

A Study into the Causes of Floods and its Socio-economic Effects on the People of Sawaba in the Bolgatanga Municipality, Upper East, Ghana

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ABSTRACT

Flooding is a phenomenon which can occur if the amount of precipitation in an area exceeds the evaporation rate and infiltration capacity of the soil and it is said to be the most lethal kind of hydro-meteorological and anthropological disaster, floods cause natural threats to life, health and population. This study sought to assess the causes of flooding and its attendant socio-economic conditions on the livelihoods of the people of Sawaba (the hardest hit or flood prone zone, especially between the months of July and August) in the Bolgatanga Municipality. Descriptive survey design was adopted in this study applying both qualitative and quantitative research methodologies. For every hundred people interviewed, as many as 82% respondents indicated lack of drainage system, while 70% of them indicated improper waste or refuse disposal. Sixty four percent (64%) of them stated lack of proper planning of structures, 40% of them mentioned heavy rains, 34% of the respondents stated that, the area was water-logged in nature while 18% of them indicated over flow of river. Forty six percent (46%) of the respondents stated that, compacted soil was the cause of flooding and 18% of them stated that loose soil rather caused flooding. It was observed that 66% of the dwelling houses had collapsed after flood situation in 2013 with 36% of the individuals either being seriously injured or lost their lives. It was revealed that residents of Sawaba spent between GH¢ 100.00 and GH¢500 (\$45 and \$220) to renovate their homes after the floods. Financial support by government and technical assistance by the departments of civil and agriculture engineering of the Bolgatanga Polytechnic should extend skills on rainwater harvesting to the people.

Keywords: anthropological, disaster, evaporation, flood, hydro-meteorological, infrastructure, rainwater, transportation.

INTRODUCTION

Flooding is part of the earth's natural hydrological cycle and an underlying factor that influence floods¹. According to Rachele², flooding can occur if the amount of precipitation in an area exceeds the evaporation rate and infiltration capacity of the soil. Pareva³ categorized flooding into duration and location. In terms of duration, flooding is categorized into slow-onset, rapid-onset and flash flooding. Slow-onset floods usually last for a relatively longer period such as one or more weeks, or even months. For urban flooding, Fazal¹, stated that they occur mostly in urban areas where roads are usually paved

with concrete prohibiting, large amount of rainwater from infiltrating into the ground and leads to urban floods.

Zahiran⁴, observed that, floods are the most lethal kind of hydro- meteorological and anthropological disasters. Most floods damage occur as a result of extreme, intense and long duration floods caused by meteorological phenomenon such as prolonged and intense rainfall/precipitation, cyclones, storms, tidal surges and drainage modifications when combined with heavy rain⁵. According to Doswell⁶, floods associated with rainfall are produced by thunderstorms and that, a single thunderstorm cell can produce enough rainfall to cause a flash flood. In terms of hydrological causes, floods can be caused by increased run off due to ice and snowmelt, impermeable land surfaces with saturated water, poor infiltration rates and land erosion⁵. Likewise, in steep slopes, rocky terrain or within heavily urbanized regions, a relatively small amount of rainfall can trigger flash flooding⁶. Interestingly; weather patterns determine the amount and location of rain and snowfall. Unfortunately, the amount and time over which precipitation occurs is not constant for any given area⁵.

The effect of flooding worldwide have being devastating to the extent that Geologists, Hydrologists, and Historians are studying the role of floods on humanity and its supporting ecosystems globally. In the Africa continent, floods are a common phenomenon despite numerous interventions (World Meteorological Organization, 2012). In Ghana, a severe rainstorm in March, 2013 in the northern regions caused destruction to properties including houses, farmlands and displaced about 25,000 people (Earth Changes, 2013). High amounts of water flowing in streams often lead to flooding⁵.

Human activities play a very important role in the magnitude and frequency of floods in many different ways⁷. Although flooding has some large negative impact on humans, it is also part of the natural processes shaping the Earth⁶. According to Parker⁸ and the HUT (2010), floods cause natural threats to life, health and population. The number of reported homeless persons following floods is particularly high because of the vulnerability of dwelling to rain and flood⁸. The destruction of roads and other infrastructure may delay on-going development initiatives and create transportation problems⁹.

According to Parker⁸, because floods frequently destroy crops and livestock, food shortages are common in the aftermath. The spillover effects of the loss of livelihoods can be felt in businesses and as a result commercial activities can be brought to a halt¹⁰. Damage to infrastructure also causes long-term impacts, such as disruptions of clean water and electricity supply, transport, communication, education and health care¹¹. The loss of loved ones can generate deep impacts, especially on children⁶. In addition, high cost of relief and recovery may adversely affect investment in infrastructure and other development activities in the area and in certain cases may cripple the frail economy¹². Loss of resources can lead to high costs of goods and services, delaying its development programmes⁹. This means that floods usually compromise drinking water supplies, resulting in short-term shortages of potable water, with the additional long-term costs in restoring drinking water service to the residents of a flooded area⁶.

Flooding can be highly traumatic for individuals, in particular where deaths, serious injuries and loss of property occur. Recent floods have killed hundreds of people and displaced millions of others as well as battered housing, infrastructure and agriculture in several countries across the globe. Over the last years, African continent has increasingly experienced severe flooding. More than one million people were affected in over 20 countries and approximately 500 lives were lost, and more than 12 million people displaced, particularly in Uganda, Ethiopia, Sudan, Burkina Faso, Togo, Mali and Niger.

Nonetheless, Ghana is prone to floods annually during the rainy season. This is because of the location of settlements which are mostly prone to flooding. These settlements include slums in the big cities such as Kumasi, Accra, Takoradi among others which are normally the worst affected during heavy down pour. Also, affected by this natural disaster are the communities which are sited along riverbanks, coastal settlements, and lowland areas.

Furthermore, dam spills from Burkina Faso are now causing annual floods in the northern parts of the country (Ghana report, 2009). According to the National Disaster Management Organization (NADMO), floods in the Upper East and Northern region do occur because of dam spillage from Burkina Faso

coupled with the peak of the July-August rains. This normally causes loss in lives and property. For instance, in 2007, about 20 people died and 260,000 displaced in the three northern regions (United Nations Office for the Coordination of Humanitarian Affairs, 2007). In Bolgatanga Municipality, the hardest hit or flood prone zone is Sawaba. Houses are easily flooded with the least precipitation (rainfall) between July-August causing difficulty in vehicular and human movement. Tracks that carry goods from Sawaba to market centers usually got stuck in the soil for days making trading activities in the area difficult. It is therefore, for these reasons that this study was carried out to investigate the causes of flooding and its attendant social economic conditions on the livelihoods of the people of Sawaba, a community in the Bolgatanga Municipality.

The main objective of the study was to assess the causes of floods, its effects on building structures as well as the socio-economic impact on the people of Sawaba. Specifically, the research sought to assess the causes and effects of floods on building structures, vehicular and human movement, and socio-economic impact on the people and suggest suitable and workable recommendations to address the phenomenon.

It is believed that the results of this study would support a quest in finding information to solving Sawaba perennial floods for sustainable socio-economic development. It will also contribute knowledge to the stream of literature as well as provide useful information on causes of floods and possible solutions to NADMO, NGOs and waste management companies. The findings of the study would also provide city planners the needed sources of data base of natural disasters such as flooding and others, in forecasting and evaluating the impact that comes with these disasters.

MATERIALS AND METHODS

Study Area

Although the climate in the study area is arid, occasional intense storms result in flooding in Sawaba damaging roads and building structures as well as impeding human and vehicular movement. To plan for anticipated flooding at Sawaba, the Bolgatanga municipal assembly in collaboration with NADMO and Geological Survey Department (GSD) began a cooperative study to locate flood prone areas in the municipality. Analysis of the flood hazards at Sawaba is difficult because, there is little existing stream flow and precipitation data, the area is extremely arid and land forms evolved under different climatic conditions. Previous flood hazards done at Sawaba by other investigators used standard method of analysis, such as physiography and channel Geometry. Results of those studies produced very extreme values for 20 years flood discharges.

The study was undertaken in Sawaba in Bolgatanga Municipality. Bolgatanga is located on longitude 0° and 10 west and latitudes $10^{\circ} 30'N$ and $11^{\circ} N$. It has a land area of 729 sq. km and is bordered to the North by the Bongo District, south by Talensi district, East by Nabdram district and Kassena-Nankana district to the west. The municipality has gentle slopes ranging from 1° to 5° with some isolated rock outcrops and some uplands which have slopes over 10° . It falls within the Birimian Tarkwainan and Voltarian rocks of Ghana. It is drained by gutters into the White Volta.

The climate is tropical with two distinct seasons: wet season that starts from May to October and a long dry season that starts from October to April. Mean annual rainfall is about 950mm while maximum temperature is $45^{\circ}C$ in March and April with a minimum of $12^{\circ}C$ in December. The natural vegetation is that of guinea savannah woodland consisting of short deciduous trees widely spaced and a ground flora. The most common economic trees are the Shea, Dawadawa, Baobab and Acacia.

RESEARCH METHODOLOGY

Descriptive survey design was adopted in this study applying both qualitative and quantitative research methodologies. This was because, in the study, data was collected based on figures which had to be described as the outcome of the study before conclusions were drawn. Also, both quantitative and qualitative research methods were used to collect, interpret, and analyze data because according to Knupfer and McLellan (2001), Descriptive survey design allows for greater degree of accuracy,

reliability, standardizations of measurement and the uniqueness of the study; much information can be obtained from individual respondents of the population. One major weakness of descriptive research is that, answers to it do not enable us to understand why people feel or think or behave in a certain way, why programs pose certain characteristic, why a particular strategy is used at a certain time and so forth.

Primary and secondary sources were used to gather relevant information for the study. The study used structured close-ended questionnaires as the main instrument to collect data alongside with focused group discussions, key informant interviews and observation. These methods sought to provide an opportunity to have an in-depth knowledge of the research which hitherto was not clear. The non-stagnant nature of the method helped study situations on ground so as to modify the questions to suite the interviews. Empirical verification was done via observation on attitudes and behaviors of females in the flooded area. This was so, because, a descriptive statement is regarded as true if and only if it is found to correspond with observed reality. The ultimate test of the truth or falsity of an empirical statement is the test of observation (Anderson, 1971).

The researcher in this study concealed his real identity and interacted with members of the community while observing women activities and keeping notes of the attributes of the community women. The researcher employed a “rapport” alongside to get first-hand information. This is because some important facts or information about the attitudes and behaviors of females in the flooded area cannot be obtained from questionnaire or interview. This enhanced the researcher’s knowledge on the study since all year round flooding activities were found to be at its peak around Sawaba during the month of July-August.

In all, three (3) focused group discussions were held with the various groups. It involved opinion leaders, households, NADMO, meteorological department (MD), waste management companies and chiefs from the study areas. The importance of this method was that, it ascertained and verified the other sources already employed to collect the information. In other words it was used to cross – check the data already gathered and analyzed. The focus group discussion with the women group and other relevant bodies in the study was held at Sawaba with twenty participants in attendance.

The researcher conducted a series of in-depth interviews with each of the respondents during the data collection. The interview with the participants focused on ten structured questions designed by the researcher. The questions were used as a guide during the interview to review cross-check and update the authenticity of the questionnaires used earlier in the study. In all, ten structured questions were used for the interview and were captured as per the following headings: the demographic characteristics, the possible causes of floods with reference to Sawaba, possible effects of floods on the people of Sawaba with reference to building structures, human and vehicular movement, and socio-economic impact of floods on the people.

Key informant interview were held irrespective of their ages. Participants were grouped according to their ages and their economic status. Others included in this interview were NADMO, meteorological staff and NGOs into biodiversity and flooding, staffs from waste management companies etc. This method sought to help these groups to freely express themselves concerning the subject. This sought the opinions and views from these individuals about the subject matter of the research.

The sample population was made up of people living in Sawaba in the Bolgatanga Municipality as well as some staff of NADMO and Meteorological Department (MD). The study targeted a population of 50 people from a population of 1,262 (source MHA-Bolga) living in Sawaba. The population of Bolgatanga Municipality is 72,768 (source MHA-Bolga)

Data collection techniques

The study used questionnaire to collect data. The questionnaire was structured into two parts, that is, sections A and B. The first sought to gather general data. The second section was designed to gather substantive data to address the subject matter of the study.

Other sources of data were obtained from NADMO, Meteorological Department (MD) and bulletins to constitute secondary data.

Data analysis

Data gathered was analyzed and presented as percentages in tables, bar graphs and pie charts using Microsoft Excel software.

RESULTS AND DISCUSSION**Opinion of Flooding in Sawaba**

All the respondents had formal education. Majority of them (68%) attained tertiary education followed by 18% who had finished secondary school and 14% were basic level holders. With regards to their occupation, 40% were public servants, 26% were traders, 18% were civil servants and 16% had no response. All respondents were conscious of flooding in the area and indicated that, flood occurred frequently in the area. Table 1 indicates the reasons assigned to flooding in Sawaba.

Table 1: Respondents' opinion on the possible causes of floods in Sawaba

Statement	Percent (%)
Lack of drainage system	82.0
Improper waste/refuse disposal	70.0
Lack of proper planning of structures	64.0
Over-flow of river	18.0
The area is water-logged in nature	34.0
Heavy rains	40.0

(Source: field data, 2013)

For every hundred people interviewed, as many as 82% indicated lack of drainage system, while 70% of them indicated improper waste / refuse disposal. Sixty four percent (64%) of them stated lack of proper planning of structures, 40% of them said heavy rains, 34% respondents stated that, the area was water-logged in nature while 18% of them indicated over-flow of river. Forty-six percent (46%) of respondents stated that, compacted soil was the cause of flooding and 18% of them stated that loose soil rather caused flooding.

Respondents had different views on how long, in days, water stayed on the land surface as a result of flood in the area. As many as 52% of them stated 6-14 days, 6% of them stated 3-5 days and 42% of them stated 1-2 days. Different interpretations were given for the causes of the water staying long in the area. Forty six percent (46%) of them stated that, the soils is clayed and makes drainage slow and agreed with Fazal, (1995) that clayey surfaces prevent water from infiltrating and cause flash floods. Also 28% of them stated that it was lack of drainage system in the area, 8% of them said it was poor infrastructural (housing) planning and 18% of them had no response. This is in conformity with Rosenberg, (2008) that floods are caused by single or multiple factors that are either natural or anthropogenic as a result of inappropriate development in flood plains, building on water course and impermeable materials that prevents water filtration (Law & Your Env., 2012). Fifty four percent (54%) of the respondents said they experienced flooding between July – August, 24% of them indicated that flooding was experienced from August – September, 18% respondents said flooding was felt from June – July and 4% did not have any response.

Impact of Flood on Human Lives and Property in Sawaba

In response to the type of waste disposal in the community, 70% disposed of their waste indiscriminately and only 30% had access to waste disposal containers. It was collectively agreed that the land was bare and had no vegetation along water bodies. Thirty two percent (32%) of the respondents lived in mud buildings because they could not afford concrete buildings. Therefore 96% of these mud houses had cracks in them either on the walls (76%) or on the floor (24%). Even some of the concrete houses were not exempted because they had sunk either by sliding (68%) or strip sinking (10%). It was observed that 66% of the dwelling houses had collapsed after flood situation in 2013 with 36% people either seriously injured or lost their lives. It was revealed that residents of Sawaba spends between GH¢ 100.00 and GH¢50, approximately \$45 to \$220 to renovate their homes after an incidence of flood.

There was outbreak of diseases mainly cholera after the floods while access to roads were muddy making vehicular and human movement very difficult because the roads had become slippery. Ninety two percent (92%) of the respondents indicated that their farms got flooded destroying their food crops. This is consistent with Fazal (1995) and Pareva (1998) that floods can lead to collapse of buildings, loss of livestock, damage to agricultural products, roads and rail links. Fifty four percent (54%) indicated that

they had bumper harvest of fish at the Kolaa River near Sawaba after the flood situation. Flooding also affected trade, at Sawaba. Seventy four percent (74%) of respondents stated that, transporting goods to the market becomes very difficult and 26% respondents stated that, customers are not able to get to the market on flood days. School children had to be carried shoulder high to school. This, according to the study, slows down business activities and some perishable crops got spoilt in the process. According to Nott¹³. Flood results in severe detrimental consequences in terms of social, physical and economic impacts. Respondents spent between GH¢ 50.00 and GH¢300.00(\$22 and \$131) (Table 2) to treat the family members who fell sick after a flood situation. This gave an indication that most of the inhabitants were not registered under the National Health Insurance Scheme.

Table 2: Amount spent on treatment after flood situations

Statement	Percent
Non respondents	42.0
50	10.0
200	42.0
300	6.0
Total	100.0

(Source: field data 2013)

CONCLUSION

The study revealed that, floods in Sawaba are largely caused by multiple factors. This stemmed from human causes such as building on water ways, inappropriate disposal of waste, soil compaction due to vehicular and human movements. Again, hydro-meteorological causes such as excessive rain fall, poor drainage system, high rate of soil water holding capacity, especially between August-September also contributed to flooding. It is therefore evident that, floods are caused by human and hydro-meteorological factors that, in turn, have disastrous effects on the people. The study also found that, floods in the study area had effects on building structures, movement that have consequent impact on the livelihood of the people. During floods, staple food crops such as maize, millet, groundnuts and leafy vegetables are affected. Cracks on walls, floors, strip and collapsed buildings are noticed.

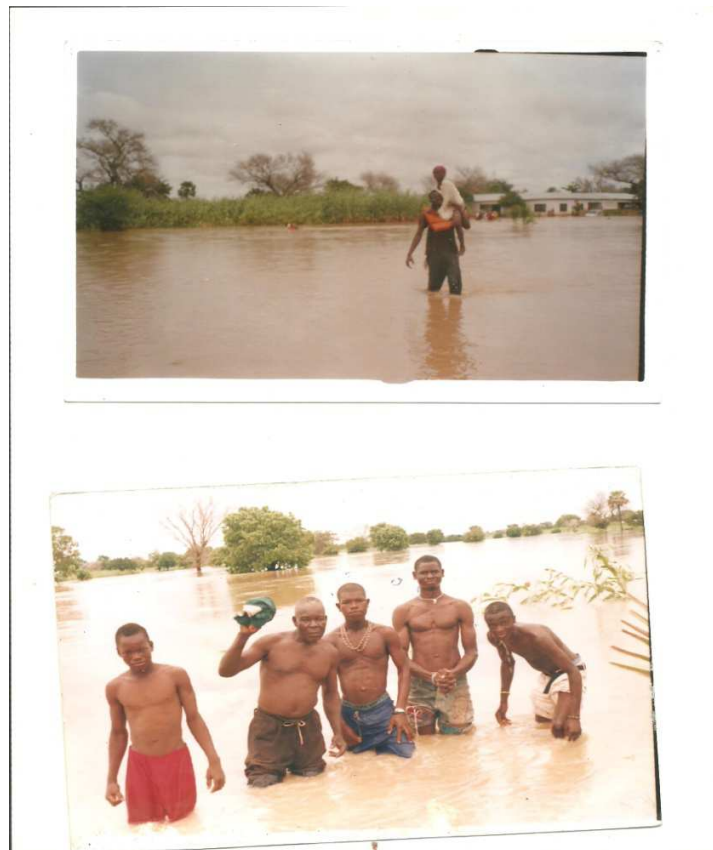
Recommendations

Proper drainage system, good planning of structures, proper waste disposal mass education on proper waste disposal practices and construction of roads and gutters if implemented could avert the incidence of flooding in Sawaba. Financial support by government and technical assistance by the departments of civil and agriculture engineering of the Bolgatanga Polytechnic to extend skills on rainwater harvesting to the people could also not be underestimated.

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Source: The NADMO, 2012.