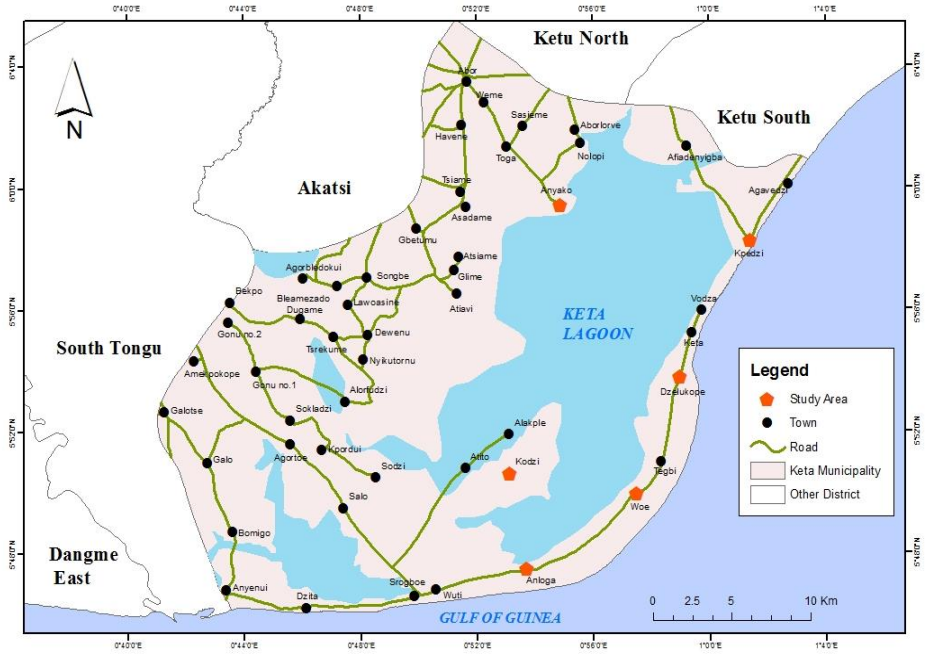


Figure 2: Map of Keta Municipal Assembly showing the study area

Source: Cartography/GIS and Remote Sensing Unit, University of Cape Coast (2014)

The Municipality experiences a double maximum rainfall pattern (MoFA, 2015). The major rainy season is between March and July whereas the minor season begins in September and ends in November. The high average temperatures (about 30^{o}C), coupled with low relative humidifies, promote high evapo-transpiration (Acheampong, 1987). Apart from this, the pattern shows a decreasing trend and distribution throughout the year (MoFA). The high evapo-transpiration also aggravates the general water deficient conditions in the area. Hence, all-year-round cropping is harshly affected except the irrigation farmers (MoFA).

Research Design

According to Creswell (2007), the purpose of a research and its objectives determine the type of research design employed for a study. Considering the nature of the research problem and purpose of this study, the most appropriate research methodology was descriptive survey design. Generally speaking descriptive study according to Creswell (2013) is capable of collecting background information and hard – to – find data and the researcher would not have the opportunity to motivate or influence respondents' responses. Sarantakos (1998) recommends the survey technique for research where attitudes, ideas, comments and public opinion on a problem or issue are studied. The descriptive survey design approach was used for the study. Descriptive survey describes data and characteristics about a population or phenomenon. It also provides simple summaries about the sample and observations made.

Study Population

Population is made up of all the individuals and items of interest under consideration. The target population for the study were all adult residents living along the Keta Lagoon above 18 years of age and hence the unit of analysis was the individual populace living along the lagoon. The targeted population were those living close to the lagoon. It also included key informants such as the assemblyman and relevant officers from institutions such as the Keta Municipal Assembly (KMA), National Disaster Management Organisation (NADMO) and the Town and Country Planning (TCP).

Sample and Sampling Technique

Sampling is a procedure of selecting a part of a population on which a research or study can be conducted. These samples are normally supposed to be selected in such a way that conclusions or inferences drawn from the study can be generalized for the entire population. Creswell and Clark (2007) simply defines sampling as the process of choosing from a much larger population, a group about which a generalized statement is made, so that selected parts represents the total group. Sampling per say is not a technique for getting information but it ensures that any technique used will help in getting information from a smaller group, which could accurately represent the entire group.

However, because the population size of the study area is unknown, as per Sullivan (2015) was computed using the minimum sample size required for accuracy in estimating proportions by considering standard normal deviation set at 95% confidence level (1.96), percentage picking a choice or response (50% = 0.5) and the confidence interval (0.05 = ±5). The formula therefore is:

$$\frac{(z)^2 * (p)\ (1-p)}{c^2}$$

Where:

z = standard normal deviation set at 95% confidence level

p = percentage picking a choice or response

c = confidence interval

Therefore, the sample size calculation is:

$$\frac{(1.96)^2 * 0.5(0.5)}{0.5^2}$$

$$\frac{(3.8416 * 0.25)}{0.0025}$$

$$\frac{0.9604}{0.0025}$$

384.16

Therefore, the sample size for the study will be 384 respondents. However, the researcher decided to increase the sample to 395 to cater for any anomaly.

Table 1: Sample Size

Units	Sample (n)
Residents	395
NADMO Representative	1
KMA Representative	1
TCP Representative	1
Assembly Member	1
Total	399

Source: Author's Construct (2014)

The nature of the study allowed the use of snowballing, convenient and purposive sampling where residents along the Keta Lagoon that could be traced were used for the investigation. The study adopted snowballing, convenience and purposive sampling procedures concurrently in selecting respondents for the study. That is, the study focused on residents who lived along the lagoon who have been affected by flooding or experience flooding. This made it difficult for any of the probability sampling techniques to be applied. At the initial stage, snowball was used to select each prospective respondent and rapport was established. However, the researcher only administered the questionnaire at the convenience (convenient sampling) of

the prospective respondents. After the first respondent, the researcher used him/her (snowball technique) to find the next prospective respondent and the approach was used until the required sample of respondents was exhausted for the quantitative data.

The purposive sampling method was used to select four (4) key informants for the IDIs. They were selected because of the vital role they play in ensuring safety in the communities. The researcher used his expert judgment to select participants that are representative of the population of experts after considering their intelligence, roles they played, departments and organizations, and period of expertise. The key informants included the assembly member of the area and representatives from the National Disaster Management organisation (NADMO), Keta Municipal Assembly (KMA), and the Town and Country Planning (TCP). Table 1 gives the breakdown of the sample size for the study.

Sources of Data

Data sources included both primary and secondary. The main source of data in this study was the primary data. Primary data or sources of data are data that have been collected from first-hand-experience. For the residents along the lagoon, data collection was in the form of interview schedules and observations whereas in-depth-interviews (IDI's) were used to collect data from the key informants. The primary data hence consisted of the background characteristics of respondents, causes, effects, and prevention and coping measures of flooding. The secondary sources were mainly information from both published and unpublished literature such as journals, textbooks, periodicals, and thesis.

Instruments for Data Collection

In line with mix methods as the underlying research approach, interview schedules, interview guides and observation checklist were developed to collect primary data from the field. These three were the main instruments used to collect primary data from the respondents because they are generally the most used in such studies (Creswell & Clark, 2007).

Interview guide (IDIs)

In consonance with the qualitative research methods, qualitative research instrument was used to collect data; specifically, an interview guide (in-depth interview). This will be used due to its general acceptance as being the best data collection method for eliciting primary data about opinions, knowledge and experiences of a particular problem directly from the "actors" or "people" affected (Creswell, 2013). Also, because of its open nature it gives the interviewer the freedom to ask the questions in the order that seem appropriate as the interview is in session not underestimating the depth of data collected. It is posited that the use of the interview guide gives the respondent the freedom to answer the questions in the way they wish and may thus bring forth new information and present issues in ways that the researcher might have not thought about.

Interview schedule (questionnaire)

The aim of this approach was to ensure that each interviewee was presented with exactly the same questions in the same order. Interview schedule was used bearing in mind the fact that some of the respondents are drop out and may not be able to read, understand and provide accurate answer as much as possible. In such a case, the interviewer reads and explains the

questions to the respondent and the respondent makes a choice from among the alternatives. While the questionnaire was used when the respondents were able to read and write hence reading and answering the questions themselves (self-administered questionnaire).

The interview schedules were developed to cover four broad sections (i.e. A, B, C & D). Section A was the socio-demographic characteristic of respondents, section B focused on the causes of flooding, section C dealt with the effects of flooding, and section D investigated the preventive and coping measures for the flooding. Each of the sections had different questions aimed at achieving the main objective of the study (see appendix A and B for the content of the instruments).

Observation

The study also made use of non-participant observation as Creswell (2007) posits that the observers study their respondents from outside the group without participating in the activities of the respondents. Some parts of the environment were observed without the researcher having to necessarily participate with a prepared observation checklist. Basically, physical structures, flooded areas, constructed bridges, flooded homes, refuse disposals, choked drains were the objects of interest. A digital camera was used to collect the observed data to complement the empirical accounts of respondents.

Pre-testing of Research Instrument

The research instruments were pre-tested to assess its validity. The research instruments were pre-tested at Bakaano in Cape Coast Metropolis which is located close to the Fosu Lagoon and presumed to have similar characteristics as the Keta Lagoon area. For the survey instrument (interview

schedule), a group of 30 respondents were involved in the pre-test exercise. After the pretesting of the instruments, it was noted that certain answers and options provided for questions were either inadequate or inappropriate. This led to changes in the instruments before the actual field work took place.

For the IDIs, the assembly member of the area, the NADMO official at the Cape Coast Metropolitan Assembly were used for the pre-testing. The discussions were recorded and transcribed verbatim. The transcripts were compared to the intents of the questions on the IDIs to ensure that the responses adequately reflected the intent of the questions. Subsequently, some of the questions were slightly reworded to reflect the intent of the questions so as to yield the desired data.

Data Processing and Analysis

The answered questionnaires were grouped according to the categories of respondents. Questionnaires for each category of respondents was numbered serially to ensure easy coding, checked for blank options and out of range responses. The coded responses were fed into the computer using the SPSS version 23 and Excel 2013. The data, was then summarized into tables, and figures using descriptive statistics, specifically, in frequencies and percentages for the presentation and discussion of results. The qualitative data was mainly transcribed, categorised and analysed manually based on emerged themes. And some were verbatim quotes used directly to support the claims while the observations were used to add more value to the issues under description by providing images of some of the interesting scenes observed.

Ethical Consideration

Standard ethical concerns in social science research were given prominent attention in the course of the research. Questions in the study were designed to prohibit questions that could harm or threaten the lives of respondents. For moral and legal reason, informed consent was adhered to. Enough information about the study was made known to them and the subsequent participation of the respondents was voluntary. Before the administration of the interview schedule the researcher briefed the elders of the community (community entry protocols were adhered to) and each individual respondent was subsequently given explicit information about the work. This process begun with the issue of introductory letter from the Department of Geography and Regional Planning to the authorities of Keta Municipality. The purpose of the study and the nature of the interview schedule were made known to them. In the end, respondents were not forced but willingly accepted to participate in the study.

Social research provides possibilities of invading the privacy of participant, as such the sensitivity of researchers to privacy, anonymity, and confidentiality is important (Creswell, 2013). There was no aspect of the research questions which required their names. Their privacy was observed unless situations where respondents could not read and write where further guidance were given them to personally answer questions. Hence, in the report, issues that could lead or relate to the identification of an individual respondent were not included.

Fieldwork Challenges

In the community, much time was spent to get respondents for the interviews. Many people showed open displeasure in participating in the study because they alleged that the researcher was collecting data from them for his own benefit, others also said people always come there for some of these information's but in the end, they do not gain from it. To address this challenge, the objectives of the research was made known to them.

In addition, because most of the inhabitants there were fisher folks, during the time of the data collection, some of the fishermen were fishing. A lot of the fishermen for instance were deep sea fishers and do not return until at least four days on the sea. To solve this problem, the researcher had to prolong the data collection period in order to meet the targeted sample size.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the findings and discussions of the data analysis and link them with the literature. It covers areas such as the socio-demographic background of respondents, factors responsible for flooding, socio-economics consequences of flooding and ways in which flood victims tend to prevent and cope. The results were mainly presented in tables, graphs and charts. Interpretations and discussion of the results were made in order to bring out the issues investigated.

Socio-demographic Background of Respondents

Personal characteristics play key roles in research, especially where they have some significant effects on the outcome of result (Bargeman & Van der Poel, 2006). In view of this, the study sought to find out the sex, age, occupation, education, and house ownership issues. Table 2 shows that 15.2 percent of respondents were below 25 years of age and 84.8 percent aged 26 years and above. Thus, information given by respondents were clear and relevant since they clearly understood the problem. The Majority (57 percent) of respondents were males while females were the minority (43 percent).

Respondents were mostly self-employed (80.8 percent) while only 2.5 percent worked in the public services as seen in Table 2 with nearly 17 percent (16.7) being unemployed. Generally, it was found that respondents were mainly traders, students, artisans, fishermen and public servants. Accommodation in the area is mostly for the middle and lower class income earners. It was established that 45.1 percent of respondents had attained

primary school education but only 2 percent of them had obtained tertiary education, 14.7 percent had never attended school and 37.2 percent of respondents are senior secondary school graduates.

Table 2: Socio-demographic background of respondents

Variables	Elements	Frequency	Percent (%)
Sex	Male	225.2	57
	Female	169.8	43
Age	24 years and below	60.4	15.2
	25 years and above	334.6	84.8
Occupation	Public servants	10	2.5
	Self employed	319	80.8
	Unemployed	66	16.7
Higher education	Tertiary	12	3
	Secondary/A level	147	37.2
	Primary education	178	45.1
	Never attended school	58	14.7
House ownership	Own a house	51	13
	Tenants	199	50.3
	Free occupants	145	36.7
Total		395	100

Source: Field data (2014)

Only 13 percent of respondents were owners of the houses they lived in with 63.2 percent being tenants and a further 36.8 percent as free occupants. Free occupants were those people who were living in homes without paying

anything and as well not owning the homes. It was revealed that most of these free occupants were family members of the owners.

Reasons for Continuous Stay in Flood Prone Area

Respondents were asked if they had experienced flooding before and almost all of them had. As many as 98.2 percent of respondents had experienced flooding with only 1.8 percent answering no to the question. This led to the attempt to understand why people continued to live in the area although the phenomenon occurred each year. Figure 3 indicates a summary of the varied reasons respondents gave to explain why they continued to stay in the flood prone area under study. It is clear that most people lived in these areas because of affordability of housing or accommodation. Over sixty point five percent (60.5%) of all respondents were still living in the study area because they just could not afford the cost of moving to another place.

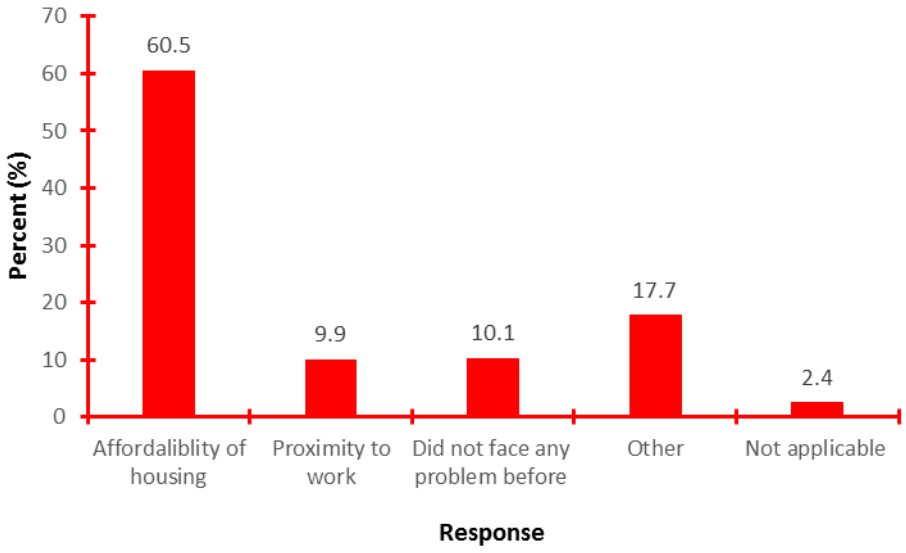


Figure 3: Reasons for Continuous Stay in Flood Prone Area

Source: Field data (2014)

Nearly ten percent (9.9%) continued to stay on because of proximity to their places of work. This made life a little easier for them especially with

regard to earning a livelihood. Some residents had their businesses right there in the study area where they also lived. Most of them were traders and artisans such as carpenters and they operated these businesses in the study area. Almost 18 percent (17.7%) still lived in the area because of other reasons such as having lived there all their lives or staying on because it is their family houses, just to mention a few.

Over ten percent (10.1%) of respondents claimed that their reason for staying on was because they did not face that problem before. This does not debunk the fact that they are not facing the problem since most of them admitted that currently, the issue of flooding was becoming a problem for them. This validates the proposition in the literature which indicates that 'Socioeconomic constraints are the motivation of inhabitants' continual stay in flood prone areas' (Attipoe, 2014). While some residents could not afford to move out of their communities, others continued to stay because of social ties such as the need to stay in a family house to take care of it and not pay any rent (Attipoe).

Desire to Move Out

Many respondents (79%) were willing to move out if they could. However, 19 percent were unwilling to move probably because of some socioeconomic reasons previously discussed. Even those who were willing to move out were still reluctant to move citing socio-economic reasons as the cause of their stay. The finding is consistent to Attipoe (2014) and Oppong (2011) that residents flood victims were willing to move out of the flood prone zones in Accra and Kumasi respectively. It therefore implies that though the affected residents wish to move out of where they stay, they are actually

constrained by other factors. As a results, it could be inferred that if those other issues are catered for residents could move out of the flood prone areas to a better environment.

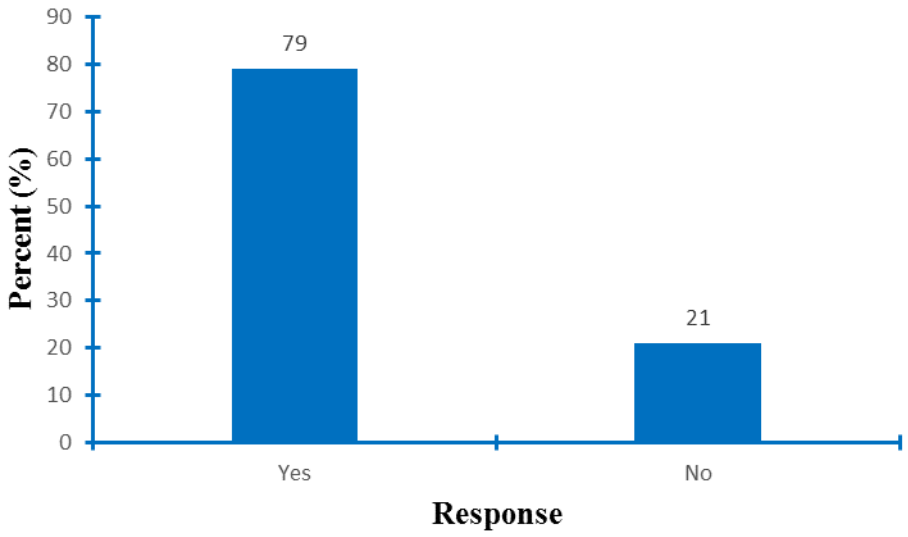


Figure 4: Desire to Move Out

Source: Field data (2014)

Causes of Flooding in the Lagoon

One major objective of this study was to verify the causes of floods in the lagoon basin. This was essential because the causes revealed would be of immense help to policy makers and other stakeholders in the attempt to adopt and mitigate current and future occurrences of the phenomenon.

Figure 4 gives an interesting insight into the causes of flooding according to the respondents who live in the area. The most important cause of flooding according to the respondents is improper refuse disposal in the area. Indeed 22 percent of the respondents indicated that the bad refuse disposal was a key issue and they believed that it was one of the cause of the problem since drains and the channel for the lagoon were choked with refuse.

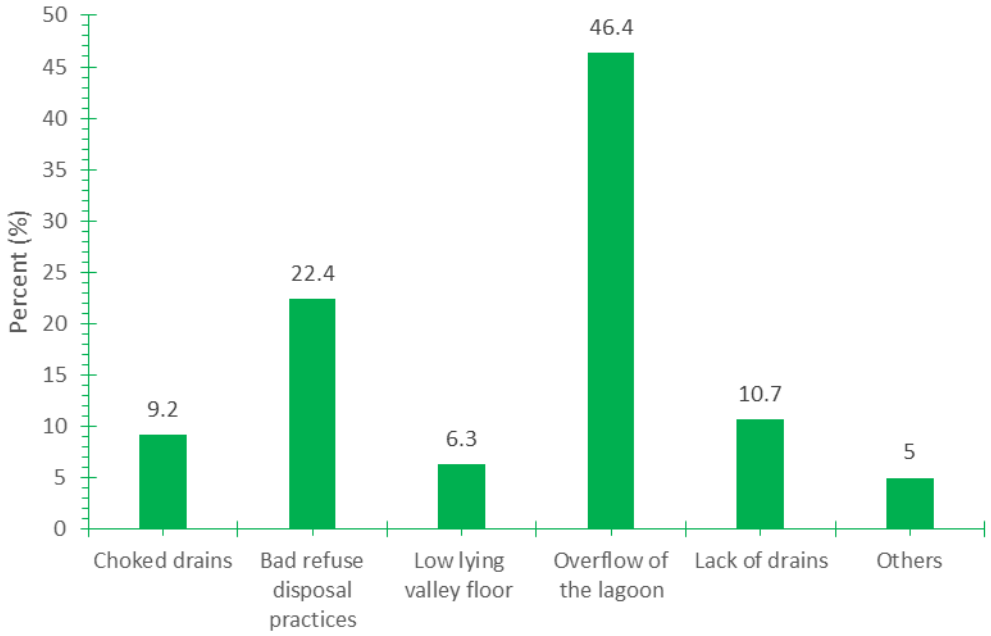


Figure 5: Causes of Flooding

Source: Field data (2014)

The next important cause of flooding incidence is the lack of drains in the area which accounted for 10.7 percent. Nearly 10 percent (9.2%) of the respondents reported that choked drains were also a cause of flooding. However, the main cause was found to be the lagoon which comprised of 46.4 percent. A further 6.3 and 5 percent were attributed to low lying nature of the relief and other factors. The study found that, even though residents believe it was the lagoon which caused the flooding, residents accelerated the severity by dumping refuse in unauthorised places, failed to desilt available gutters, and failed to construct drains. This result is similar to the situation witnessed at Alajo in Accra where bad refuse disposal practices, choked gutters were reported to be the main causes of flooding from the Odaw and Onyasia Rivers (Attipoe, 2014) whereas Oppong (2011) found that the Aboabo River in the Kumasi metropolitan flooded its bank due to the refuse disposal, lack of drains, low lying terrain and choked drains.

The Role of the Related Institutions in Preventing the Floods

The Keta Municipal Assembly (KMA) confirmed that generally because they are under resourced the problem is still persistent even though they make the effort to prevent, control and cope with the flooding. Even though the area around the lagoon has been zoned as a nature reserve, people still build there and dump refuse into and around the lagoon without any consequences. The authorities indicated that efforts to dredge and clean-up the lagoon have proved unsuccessful because people return to their old ways after the clean-up. Whereas some people think the authorities concerned are not enforcing the laws as they should for various reasons others also think that people are so stubborn and do not obey laws.

The Town and Country Planning (TCP) are basically in charge of the layouts of the communities applying the safety principles. They are usually mandated for the demarcation of the lands and areas into the various land use patterns. In doing their work it becomes automatic that effort to cope with floods are taking into consideration by doing a proper layout of the area. It is ensured that the layouts prepared take cognizance of areas that are not buildable and need to be preserved for other uses. According to the TCP Land uses are allocated with safety in mind and would therefore not apportion a flood prone area for residential purposes. They stressed that the difficulty of their work is the non-compliance with the layouts prepared. The truth is that they build without permits and flout so many planning regulations and regulations.

The NADMO is an institution that coordinates the activities of other institutions to help prevent floods and respond to emergencies related to

floods. NADMO embarks on public education on causes of floods within flood prone communities. They also set up Disaster Volunteer Groups to advise residents not to build on flood prone lands. NADMO collaborates with various institutions and departments in executing their mandated duties.

Land use

With the causes of floods given as they were by the respondents in the field, one would wonder if there were any rules, regulations and plans governing land use planning in the lagoon basin. Interviews with stakeholders such as the Town and Country Planning Department (TCPD) of the Keta Municipal Assembly proved that the immediate areas around water bodies in the Municipality have been zoned as green belts meant for the planting of trees to create environmentally friendly recreational areas such as parks for relaxation and also to protect the lagoon. However, a visit to the field showed that this was just on paper and was woefully not adhered to. Observations made in the field showed buildings were built right next to the lagoon and trees are almost totally absent (see Figure 6).

Figure 6: Houses sited very close to the Lagoon

Source: Field Data (2014)

Respondents were thus asked to share their views so far as land use in the area was concerned. It was seen that majority of respondents believed that land use processes were not followed at all. Buildings were erected anywhere and anyhow without permits around the lagoon. Over 68 percent (68.1%) of respondents (269) believed that rules were not followed and so land use was an issue to be dealt with in solving the flooding problem. This is consistent with the findings of Oppong (2011) in the Ashanti Region, where majority of the residents along the Aboabo River built houses closer to the River without adhering to the Town and Country Planning Departments regulations even though they knew the consequences. A 54 year old male interviewee from the TCPD indicated that:

> *"There are land use plans for this municipality and these plans prohibits people from building or undertaking certain activities on different areas but the people do not adhere to. They build without consulting TCPD for permits"*

Waste Disposal Practices

According to Karley (2009) and Adams (2010), the periodic flooding in Accra is mainly caused by man in the form of physical planning and waste disposal practices. He indicated that most of the residents especially those staying along drains empty their bins in the drains and others also build along water courses. This was the basis with which respondents views were sought on the waste disposal practices in Keta. Observations made in the field showed that waste disposal practices in the area were not environmentally friendly (see Figure 7).

The findings of this study is consistent with Karly (2009) as respondents indicated that this was one important cause of flooding in the area. Almost 78 percent (77.9%) of respondents indicated that they disposed of their domestic and commercial waste either in the lagoon itself or on the banks.

Figure 7: Waste Disposal close to the Lagoon.

Source: Field Data (2014).

According to a 46 year old male KMA respondents:

> "*Majority of those staying along the lagoon are victims of waste disposal into the lagoon; go to their houses and check you will find that they do not have waste collectors. Information available to us is that there is a refuse dumpsite provided by the elders of the community but they it looks as if they prefer their old ways of refuse disposal and hence hardly patronise the dumpsite*".

Table 3: Respondents Views on the Issue of Waste Disposal

Waste disposal method	Frequency	Percentage
Public dump	81	20.5
Dumping of refuse in the lagoon	91	23.0
Dumping of refuse at the banks of the lagoon	217	54.9
Burning of refuse	4.0	1.0
Others	2.0	0.6
Total	395	100.0

Source: Field data (2014)

Table 3 is a summary of respondent's views on the issue of waste disposal. It gives a clear indication of the fact that human activities is one of the important causes of flooding in the lagoon since the lagoon is choked leading to the overflow of excess discharge into the flood plains causing havoc. Over 97 percent (97.5%) of respondents indicated that they paid nothing for waste disposal. This was not surprising since they freely throw all their waste into and around the lagoon. The remaining 2.5 percent of respondents paid less than GH¢1.00 for their waste to be collected and disposed of properly. Unfortunately, they formed a minority with the majority choking the channel of the lagoon daily with refuse and thus contributing to flooding. Alhassan et al., (2010) put it that human activities imprints on the natural landscape and as a result changes the natural state of things. Some of these changes reinforce the incidence of flooding resulting in serious consequences on man and the environment in general. Thus, the present study confirms this assertion.

Frequency of Flooding

In an attempt to examine the nature of flooding in the study area, the researcher sought information from the Ghana Meteorological Agency (GMet) as well as respondents regarding how often floods occurred. In this case, particular months and the rainfall pattern over ten years were compared.

Close to 98 percent of respondents indicated that flooding was a frequent phenomenon in the study area, the floods occurred several times annually. Only 2 out of the 395 respondents claimed the floods came once a year with 7 others claiming that it occurred only twice a year. Majority of the respondents (47.3%) also claimed the floods usually occurred during the months of June and July. Over 35 percent (35.2%) of the respondents found it difficult to indicate the particular months in which the floods usually occurred. They elaborated that the floods came whenever there was heavy rainfall or a long period of heavy rainfall or storms. It emerged that floods occurred mostly in June and July and least in the month of October. This findings follow the annual rainfall distribution patterns of Ghana where wet seasons are associated with floods (Darteh, 2010). Darteh) found similar results in Accra where flooding has been observed to be particular during the rainfall seasons. The 55 year old male NADMO representative reiterated that:

> *"Flood is a continuous disaster during the major rainfall season because the lagoon increases in volume and overflows its banks coupled with surface run off from gutters and on the streets. But it is quite occasional beyond the rainfall season"*

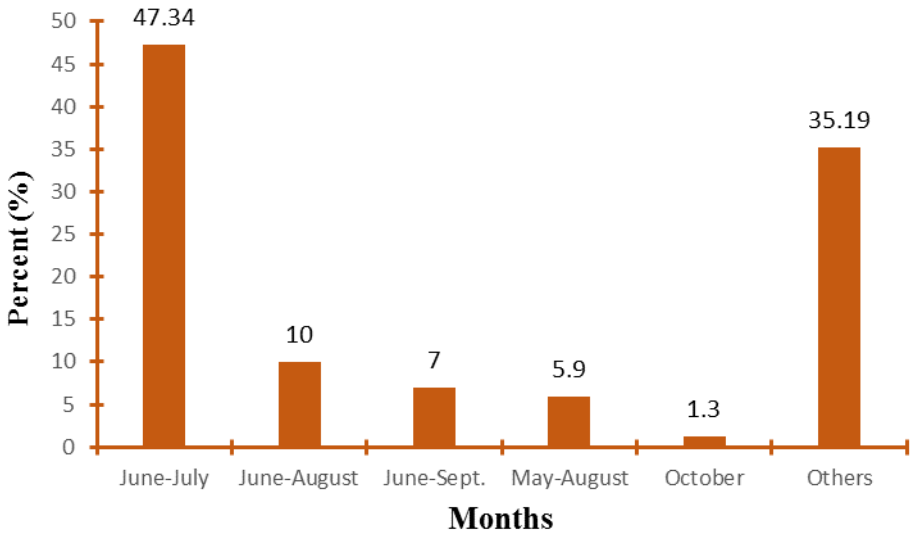


Figure 8: Frequency of Flooding

Source: Field data (2014)

For an in-depth understanding of the problem and its solution, it was important to find out the duration of floods. Enquiries were made from respondents of which majority (60.3%) indicated that floods and its after-effects usually lasted for as long as 6 days. That is to say that the flood waters took that long to recede. Some 29.6 percent of the respondents indicated that floods lasted from 2 to 6 hours. However, the study gathered that those who made this assertion were not living very close to the lagoon in the valley floor. Those who claimed floods could last for days, however, were those who reside in the bottom of the lagoon basin.

Effects of Flooding

One equally important objective of the research was to investigate the effects of flooding in the lagoon basin. The effects of lagoon flooding have been described as fatal; loss of life and property (Karley, 2009). The consequences of have generally been negative in nature especially in situations where human settlements have developed on the flood plains of lagoon and

rivers (Darteh, 2010). This section sought to throw more light on the effects of flooding. The effects have been divided mainly into social, economic, housing (structural), and others.

Social effects

Figure 9 indicates the main ways through which communities are affected socially by flooding. The main effect here, according to respondents, is due to the breeding of mosquitoes and malaria infection (52.9%) followed by poor health (19.5%), inability to go to school or work (12.7%), increased criminal activity (2.5%), low self-esteem (2.0%), low living standards (2.5%) and others. An unhealthy person obviously cannot contribute meaningfully to the development of a society and sometimes becomes a burden to those around him.

More money is spent on treatment of water borne related diseases especially malaria due to the breeding of mosquitoes from stagnant dirty or muddy water which remains after the floods for a while before drying up. This is worsened by the sanitation situation within the area; often leaving the environment susceptible to the outbreak of diseases such as malaria and cholera (Atuguba & Amuzu, 2006). Students and workers often cut out from their schools, work places and other communities. During this period, crime increases since thieves take advantage of the situation to steal properties belonging to victims of the floods.

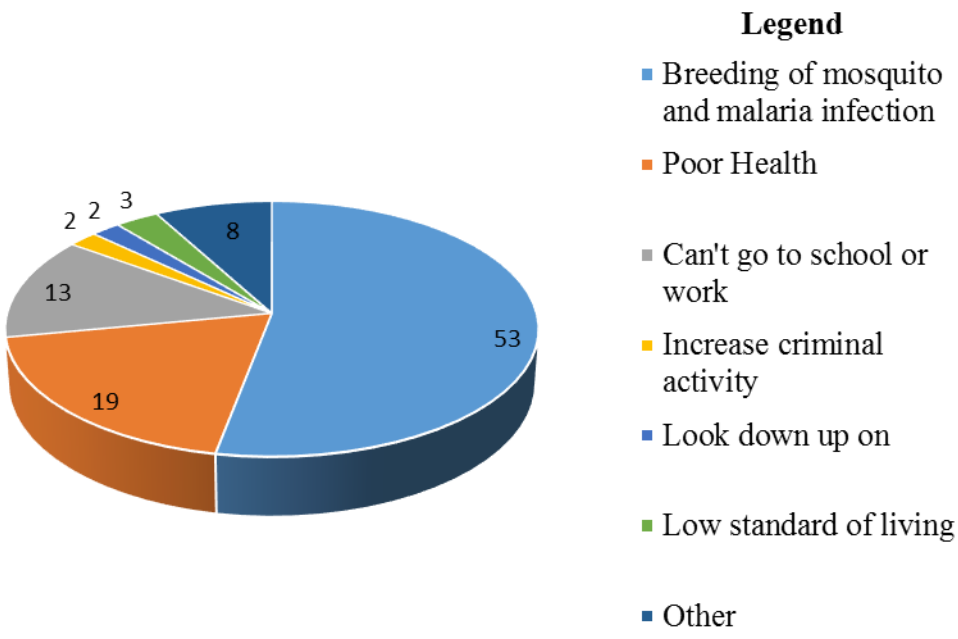


Figure 9: Social Effects of Floods

Source: Field data (2014)

All these lead to a low living standard in these areas since money is spent annually to repair or replace broken properties or properties carried away by flood waters. Flooding situations have also led to a low self-esteem among members of these communities. During floods, the smooth function of society is affected with the direct consequences borne mainly by members of affected communities and their relatives (Adams, 2010).

Another unfortunate effect of floods in the lagoon basin is that of property damage. Properties destroyed by flood waters are mainly household furnishings and appliances such as furniture and electric appliances including television sets, radios and sound systems. Almost 60 percent (59.5%) of respondents made this claim. A fishing community where residents are generally wealthy to be counted among the wealthy class this has the tendency to reduce affect their economic status and in effect their psychological status.

Other properties are also destroyed as can be seen in Table 4 and all these bring untold difficulties into the lives of victims. This supports the findings of Adams (2008) and Attipoe (2014) in Accra and Kumasi respectively that one of the main primary effects of lagoon floods is the destruction and loss of personal belongings and other household properties when lagoon flood waters enter human built structures.

Table 4: Property Damage due to Floods

Property damage	Frequency	Percentage
Cloths, foodstuff and cooking utensils	67	17
Interior room properties and electric appliances	235	59.5
Building material	56	14.2
No property damage	5	1.3
Others	18	4.6
Total	395	100

Source: Fieldwork, 2014.

Economic effects of flooding

A very interesting assertion was made by respondents so far as economic effects of flooding are concerned. A little over 44 percent (44.05%) of the respondents believed there were no financial loss of flooding in the lagoon basin at least as far as they were concerned.

These respondents comprised the civil service, unemployed or self-employed who were located in other parts of the metropolis such as the Central Business District (CBD).

However, more than 50 percent of respondents believed that they were economically affected at least one way or the other. These effects included

increased poverty (9.9%) and increases in health expenditures (5.1%) as well as expenditures on maintenance and replacement of damaged or lost property (14.4%).

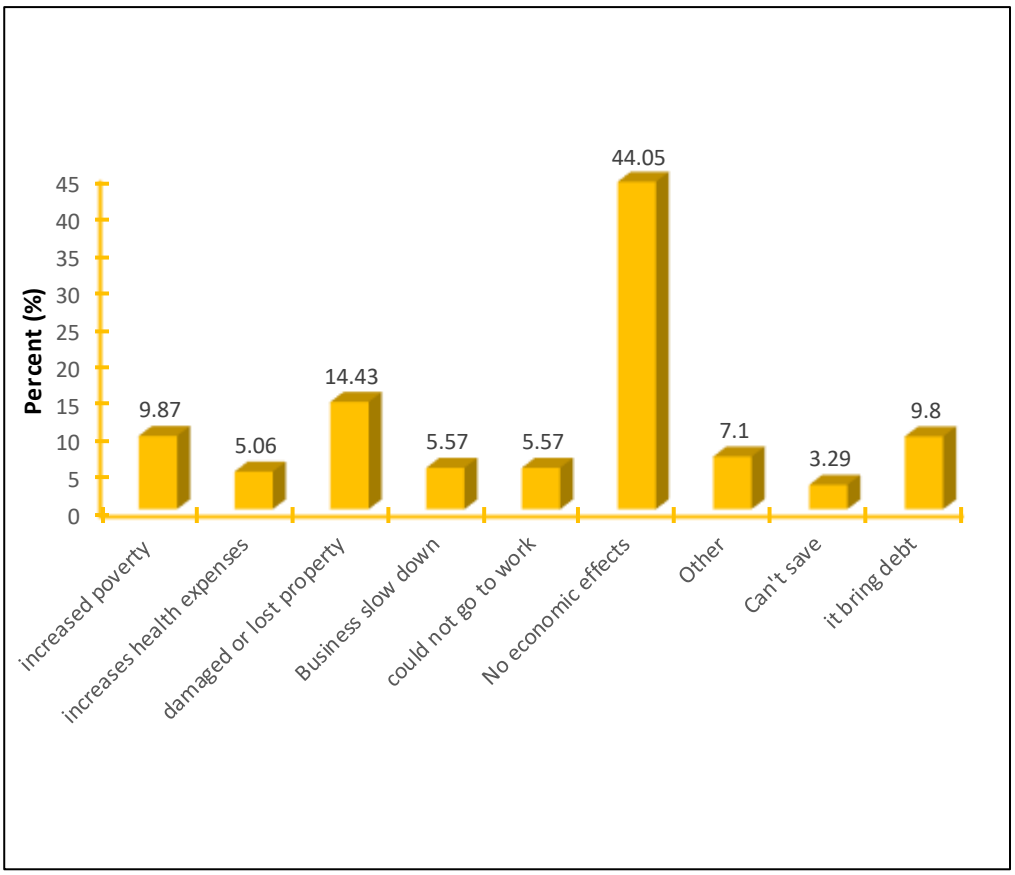


Figure 10: Economic Effects of Floods

Source: Field data (2014)

Also, floods led to loss of productive man hours such that incomes reduced since people could not go to work (5.6%) and so focus and diligently earn their livelihoods and also save part of their incomes (3.3%) or plough back profits to increase productivity since a lot more expenditures have to be made. Economic activities especially among members of communities found in the lagoon basin slow (5.6% of respondents) down and in some cases ground to a halt for severely affected areas.

Figure 10 gives a first-hand impression of economic effects of flooding in the lagoon basin. It could be inferred that flooding affects the residents generally in one way or the other as indicated by Adams (2008) and Attipoe (2014). However, respondent's finding that there was no economic loss resulting from flooding contradicts the findings of Attipoe and the general reported economic effects of flooding on the lives of the vulnerable (Darteh, 2010; Oppong, 2011). This could have come about as a result of the understanding of the term 'economic losses' or the way question was framed for the respondents.

Effects on physical structures (including housing)

Flooding also affects the built up environment considerably. It was observed on the field that many structures were affected by the floods with the foundations of some buildings exposed while others have developed cracks. And yet both completed and uncompleted buildings were abandoned as a result of this annual occurrence.

a. Cracked building near the lagoon

b. Collapsed walls and exposed foundations near the lagoon

c. Abandoned uncompleted buildings near the lagoon

d. Abandoned completed buildings near the lagoon

Figure 11: Effects of Flood on Physical Structures

Source: Field Data (2014)

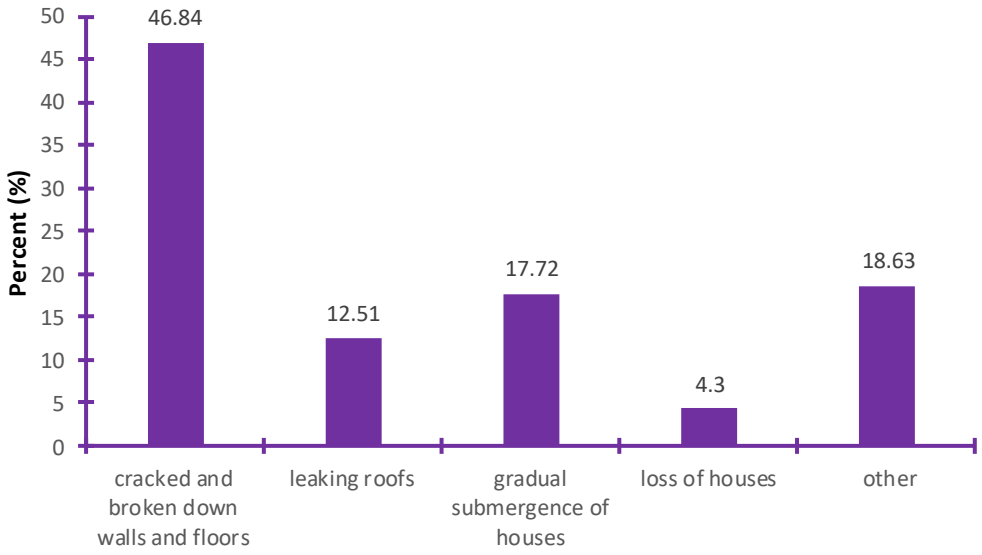


Figure 12: Effects of Floods on Housing

Source: Field data (2014)

Figure 12 shows clearly that floods in the lagoon basin affected the built environment in the basin, especially on structures like houses in the communities. The main structural effect of floods according to respondents was cracked and broken down walls and floors (46.8%), leaking roofs (12.2%), gradual submergence of houses (17.7%) and in some cases loss of houses (4.3%). In line with this study, Amoani et al, (2012) stress the fact that coastal inundation has profound effects on the structures of coastal settlers. They posit that flooding at the coast could lead to the collapse of buildings at the coast especially in poor coastal areas. This is a significant finding in the sense that, most of the settlers in and along the Keta Lagoon are usually the financially vulnerable groups. As flooding continues, buildings weaken and breakdown, society as a whole then bear some of the cost. Education of the coastal setters by the responsible agencies is key to the amelioration of this effects.

Coping Strategies of Residents to Floods

The quest to find coping mechanisms for flood victims led to the question of how residents were coping with this phenomenon. Only 2 percent of respondents indicated that some agencies or organisations came to their aid during the floods through rescue efforts to save lives and property. The remaining 98 percent stated otherwise with residents devising their own coping strategies to survive during and after the floods.

Since no organisation came to their aid, members of the communities tried to help themselves before, during and after the floods? The feedback received to that was before the floods set in, efforts are made to clear choked gutters (13.2%) while temporal drains and bridges are constructed in some cases (19%). Eleven percent (17.8%) of respondents fill sacks with sand and stones putting these at the entrance of their houses to prevent flood waters from entering their homes. Only 2 percent of respondents just abandon their homes till the floods subside but 21 percent of respondents do nothing before the floods set in. a further 12 and 15 percent stay with friends or relatives and build walls to block the flood water respectively. These activities took place before the floods actually occurred. This is in tandem with the findings of other researchers (Attipoe, 2014; Oppong, 2011) where affected flood residents were either trapped in doors till floods retreats or stay out of the flooded areas until the flood recedes for them to return to their various homes. By implication, respondents are aware of the annual floods and hence resort to any of these strategies to survive.

Table 5: Strategies Adopted to Cope with the Danger of Floods

Before	Frequency	Percent
Stay with friends or relatives	47	12.8
Build walls/ steps to block the flood	59	15
Construct temporal bridges	32	8
Construct temporal drains	44	11
Clear choked drains	52	13.2
Fill sacks with sand and stones	70	17.8
Abandon homes	8	2
Do nothing	83	21
During		
Stayed indoors	134	34
Packed valuables	75	19
Stay above	5	1.3
Abandon homes	157	39.7
Do nothing, just stay there	24	6
After		
Clean up and settle	170	43
Abandon homes	35	8.9
Efforts to rescue lost items	9	2.3
Desilt gutters	24	6
Dig trenches	83	21
Repair damaged items	54	13.8
Seek funds	20	5
Total	395	100

Source: Field data (2014)

The 37 year old assembly member indicated that:

> *"It is because of the regular floods some people have permanently abandoned their homes and built elsewhere or migrated. There are some uncompleted and completed buildings that have no tenants."*

During floods, thirty-four percent (34%) of respondents claimed they simply stayed indoors when the floods occurred. Over 40 percent (39.7%) abandoned their houses for their own safety when the floods actually occurred. It was confirmed by the assembly member of the area that:

> *"Everyone around here is facing same or similar problem so you cannot and you wouldn't want to go to a friend's place except those who anticipated earlier and travelled out of here. It is not always dangerous because at times the flood is not so intense but manageable although naturally it is dangerous to venture flood water."*

Nineteen percent (19%) made efforts to safeguard their most valuable properties and 1.3 percent staying above ground surfaces. Unfortunately, 6 percent were unable to do anything and just had to bear the brunt of the floods anytime they occurred. This is rather unfortunate since such people (e.g. the aged and the sick) could easily lose their lives or be seriously injured.

The 55 years old male respondent for NADMO indicated that:

> *"It is very pathetic to find some people actually still living in their flooded environment. Most of these people actually do not get their homes flooded but the surroundings because they managed to raise the buildings to some extent. So when the*

flood is not so intense they stay home. At times when we visit the areas you see some people indoors feeling at ease."

After the floods, 43 percent of respondents indicated that they clean up and settle. About 2.3 percent made effort to rescue lost properties and 8.9 percent abandoned their homes. Whereas 6 percent desilt gutters after the floods, 21 and 13.8 percent dig more trenches and repair damaged items respectively. And 5 percent of the respondents indicated that they sought for funds to undertake repair works, replacement of lost items and generally, return to normal life. There is generally a lot of fixing and drying after the floods. Unfortunately, reptiles and other dangerous animals may remain hiding in homes exposing people to risk of snake bites and other health hazards.

In the literature, it was indicated that strategies to mitigate floods were varied depending on resources availability. The findings in this study confirms those existing in the literature as reported by Musa and Usman (2013). They found that desilting of drains, dredging of water bodies, destruction of buildings blocking water ways, and efforts to block flood water ways were the commonest strategies among victims. In Ghana in general and Accra to be specific, many of such actions have been taken to prevent and control the floods especially in the coastal areas (Attipoe, 2014). In the long term however, it would be necessary for government to consider putting up affordable housing to relocate people living in the flood plain of the lagoon as a lasting solution to the problem of annual floods. Plate 5 shows some observations made from the field.

a. Temporary bridge b. Wall built around the houses

c. Built concrete around houses d. Temporary drainage

Figure 13: Coping Strategies

Source: Field Data (2014)

Reports Made to Authorities about Annual Floods

It was noticed that only 16.5 percent of respondents had reported to the authorities in charge whereas 53.5 percent had never reported flooding incidence to the assembly. Reports had been made mainly to the Assembly man or Unit committee members of their respective communities with a few people reporting the problem of flooding in the lagoon basin to Keta Assembly (KMA). Over a fifth (21%) of respondents however were aware of efforts made by the KMA to curb the situation.

The 46 year old KMA official attested that:

> "*It is true they report to us, we also forward the reports in collaboration with the NADMO to solicit for relief items. We equally report flooding on their behalf but when we are not able to help them with relief items they think we do not share their grievances"*

The failure of respondents to report the issue to the authorities is probably rooted from the fact that their previous reports of the flood may not have yielded expected response. Or it could also be due to the generally attitudes of people to not really care about the help of others but what they can do to survive on their own. This is in line with the assertion of the EPA (2009) that residents though do not adhere to their warnings and regulations they also fail to report relevant issues to them for their action. It could be deduced that, residents may not be reporting the issue based on the fact that they feel that they are their own problem.

Flood Prevention

Some members of the communities (32.7%) also claimed that they had made efforts to prevent flooding in their respective communities by reporting to authorities but to no avail and they contribute money and do discuss proper means of waste disposal and relocating habitants around the lagoon. The assembly member confirmed that:

> *"It is true they make some contributions but those are purposely to provide waste collection bins at vantage points. For waste disposal sites most of the people find the new*

dumpsites long and stressful so they rather stick to their old ways"

Though they are not regularly visiting them, the 55 years old NADMO official claim that:

"They offer them periodic education and advise on flood prevention especially prior to rainy seasons. Through the education, we give them early warnings as to when they should expect flooding to prepare themselves"

As identified in the field, out of 395 respondents, 67.3 percent had made absolutely no attempt at flood prevention claiming that there was nobody to talk to since nobody cared about them and the situation was beyond their control. They also claimed the community layout was poor with some simply saying that nothing has been done. The reasons given by the latter are quite lame and only an attempt to blame everybody else except themselves.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter concludes the study by first recapping the key findings of the study, a summary of the work, and drawing conclusions from the findings. It further provides flood management interventions by way of recommendations based on the findings and conclusions drawn and ends with the limitations and areas for further research.

Summary

The Keta lagoon floods its banks every year taking over vast areas of land around it leading to loss of lives and properties. Smith (2004) made the assertion that flood-related challenges are more concentrated in developing countries of which Ghana is inseparable. A preliminary visit to communities along the Keta lagoon revealed the firmness of the residents to stay in the flood prone areas despite the fact that flooding is an annual event during which flood waters rise to the level of their buildings windows. As a result, this study focused on the effects of lagoon flooding on communities along the Keta lagoon as an environmental hazard on life, property and the socio-economic activities of the residents. Specifically, the study sought to:

- Identify the causes of flooding in communities along the Keta lagoon;
- Assess the environmental and socio-economic effects of lagoon flooding in these communities; and
- Investigate the coping mechanisms flood victims with the lagoon flood situation.

The study used both the qualitative and quantitative data collection methods as its design, a sample of 395 respondents of the population was used through convenience sampling technique. Additionally, four (4) key informants and stakeholders were purposively selected. With the primary data as its main data source, the interview schedule, in-depth interview guide and observation checklist were the research instruments used for the data collection. Data analyses and presentation was done with the help of the SPSS; frequencies, percentages and graphs were used to present findings.

Key findings of the Study

Based on the results and discussions the main findings of the study are summarised as follows:

- Over 46 percent (46.4%) of the inhabitants of the communities along the Keta lagoon believed that flooding of their community is due to the lagoon but 22 percent of the respondents also shared the view that bad waste disposal practices accelerate the flooding;
- Majority (54.9%) of the respondents however indicated that refuse is deposited rather at the bank of the lagoon where surface runoff drain all into the lagoon;
- More than half (%) of the respondents indicated that infestation of mosquitoes and malaria illnesses is one of the main environmental effects of flooding. There was however only 2 percent of the respondents who indicated that society looked down upon flood victims;

- The results show that over 44 percent (44.5%) of the people experience no direct financial loss from floods. But it was found that 14.4 percent claimed they had lost valuable items or properties;
- Among the physical items, 46.8 percent had cracks and broken wall or floors in the buildings whereas only 4.3 completely lost their houses.
- Interior room properties and electric appliances were mostly (59.5%) destroyed among the household properties;
- The study also found that residents use many coping strategies such as desilting of gutters and constructing trenches to manage the situation. The commonest preventive method was filling sacks with sand and stones to block the water ways and it constituted 17.8 percent while only 2 percent abandoned their homes prior to floods;
- During floods however, nearly 40 percent (39.7%) of the victims abandon their homes for safety reasons and yet 34 percent stayed indoors but only 1.3 percent of the people stay above the ground level in the same houses for the same safety reasons; and
- Among the numerous strategies such as repair of damaged items, digging more trenches to drain water, abandoning homes after floods recedes, 43 percent opt to clean up and settle in their flooded homes with only 2.3 percent making the efforts to rescue their lost items.

Conclusions

The following conclusions are drawn from the findings from the current study.

- It can be said that the study area is faced with the flooding of the Keta lagoon on annual basis. Causes of flooding in the area is natural but

accelerated by human factors, notable among the factors was bad refuse disposal practices. The study hence stressed that residents in the area are therefore part of the annual flooding incidence in and around the Keta Lagoon area.

- Flooding led to many environmental problems in the study area including erosion, breeding of mosquitoes and malaria infestation. Though, the flood is an annual problem, its environmental problem have long term effects on the residents. These problems are however, manageable should the residents be equipped with the necessary knowledge and resources.
- Financially 56.5 percent indicated that they did not lose, physical or economic assets such as properties, electrical appliances, and cracks of floors and walls were the main economic loss of residents. Hence, this study concludes that the flooding in the Keta lagoon area is associated with lots of financial challenges of the residents. This is very critical given the fact that the residents are mainly fisher folks and hence their livelihood is threatened.
- Residents adopted so many strategies in their efforts to cope with floods before, during, and after floods. It can be concluded that prior to floods, residents made efforts to construct trenches, desilt choked gutters, filled sacks with sands to block water courses. Their coping strategies are however, not sustainable as they usually to that with weak materials either due to inadequate finance or because they do it in a haste to have immediate effects on their flooding problem; and

- Residents rather abandoned their homes during floods and return to them after floods, but a significant proportion also stayed indoors till the flood season is over. At the time of flooding, most residents are aware of their situations and as such vacate their homes prior to the floods whiles others leave immediately their homes begin to flood.

Recommendations

Based on the findings and conclusion drawn the following recommendations are submitted for consideration by the key stakeholders.

- Residents could be advised through the collaboration of NADMO and the EPA on other building strategies such as building on pilings (elevation building) to raise houses above the ground. In that way, surface runoff and lagoon floods are likely to pass under the building;
- The KMA should make it a priority to provide waste bins in the communities and ensure its effective use and final disposal. With this both the human cause and effects of flood will be reduced;
- The Town and Country Planning Department of the KMA should be given monitored and supervised to enforce planning laws in the municipality. In this way construction along the lagoon will be prevented;
- Since the lagoon overflows its banks, drains should be constructed to properly channel the lagoon's overflow to reduce flood effects in the communities. Regular dredging of the lagoon would be very helpful in checking the flooding problem; and

- In the long term, the KMA should develop a program to gradually and effectively pull down buildings and relocate residents in the lagoon basin especially those in the nature reserve.

Limitations and Areas for Further Research

This study focused on the effects of lagoon flooding on communities along the Keta lagoon as an environmental hazard on life, property and socio-economic activities of residents. The study assumed that respondents could recall incidents before, during and after flooding and used it as its method of data collection in analysing flooding effects on the surrounding communities of Keta Lagoon.

The main limitation is how to actually situate it empirically that the information provided were accurate enough to warrant the conclusions. This is partly because of lack of a base line study to serve as a source of comparison to the current findings. Nevertheless, the study held on to its assumption that respondents could recall exactly what happens before, during and after flooding of the Keta Lagoon. It is also true in the literature that this methodology has been employed by other writers such as Afrane (2002) and Quartey (2015) in their respective studies. This however informed the interpretation and conclusions of the findings.

It is recommended that a detailed impact assessment of floods on the livelihood of the people living along the Keta lagoon be considered in the future. Such a study will provide detailed implication of the floods experienced in the area.

REFERENCES

Abbott, P. L. (1996). *Natural Hazards*.Wm. C. Brown Publishers, USA.

Acheampong, P. K. (1987). The climate of Ghana according to the Thornthwaite 1948 climatic classification. *Malaysian Journal of Tropical Geography*, 16 1-5.

Action Aid, (2006). *Climate Change, Urban Flooding and the Rights of the Urban Poor in Africa: Key Findings from Six African Cities*. A Report by Action Aid International.

Adams A. G., (2010) Perennial Flooding in the Accra Metropolis: The Human Factor. Accra.

Adams, G. (2008). Perennial Flooding in the Accra Metropolis: The: A Human Factor. *(An MSc thesis submitted to the School of Graduate Studies, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana).*

Afrane, S. (2002). Impact assessment of microfinance interventions in Ghana and South Africa: A synthesis of major impacts and lessons. *Journal of microfinance/ESR reviews*, *4*(1), 37-58

Agence France-Presse (AFP, 2007). Flooding caused 210 deaths in West Africa, said UN. Accessed on 31st October 2015, from http://newsinfo.inquirer.net/922799/312-dead-as-mudslides-flooding-sweep-through-sierra-leone-capital

Alhassan, A. R., Gabbay, O., Arguello, J. E. M. & Boakye-Boaten, N. A., (2010). Report to the Accra Metropolitan Assembly on Solid Waste Composition in Aryee Diki Electoral Area, Ayawaso Central Submetro, Accra New Town.

Amoani, K.Y., Appeaning-Addo, K., & Laryea, W.S. (2012). Short-term shoreline evolution trend assessment: A case study in Glefe, Ghana. *Jàmbá: Journal of Disaster Risk Studies* 4(1), Art. #45, 7 pages. Available at http://dx.doi.org/10.4102/jamba.v4i1.45 (viewed on 22nd June, 2014)

Anokwa, Y., Martin, N. & Muff, R., (2005). *Coastal stability map of Greater Accra Metropolitan Area; Environmental and engineering geology map of Greater Accra Metropolitan Area*, Accra, Ghana.

Appeaning Addo, K. & Adeyemi, M. (2013). Assessing the impact of sea-level rise on a vulnerable coastal community in Accra, Ghana. *Jàmbá: Journal of Disaster Risk Studies* 5(1), Art. #60, 8 pages.

Appeaning-Addo, K., (2009). *Detection, measurement and prediction of shoreline change in Accra, Ghana*. Lambert Academic Publishing, Saarbrücken.

Appeaning-Addo, K., Lloyd, L., Amisigo, B. & Ofori-Danson, P.K., (2011). Impacts of coastal inundation due to climate change in a cluster of urban coastal communities in Ghana, West Africa. *Remote Sensing 3(5)*, 2029–2050.

Attipoe, S. K. (2014). An assessment of flood mitigation measures in Accra, Ghana. *(A master's thesis submitted to the department of Planning, Kwame Nkrumah University of Science and Technology, Ghana)*

Atuguba, R.A. & Amuzu, T.E. (2006). Report on Climate Change and flooding in Alajo, Accra. Accra: The Legal Resources Centre-Ghana (LRC) And Action Aid (International) Ghana.

Ayoade, J. O. (1988). *Tropical Hydrology and Water Resources.* Macmillan Publishers Limited, London.

Bargeman, B. & van der Poel, H. (2006). The role of routines in the vacation decision-making process of Dutch vacationers. *Tourism Management. 27: 707-720.*

Bolt, B. A.; Horn, W. L.; Macdonald, G. A. & Scott, R. F (1975). *Geological Hazards: Earthquakes, Tsunamis, Volcanoes, Avalanches, Landslides, Floods,* Springer-Verlag, New York Heidelerg, Berlin

Centre for Research on the Epidemiology of Disasters [CRED] (2011). *CRED CRUNCH: Disaster data: a balanced perspective.* http://reliefweb.int/sites/reliefweb.int/files/resources/F7E6E30438715736C125784C004D2F49-Full_Report.pdf [Accessed 29 August, 2013].

Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches* (2nd Ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2013). *Research design*: *Qualitative, quantitative and mix methods approach.* (4th Ed.). Thousand Oaks, CA: Sage Publications Incorporated.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications Incorporated.

Darteh, B. (2010).Flooding in the City: The Blame Game. Accra Learning Alliance Blog. http://switchaccra.wordpress.com/2010/08/

Cartography/GIS and Remote Sensing Unit (2014). Map of Keta Municipal Assembly showing the study area. Department of Geography and Regional Planning University of Cape Coast.

Environment Protection Agency (2009). *Flooding in England: A national assessment of flood risk*, Bristol: Environment Agency.

Environmental Protection Agency (2004). *Ghana climate change impacts, vulnerability and adaptation assessments*. Accra: EPA.

Geology Labs On-line: What is flooding? Accessed on 13th November, 2008 (1330hrs) from http://www.mountain.org/education/multimedia /novag 02a .cfm

Ghana News Agency (September, 2007). Five Million GH Cedis to Support Flood Victims. http://www.dagbon.net/news.php?bo=showNews&ID=2507.

Ghana Statistical Service (2012a). *Population and Housing Census: Summary Report of Final Results.* Accra: Ghana.

Ghana Statistical Services (2012b). *Report of the 2010 Population Census,* by K, A, Twum-Baah, J. S. Nabila and A. F. Aryee. Accra: Ghana Statistical Service, 2010.

Hualou, L (2011). Disaster Prevention and Management: A Geographical Perspective. *Disaster Advances 4(1)*

Institute of Local Government Studies (ILGS), International Water Management Institute (IWMI) (2012): *Community Adaptation to Flooding Risk and Vulnerability.* Accra, Ghana.

International Federation of Red Cross and Red Crescent (2010). Turkey: Floods. DREF operational final report.

https://reliefweb.int/map/turkey/turkey-floods-8-sep-2009-location-map

Karley, N. K. (2009). Flooding and physical planning in urban areas in West Africa: Situational Analysis of Accra, Ghana. *Theoretical and Empirical Researches in Urban Management, 4 (13)*

Kponor, K. (Feature Article of Tuesday, 25th May 2010). It Is Time For Government To Establish Keta Basin Development Authority. Retrieved 28th February, 2016 from http://www.ghanaweb.com/GhanaHomePage/NewsArchive/It-Is-Time-For-Government-To-Establish-Keta-Basin-Development-Authority-182660

Keta Municipal Assembly [KMA] (2014). Physical characteristics. Retrieved from http://ghanadistricts.gov.gh/DistrictSublinks.aspx?s=965&d=182

McGuire, L., Ford, E., & Okoro, C. (2007). Natural disasters and older US adults with disabilities: implications for evacuation. *Disasters*, 49–56.

Microsoft Encarta Dictionary (2007). Definition of Flooding. Microsoft.com. Available on 22/02/2014.

Ministry of Food and Agriculture [MoFA], (2015): Keta Municipal Assembly: Physical characteristics.

Retrieved from http://mofa.gov.gh/site/?page_id=1713

Musa, D. & Usman, M. (2013). An evaluation of the physical planning flood control measures adopted in Kubwa Town, Federal Capital Territory, *Abuja. Elixir International Journal*. (www.elixirpublishers.com).

Nelson S. A. (2007). *Flooding hazards, prediction and human intervention, EENS 204, physical geology lecture notes, Tulane University*.

Nelson, S. A. (2008) *Natural disasters and assessing hazards and risk. EENS 3050 natural disasters lecture notes, Tulane University.* www.tulane.edu/~sanelson/natual_disasters/introduction.htm

Oppong, B. K. (2011*).* Environmental hazards in Ghanaian cities: the incidence of annual floods along the Aboabo River in the Kumasi metropolitan area (KMA) of the Ashanti region of Ghana. *(A master's thesis, 2011, department of Geography and Rural Development, Kwame Nkrumah University of Science and Technology)*

Plummer, C. & McGeary, D (1993). *Physical Geology (6th ed).* Wm. C. Brown Publishers, USA.

Ouartey, J. (2015). *Impact of Microfinance on the growth of small businesses in urban Ghana.* Paper presented at the 8th International Microfinance Conference held in the University of Cape Coast between 12th and 13th February 2015.

Sarantakos, S. (1998). *Social Research* (3rd Ed). London: Macmillan Press Ltd

Smith, Keith (2004*). Environmental hazards: assessing risk and reducing disaster*. Routledge Publishers, New York.

Sullivan, L. (2015). Power and sample size determination. Boston University School of Public Health. Accessed on 9th November, 2017.

Tschakert, P., Sagoe, R., Ofori-Darko, G. & Codjoe, S. N. (2009). Floods in the Sahel: an analysis of anomalies, memory, and anticipatory learning. *Climatic Change* DOI 10.1007/s10584-009-9776-y

APPENDICES

APPENDIX A

QUESTIONNAIRE FOR RESIDENTS

UNIVERSITY OF CAPE COAST

QUESTIONNAIRE FOR RESIDENTS

DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING

FLOOD RELATED CHALLENGES OF LAGOON SETTLEMENT: A CASE STUDY OF KETA, GHANA

This research aims mainly at investigating flooding and environmental challenges at lagoon settlement: a cases study of Keta Lagoon basin and the effects as a hazard on life, property and socio-economic activities of residents. It also aims at suggesting recommendations to remedy the problem. This is a purely academic research and the anonymity of respondents is assured. Information given will be used purely for academic research purposes.

Section A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. (a) Sex: a. Male [ ] b. Female [ ]

(b) Age: .....

(c) Ethnicity: ……

(d) Household status……

(e) Occupation: ……

(f) Level of educational (i) Primary [ ] (ii) Secondary/A level [ ]

(iii) Tertiary [ ] (iv) Never attended school [ ]

(g) Length of stay in the community (i) 0 – 5 years [ ] (ii) 6 – 10 years [ ] (iii) 11 – 15 years [ ] (iv) 16 – 20 years [ ] (v) Above 20 years [ ]

(h) Residential status: Free occupant [ ] Tenant [ ] Owner-occupant [ ]

SECTION B: CAUSES OF FLOODING IN KETA

2. Has your household experienced lagoon flooding before?

a. Yes [ ] b. No [ ]

3. If yes, why do you still live here?

a. proximity to work [ ]

b. affordability of housing [ ]

c. did not face problems before [ ]

d. other [ ] , specify .....

4. What do you think are the causes of these floods?

a. Building in water courses [ ] b. Bad refuse Disposal [ ] c. Building Designs [ ] d. Hard Landscaping [ ] e. Lack of Drains [ ] f. Poor design of Drains [ ] g. Choked drains [ ] h. low lying nature of relief [ ]

i. other [ ], specify

5. Are you willing to move out of this area in view of the floods?

a. Yes [ ] b. No [ ]

6. How often do floods occur in this area?

a. Once a year [ ] b. Twice a year [ ] c. Several times a year [ ]

7. When do floods occur during the year? .....

8. How long do the floods usually last?

(a) .....Hours (b) .....Days (c) .....Weeks (d).....Months

(e) Other [ ], specify.....

9. Which agency or organisation (s) come to your aid during the floods?

a. National Disaster Management Organisation (NADMO) [ ]

b. Keta Municipal Assembly [ ]

c. Sub-municipal assembly [ ]

d. None [ ]

d. Other [ ], specify.....

10. What did they do to help?

a. Provision of relief items (food, building materials, blankets, medicine, etc) [ ]

b. Rescue Effort [ ]

c. Other [ ], specify.....

11. Do you think the procedure involved in locating any activity (land use) on land in this area / community are followed?

a. Yes [ ] b. No [ ]

12. How do you dispose of waste in this area?

(a) Public Dump [ ] (b) Door to Door [ ] (c) Dumping in the lagoon [ ]

(d) Dumping at the banks of the lagoon [ ] (e) Burning [ ] (f) Burying [ ]

(g) others [ ] specify.....……

SECTION C: EFFECTS OF FLOODING IN KETA

13. How much do you pay to dispose of waste in this area?

(a) 0 – 0.99 Ghana cedi [ ]

(b) 1 – 1.99 Ghana cedis [ ]

(c) 2 – 2.99 Ghana cedis [ ]

(d) above 2.99 Ghana cedis [ ]

14. How often do you pay this levy to enjoy the service and properly dispose of your waste?

a. Daily [ ]

b. Weekly [ ]

c. Monthly [ ]

d. Other [ ], specify.....

15. What do you do when the floods occur?

.....

.....

.....

16. In what ways are you affected by the floods?

a. Social (Education, Health etc) [ ]

b. Property Damage [ ]

c. Economically [ ]

d. Housing (structure) [ ]

e. Others (specify) [ ]

SECTION D: PREVENTIVE AND COPPING MEASURES

17. Do you think these floods can be prevented?

A Yes [ ] b. No [ ]

18. If yes, how can this be achieved?

……

…….....……

……

19. Have the members of this community made any efforts to prevent flooding?

a. Yes [ ] b. No [ ]

20. Give reasons for your answer.

.....

.....

……..……

21. What do you do before the floods set in?

.....

……..……

……

22. What do you do when the floods actually occur?

……..……

……

……

23. How do you cope with the danger of incidence of annual flooding in your area?

(a) Stay with friends and/or relatives [ ]

(b) Build walls/steps to block the flood waters [ ]

(c) Construct temporary bridges to access our property [ ]

(d) Construct temporary drains [ ]

(e Clear choked gutters [ ]

(f) We just hope and pray the floods do not occur [ ]

(g) Other [ ], specify.....

24. What do you do after the floods?

.....

.....

25. Do you usually report the incidence of flooding any authority?

a. Yes [ ] b. No [ ]

26. If yes, which authorities did you report to?

(a) Keta Municipality Assembly [ ]

(b) Assemblyman/Unit Committee Member [ ]

(c) Other [ ], specify.....

27. Are you aware of the city authorities' (KMA) efforts to solve this problem?

a. Yes [ ] b. No [ ]

28. If yes, what exactly have these efforts been?

.....

.....

29. Additional Comment/Observation (if any):

…….....……

……

APPENDIX B

INTERVIEW FOR KEY INFORMANTS

UNIVERSITY OF CAPE COAST

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Section A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

(a) Name of agency ……

(b) Position

……

(c) Sex: a. Male [ ] b. Female [ ]

(d) Age:

.....

(e) Level of educational:

(a) Basic [ ] (b) Secondary/Technical/Vocational [ ] (c) Diploma (DBS/HND) [ ] (d) First Degree [ ] (e) Postgraduate [ ] (f) never attended school.

(f) Length of stay in the community (a) 0 – 5 years [ ] (b) 6 – 10 years [ ]

(c) 11 – 15 years [ ] (d) 16 – 20 years [ ] (e) Above 20 years [ ]

Section B: NATURE, CAUSES, EFFECT AND COPING STRATEGIES OF FLOODING

1. Cause of flood

   Probe for negligence

   Probe of waste disposal

   Probe for lack of drains

   Probe for building on water courses or houses close to lagoon

2. Nature of flood

   Probe frequency of flood

   Probe for land use of the area

   Probe the roles each agency play in the area towards flood prevention

3. Effects of flood

   Probe most significant effect

   Probe for damaged items

   Probe how those lost/damaged items are repaired or refunded

   Probe physical and economic effects

   Probe environmental and social effects

4. Coping strategy of victims

   Probe for the most commonly adopted

   Probe for assistance

   Probe for reports made by the citizens of the area

Probe for which agency they most likely report to and which people really do the reporting