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The Impact of Flood on Food Security in Farming Communities in Kumbungu District in the Northern Region of Ghana

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Abstract
Flooding is the most common environmental hazard worldwide, after diseases and transport accidents. Excessive rainfall coupled with the spillage of excess water upstream from the Bagre Dam in Burkina Faso has resulted in the death of humans and animals and destroyed farms, buildings, storage facilities, and crops. This is because of the wide geographical distribution of river floodplains and low-lying coasts and their long-standing attraction for human settlement. The research focused on communities along the White Volta basin in the Kumbungu District. The study discussed local farmers' perception of the causes of floods in the affected communities, identified factors that exposed the people staying in these communities to vulnerability, and identified coping mechanisms employed by the community during and after floods. The study employed both quantitative and qualitative approaches. The research used household and institutional surveys and face-to-face interviews to collect data on flood disaster experiences. A sample size of 168 respondents was selected using systematic, purposive, and simple random methods. The study established that floods negatively impacted food security and people's livelihoods, especially agriculture. Children, women, and the elderly were groups identified to be most vulnerable to flooding. The research revealed that victims do not receive timely and adequate support in the aftermath of flooding. Most respondents used wood, grass, and mud as building materials that are not flood resistant. Some coping mechanisms are pito brewing, petty trading, fish mongering, prematurely harvesting crops, weaving thatch for local roofing, planting early maturing crops, and selling livestock.
Keywords: Flood, Vulnerability, Food, Farms, Households
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Introduction

The world has experienced various hazards and disasters from the past decades till now. These hazards have taken various forms, including floods, hurricanes, earthquakes, volcanic eruptions, tsunamis, tornadoes, landslides, etc. In all these environmental hazards, precious human lives are sometimes lost, and huge financial losses are incurred. According to Smith and Smith (2003), the most common environmental disaster in the world is flooding, diseases, and vehicular accidents.

"Annually, floods claim around 20,000 human lives and adversely affect at least 20 million people worldwide, mostly through homelessness" (Smith & Smith, 2003). The flooding issue has been of great interest and concern to humanity, especially in recent years, where climate change and variability are 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 severe drought, torrential rain, or extreme heat conditions in various parts of the world.

Flooding is now a global problem that has attracted considerable attention from the media, academia, and other international discourse (Oppong, 2011). Flooding has been explained and defined in various ways. Ayoade (1988) states, "A flood is said to occur when a water body rises to overflow dry land which is normally not submerged."

According to a United Nations Regional Coordinator in Dakar (2007), the worst flooding in 30 years that battered West Africa from July 2007 affected more than 785,000 people and caused more than 210 human deaths. It was also noted that the catastrophic rains affected almost half of all African countries, causing more than 350 human deaths with hundreds of thousands of people affected. Ghana recorded 56 human deaths and 332,000 displaced. Human lives have been lost in Ghana, including several properties and farm produces to flood. Flood has been an annual disaster facing the country. Northern Ghana experienced a terrible flood in 2007, destroying several properties, as captured by Kunatch (2009).

In recent times, the weather and climate seasons have become unpredictable, and there has been an increase in erratic rainfall patterns. Climate change causes the rains to fall in excess during periods when water is not needed for crop production and vice versa. The excess rain usually leads to floods destroying farmlands and agricultural produce. These climate changes severely impact key resource-dependent sectors, such as agriculture, food production, and food security (Thomas et al., 2008).

It is often argued that higher temperatures will increase evaporation and result in higher levels of precipitation and more rainy days per year, consequently increasing the risk of flooding. Flooding is considered a primary

example of climate change-related events in all parts of the World (IPCC, 2007).

Frederick et al. (2010) posited that in some parts of Northern Ghana, heavy rainfall during August and early September, especially in 2007, led to severe flooding leading to the loss of lives, displacement of vulnerable persons, and the destruction of crucial infrastructure, food stock, and livestock. The floods coincided with the most critical time of the year when Ghanaian families faced food insecurity.

Problem Statement

Over the past decade, there have been yearly water spillage upstream from the Bagre and Kompirga dams in Burkina Faso. This raises the Black and White Volta Rivers to unprecedented levels resulting in severe flooding in the three northern regions, mainly for communities along the tributaries of the rivers, which leads to the destruction of farmlands and loss of property, including infrastructure (Armah et al., 2010).

The main occupation of rural communities in Northern Ghana is agriculture, an important livelihood source. The poorest or most vulnerable people of most societies in Africa are those who depend on rain-fed subsistence agriculture for food, jobs, and income, and hence the most vulnerable to climate change (Afrifa, 2010). In 2013, Agriculture contributed about 22% of the GDP in Ghana (Ghana Statistical Service, 2014), and in 2014 employed about 56% of the labor force (Ghana Economy, 2015). In Kumbungu, agriculture employs about 60% of the labor force (Population & Housing Census, 2012). It also supplies about 40% of vegetables in the Tamale area because of the big Botanga dam.

Flood disasters play a substantial role in inhibiting economic development and create more significant difficulties for many regions. Floods cause poor harvests with growing food insecurity and hunger, worsening poverty levels, and high outmigration among the youth. (UNDP/NADMO, 2009).

Government and Non-governmental organizations have tried to deal with the problems of flood in these communities. However, their main initiatives have been settling victims after the said floods (relief oriented) and short period targeted as it is always within a short time frame. No long-term measures have been initiated to influence people's coping capacities or to reduce or eliminate the effects of the flood on the local people (Brahmi & Poumphone, 2002).

The research focused on the Kumbungu District, communities along the White Volta basin. Excessive and heavy rainfall coupled with the spillage of excess water upstream from the Bagre Dam in Burkina Faso results in annual flash floods. In August 2007, the worst flood resulted in the death of six human beings, with more than 1,300 households rendered homeless and lost properties. Furthermore, over 3,000 hectares of farmlands were destroyed (NADMO, 2009).

It is common to see communities almost submerged in flood waters but with flood victims still living close or even within the vulnerable areas. How do flood victims understand and interpret their vulnerabilities regarding the causes and effects of floods, and why do they stay near flood-prone areas? (Bempah, 2011).

According to Kunateh (2009), in 2007, a relief agency built 300 houses for flood-affected victims in some communities in the then Tolon\Kumbungu district of the Northern region. However, the beneficiaries of the building project refused to move in. The most obvious question is why affected residents did not use the new housing facility. According to Berker et al. (1993), current disaster relief packages sometimes fail to consider the internal conflict of interest deep-rooted in social structures, which may include inequality and conflict over property rights and lands. This often results in post-disaster conflict, dissatisfaction, and rural-urban migration (Berker et al., 1993).

Although several programs and projects were designed and implemented by governments and development agencies in the past and present, all aimed at controlling floods, flooding has persisted and is increasing in frequency and magnitude. Past studies on the effects of floods focused on Tolon/Kumbungu District, but the current study is focused on communities in the Kumbungu District.

Research objectives

The broad objective of the study is to assess the perceptions of flood impacts on food security in the Kumbungu district.

Specific objectives:

- To assess local farmers' perception of the causes of flooding in the communities.
- To investigate the factors that expose flood victims to flood vulnerability.
- To identify the coping mechanisms employed by flood victims.
- To examine the perception of flood victims about public intervention.

Significance of the Study

Firstly, from the findings and recommendations of the study, the researcher envisaged that policymakers would adopt strategies that would ensure appropriate measures to curb flooding in the district and improve food security

as well as guarantee the safety of the indigenes of the flood-prone areas.

Furthermore, the study provides information on the impact of flooding on livelihood and food security in the district. It can assist the actors of environmental sustainability, especially those in developing countries, with planning, managing, and implementing policy frameworks appropriately for flood and food security issues at the community, local and national levels.

Finally, it would yield information that would add to the existing knowledge on flood, food security and other related issues.

Scope of the Study

The study was carried out in the Kumbungu District in the Northern Region of Ghana. The district faces flooding often because some of the communities in the district are located along the White Volta. The focus of the study contextually is on the increasing risk of flooding in these communities, the impact of these floods on farm produce and domestic animals, the capacity of the victims of these floods to respond and cope with these floods to reduce the risk, and the vulnerability associated with floods.

Limitations of the study

There was limited time and resources for the study.

Conceptual Framework

Disaster Risk Reduction (DRR) is the conceptual framework identified to guide this study. DRR is the logical or systematic development and use of strategies, plans, and practices to reduce community vulnerabilities and disaster risks and prevent or limit or mitigate the adverse impacts of hazards within the broad context of sustainable development.

Over the last few years, the occurrence and number of disasters have increased, rendering the already impoverished populations more vulnerable. The response to the effects of hazards such as floods has been reactive rather than proactive. This is prepared by developing the risk profiles and the flood hazard, which can be used to design suitable measures to manage and mitigate or reduce the floods and build people's adaptation capacity and resilience (Regional Stakeholders' Consultative Workshop on Disaster Risk Management Report, 2004).

Disaster can be minimized through event modification, loss sharing, and vulnerability modification (Crozier, 2002). Event modification aims to move the hazard away from people. Vulnerability modification is about adaptation by supporting forecasting and warning schemes, community preparedness, and land-use planning. Loss sharing is about insurance and disaster aid (relief).

Hazard, vulnerability, exposure, and coping capacity/resilience directly impact risk and disaster. Hazard, vulnerability, and exposure increase disaster risk, while coping capacity/adaptation minimizes disaster risks. Therefore, hazards, vulnerability, and exposure should be reduced to build a safer community while increasing coping capacity/ adaptation. Adaptation/coping capacity includes proactive mechanisms that can be constantly built to increase the capacity of a community to respond and recover from a disturbance.

Profile of the study area

The Kumbungu District was created out of the former Tolon/Kumbungu District with Legislative Instrument (L.I.) 2062 of 2011. The district was launched on June 28th, 2012, with Kumbungu as its district capital city. The district also has other bigger towns, such as Dalun and Golazoli (Population & Housing Census, 2014).

The district, which has a land area of 59 km2, is located on the northern edge of the Northern region. The district is bordered to the north by Mamprugu/Moagduri District, to the west by the districts of Tolon and North Gonja, to the south by the district of Sagnerigu, and to the east by the municipality of Savelugu/Nanton. The district is made up of 115 communities with 24 electoral areas (E.A.s), One (1) Town Council (T.C.), and Five (5) Area councils (A.C.) (Population & Housing Census, 2014).

There are no marked high elevations throughout the district. Some rivers and streams, such as the Kudo, Gbumbugi, and Zulabong rivers, drain the district. The White Volta is the most renowned. Dendrite drainage patterns can be seen in the main rivers and their tributaries. Most of these tributaries dry up during the dry season. In the Kumbungu District, the rains begin in May and end in the latter part of October. July to September is the peak period, and the district experiences floods. The rest of the year is dry. The average annual rainfall is 1000 mm (Population & Housing Census, 2014).

Shea nut, dawadawa, and mango are three major tree species that are economically important and play a crucial role in people's livelihood. The vegetative cover is Guinea Savanna interspersed with short drought-resistant trees and grassland. The land is undulating with several scattered depressions. Except for the lowlands, which have alluvial deposits, the soils are of the sandy loam variety. Apart from the gentle slopes, the soil is highly vulnerable to sheet erosion, and in some areas, gully erosion also occurs. The primary cause of this problem is the recurring burning of the natural vegetation, which exposes the soil to the sun's typically intense rays. (Population

& Housing Census, 2014).

The Chiefs own lands in the district. Individuals or groups can acquire land parcels for construction or farming purposes. Land acquisition in the district is accessible and open to everybody without discrimination (Population & Housing Census, 2014).

The natural vegetation in most parts of the district, especially around the local settlements, has disappeared due to over-cultivation, overgrazing by animals, and over-exploitation for fuel wood without replacement. Farming (crop and livestock production) is the people's primary livelihood. Crop production comprises compound (bush) farms with an average of 0.5 hectares per farm. Utilizing tractors frequently increases soil degradation and decreases crop output—overfishing, felling of trees, and farming along banks of tributaries of the White River. Equally, chemical fertilizers' applications have led to fish depletion in the river's tributaries. Bush burning and hunting have led to the partial extinction of some birds, reptiles, and animal species that were common in the district. Cutting shrubs for yam farming and constructing feeder roads also deplete the Natural environment (Population & Housing Census, 2014).

The major land degradation issues are cutting trees for firewood and burning charcoal in some parts of the district. The District Assembly, in collaboration with the Ministry of Energy, is introducing gas cookers and cylinders to the communities to help curb the use of firewood as a domestic energy source. The Assembly is in partnership with the Environmental Protection Authority (EPA) to embark on afforestation projects in selected communities under the GEMP Program (Population & Housing Census, 2014).

The opening of the Bagre Dam in Burkina Faso cause flooding in settlements in the district along the White Volta during the peak of the rainy season. In collaboration with other stakeholders, the District National Disaster Management Organization (NADMO) educates communities along the White Volta to move to higher grounds during the peak of the rainy season. In addition, the District Disaster Management Committee (DDMC), chaired by the District Chief Executive (DCE), works towards mitigating disasters in the districts as well as acting as a rapid response team to disasters (Population & Housing Census, 2014).

The district liaises with the Ministry of Food and Agriculture, Savannah Accelerated Development Authority (SADA), and other development partners to support farmers in cultivating assorted food crops at the Botanga Irrigation Project located at Kumbungu so that they will not solely depend on rain-fed agriculture. This aims to mitigate the effects of climate change on food production in the district (Population & Housing Census, 2014).

Research Design and Source of Data

The study design adopted was a cross-sectional survey. This design was selected because it was a brief study with a systematic approach to data collection and presentation to describe a specific situation throughout the study time. As a result, information pertinent to the study was derived from multiple communities to fulfill its goals. The data required for the research work was collected from two main sources; primary and secondary sources as follows:
Primary data was collected from households and strategic public institutions responsible for managing the environment in the district and at the regional level. Primary data were mainly gathered from household heads, the Kumbungu District Assembly, the Environmental Protection Agency, the Hydrological Service Department (HSD), the Water Resources Commission, Town, and Country Planning, the Ministry of Food and Agriculture (MoFA), and the National Disaster Management Organization (NADMO) both at the District and Regional level.

The secondary data were gathered from magazines, books, newspapers, the internet, and articles.

Sample frame and Sample Size Determination

The study obtained total households of three thousand one hundred and seventy (**3,170)** as a sample frame from nine (9) selected communities. For the study, the number of households was equal to the number of houses, that is, one household per house. Because each house contains at least one household.

To calculate the sample size, Slovins' sampling method (Guildford and Fruchter, 1973) was adopted. The mathematical formula is stated: $n = \frac{N}{1+N(e)^2}$

$n = \frac{3,170}{1+3,170(0.075)^2} =$ **168**

Where **n**=sample size, **N**=sample frame **(3,170)** and **e** represent the margin of error of 0.075 with confidence level of **92.5%.** By substituting **3,170** and **0.075** into the formula: **n=168.19564** hence**: n=168.**

Therefore, the sample size for the community household survey was **168** households. This was to ensure that the sample mean was closer to the household population mean and minimise errors. The determined sample size of **168** households was proportionally distributed among the selected settlements as indicated in the Table 1.0 below.

Table 1.0 The sample size and distribution among the communities

NO.	Name of Community	No. of Households	Sample size	Sample share (%) distribution
1	Tolgu	178	9	5.4
2	Buglang	250	13	7.7
3	Bihi-Naayili	189	10	6.0
4	Dalun	1,310	69	41.2
5	Yuni	200	12	7.1
6	Golazoli	350	19	11.3
7	Ganvuliga	175	9	5.4
8	Nawuni	270	14	8.3
9	Dalun-Kukuoo	248	13	7.7
TOTAL		**3,170**	**168**	**100**

Source: Field Survey (2020)

The study adopted the multi-stage approach, i.e., a combination of appropriate sampling methods, purposive sampling, systematic sampling, and simple random and accidental sampling. The approach was used to select one (1) district (Kumbungu) from the other districts that were affected by floods in the Northern region and to further select nine (9) communities that were the worst hit settlements and 168 households for interview.

Purposive sampling involves the selection of settlements, organizations, and respondents (households/individuals) who can best answer the research questions (Twumasi, 2001). The significant institutions responsible for planning and managing disasters at the regional and district level were also purposely chosen. These include the Environmental Protection Agency, Hydrological Service Department (HSD), Water Resources Commission, Kumbungu District Assembly, Town and Country Planning, Ministry of Food and Agriculture (MoFA), and the National Disaster Management Organization (NADMO).

Systematic sampling was used to select the compounds in each community. Table 2.0 illustrates the systematic procedure followed in the selection of the Compounds. Therefore, every Kth house was selected for an interview. Thus 168 compounds were interviewed, as shown in Table 2.0.

Table 2.0 Systematic Sampling Procedure

Selected Area	No. of Households	Number of Households to be Interviewed (Sample Size)	Sample Fraction (Kth House)
Tolgu	178	9	Every 20th house
Buglang	250	13	Every 19th house
Bihi-Naayili	189	10	Every 19th house
Dalun	1,310	69	Every 19th house
Yuni	200	12	Every 17th house
Golazoli	350	19	Every 18th house
Ganvuliga	175	9	Every 19th house
Nawuni	270	14	Every 19th house
Dalun-Kukuoo	248	13	Every 19th house
Total	**3,170**	**168**	

Source: Field Survey (2020)

Simple Random Sampling

Since each house contained at least one household, the study used the simple random sampling method to select the starting house randomly. Due to the unplanned settlement pattern in the district, a serpentine movement and counting were used to select every Kth house. With this approach, a respondent representing a household was interviewed in every Kth house in each selected area until the required sample share of the selected settlement was obtained. Once the house is located using the Kth number (systematic), the accidental approach was used to select a household respondent. By the accidental sampling approach, upon entering a house, the first person the researcher encountered eighteen years and above who was ready and willing to offer information was interviewed. The approach gave each household in the house an equal chance of being part of the selected respondents.

After training the research assistants, the instruments for the research study were pre-tested at Nawuni, a Tolon District community with similar characteristics to those in the Kumbungu District. All potential problems were identified and rectified before administering the questionnaires and collecting data during the actual research work.

Methods of Data Collection and Data Analysis

Semi-structured interviews were conducted using an interview schedule with the households and relevant

institutions as key informants to the research problem. Open and closed-ended questionnaires were also used to gather data from respondents.

The observation method was used in the data collection. The intensities or the levels of flood water in and around such erections or buildings were noted, identified, and observed in times of floods. The effects of flooding on different structures or buildings and farms were observed with the observation method, and some photos of these places were taken.

Information from relevant secondary sources was also used to support the excellent implementation and understanding of the research work.

Microsoft Excel and Statistical Product and Service Solution (SPSS) were used to analyze the data collected. The data was reviewed after the collection of filled questionnaires, and the compilation of data from the interview was also performed. After a critical analysis, the data was interpreted and graphically represented.

The approaches for qualitative analysis of data involved the reduction of data, coding, and tabulation. However, secondary data from published and unpublished works relevant to the study objectives were also reviewed.

The validity and reliability of the study instruments were ascertained by following the recommendations of the America Psychological Association (APA) standard.

Presentation of Findings

Sex Distribution of Respondents

The gender distribution of respondents in the study area is shown in Fig. 1.0 below. The results have shown that most of the respondents were male because they constituted about 62% of the total respondents, while women constituted about 38%. The results showed male-dominated households and communities, where men mostly take decisions without input from their female counterparts. In most cases, women are ignored in terms of seeking their views, ideas, and inputs into decisions that affect the entire community, particularly women who are vulnerable to disasters such as floods.

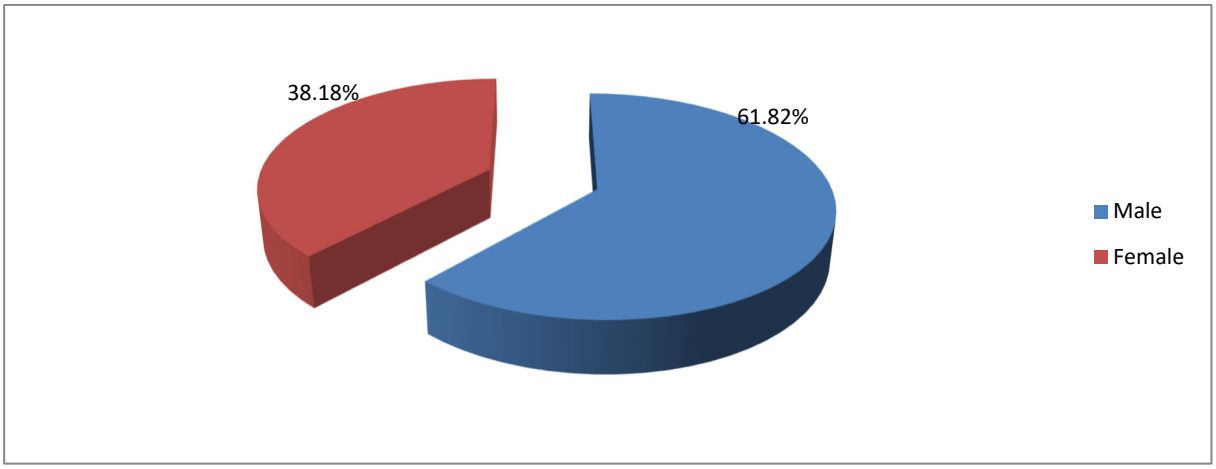

Fig. 1.0 Sex Distributions of Respondents

Age Distribution of Respondents

Most respondents were 40 – 59 years old, constituting about 45% of the total respondents. This was followed by the age bracket of 20 -39 years, constituting about 41% of the total respondents. About 13% of the respondents were above 60 years, and only about 2% of the total respondents were within the age group below 15 years. This shows that if significant steps are put in place to control and prevent flood disasters in these communities, agriculture will have excellent prospects because most of the people involved in these communities are young (20-59 years).

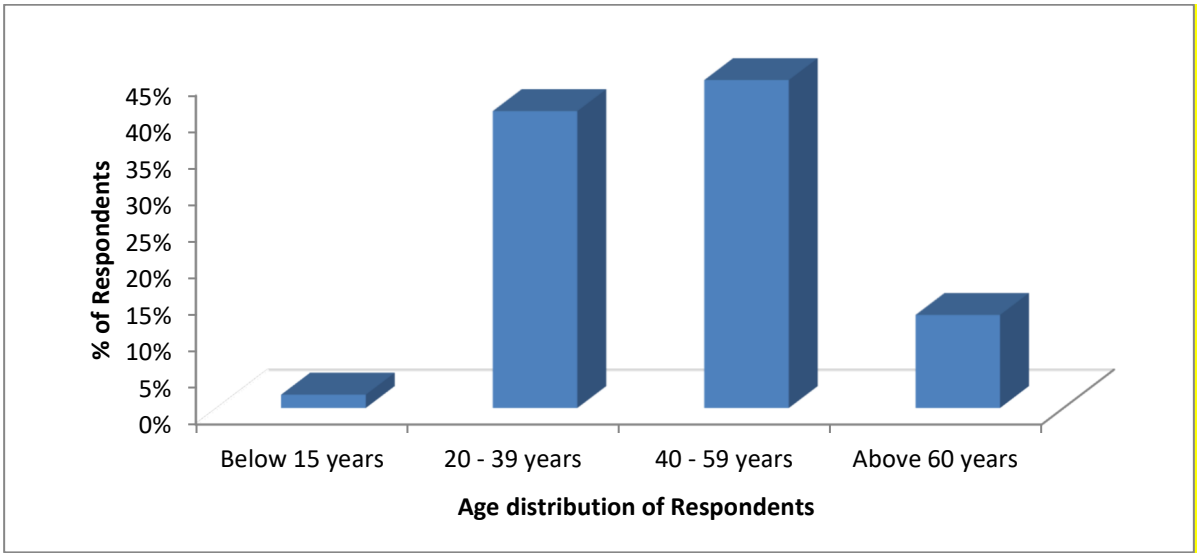

Fig. 2.0 Age Distribution of Respondents

Educational Attainment and Religious Distribution of Respondents

About 52% of respondents had no formal education, while respondents who had attained primary education constituted about 26%. About 18% and 3% of respondents represent those who have attained secondary and Junior High or Middle school levels, respectively. Fig. 3.0 below gives a clear picture of the educational attainments of respondents in the study area.

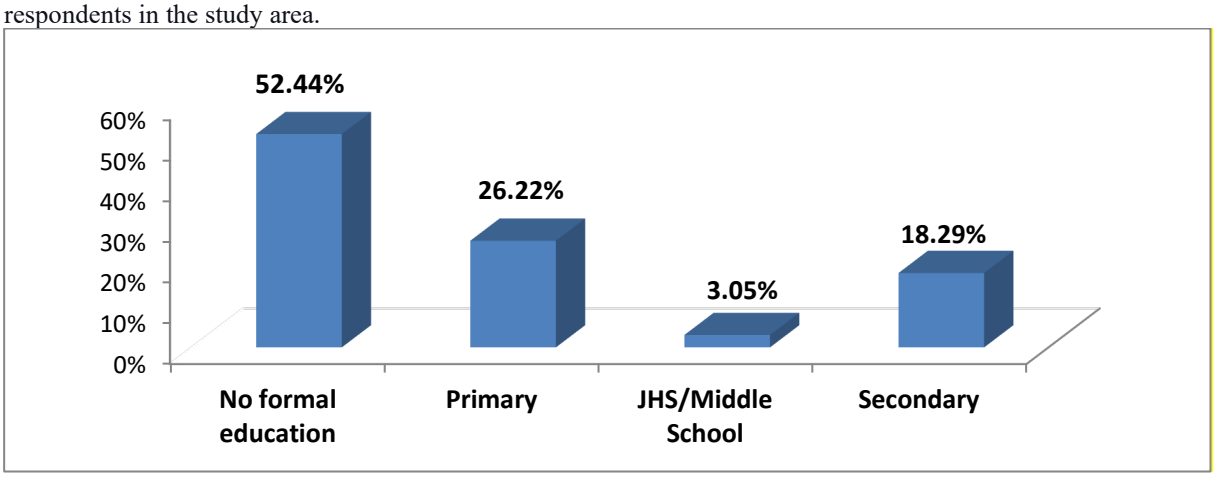

Fig. 3.0 Educational Attainments of Respondents

The religious distribution of respondents showed that Christianity and Islam are the two dominant religions in the study communities. Analysis of the data revealed that about 48% of respondents profess the Christian religion, whiles about 42% of respondents are affiliated with the Islamic religion, and the African Traditional Religion constituted about 6% of the total respondents.

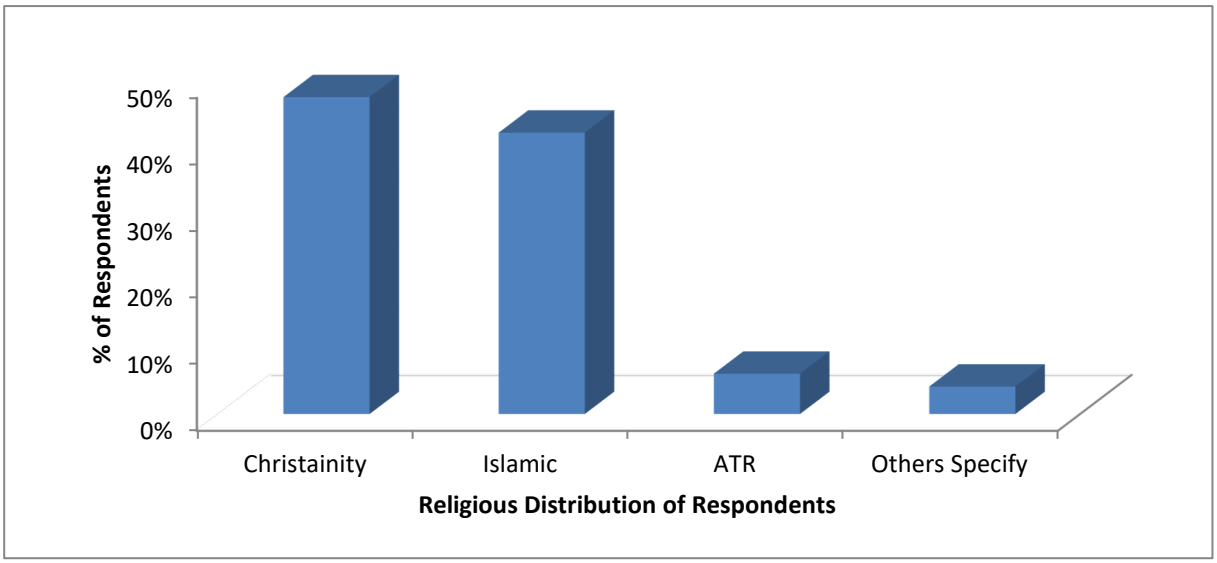

Fig. 4.0 Religious Distributions of Respondents

Occupational Distribution of Respondents

The study uncovered that majority of respondents were fishermen. About 24% of the total respondents indicated that they were engaged in fishing as their primary source of livelihood, while about 23% of the respondents mentioned that they were crop farmers. Further, 16% of respondents were engaged in animal farming, 14% were laborers, 13 were engaged in trading, and about 10% were engaged in blacksmithing, tractor operator, teaching, and mechanic as their primary occupations.

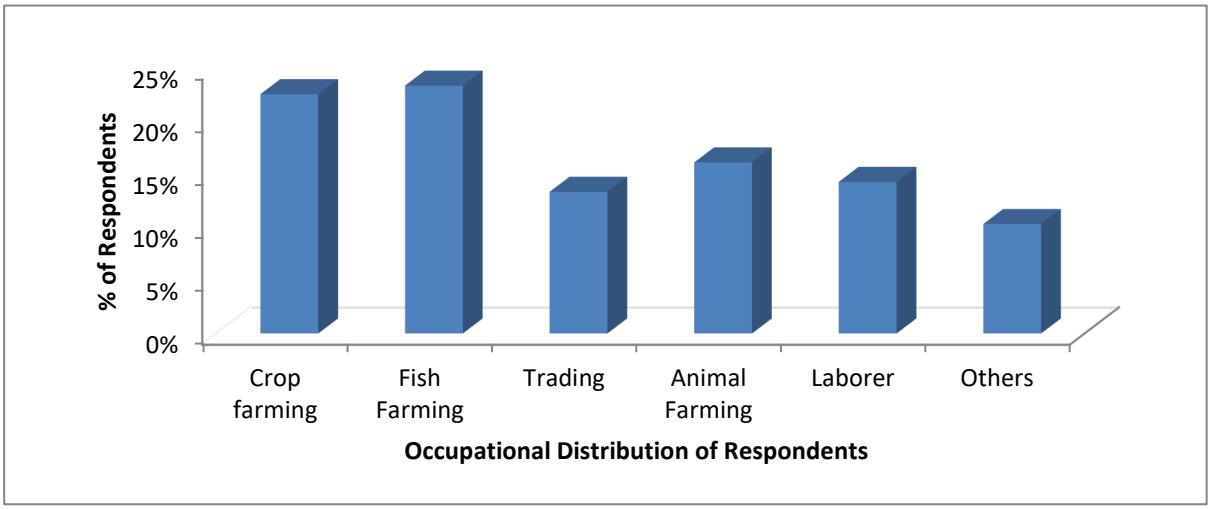

Fig 5.0 Occupational Distributions of Respondents

The pie chart below shows that 64% of respondents had no alternative source of livelihood. They depended on only one source of livelihood. About 63% of these livelihoods (crop farming, fishing, and animal farming) were agriculture-related, making these people very susceptible to food insecurity during floods. These people relied on friends, relatives, and the government for food during the flood. Only 36% of respondents had other sources of livelihood apart from their primary source of livelihood.

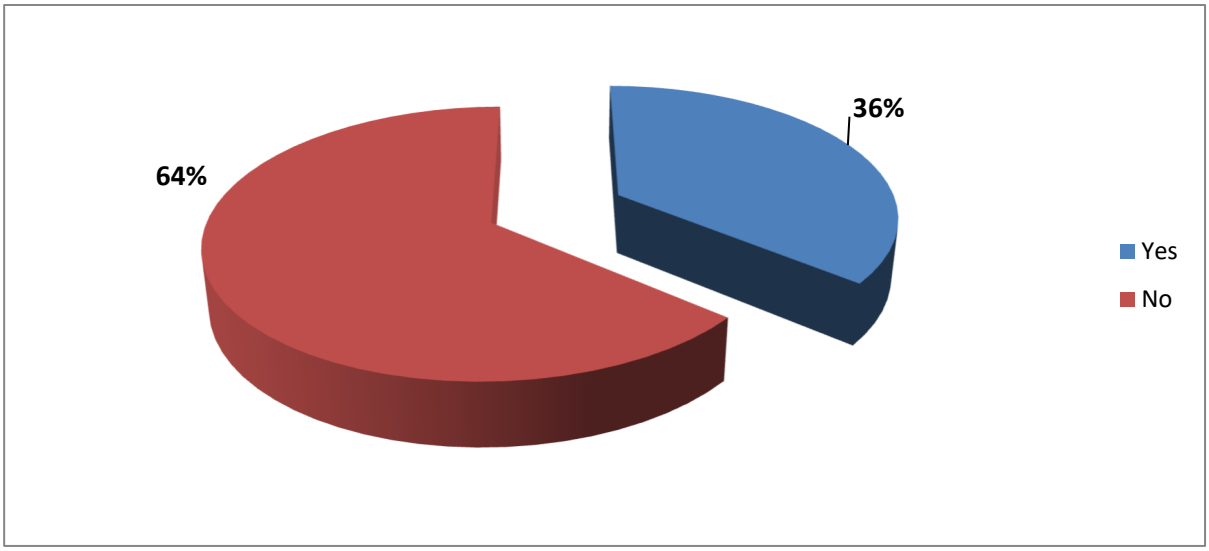

Fig. 6.0 Alternative sources of livelihoods

Average annual Income of Respondents from Farm produce

Most respondents' earnings ranged from Gh¢ 100 to Gh¢ 500 (35%) from farm produce per year. About 29% of respondents earned an annual income of less than Gh¢ 100.00. The study further uncovered that the categories of farmers who earn between 501 to 1000 constituted 16% of the total respondents and those who earned an annual income of Gh¢ 1001 to Gh¢ 1500 represent about 18% of the respondents, and respondents who earned an annual income of more than Gh¢ 1500 constituted about 3%.

Table 3.0 Table showing annual income of Respondents

Average annual Income (Gh¢)	Frequency	Percentage (%)
Less than 100	49	29.6
101 to 500	58	35.15
501 to 1000	27	16.36
1001 to 1500	30	18.18
Above 1500	5	3.03
Total	165	100

Source: Field Survey (2020)

Perceptions of the Causes of Flood

Out of the 165 respondents contacted, about 30% attributed the flood in the area to the opening of the Bagri Dam in Burkina Faso. About 27% indicated that flood is caused by excessive rainfall experienced during the rainy season, 17% mentioned spiritual forces as a cause of the flood, and about 13% said changes in climate cause flood in the area. The rest of the respondents mentioned poor drainage systems (about 5%), indiscriminate dumping of refuse (about 2%), poor physical planning (about 2%), and neglect of the government (about 1%).

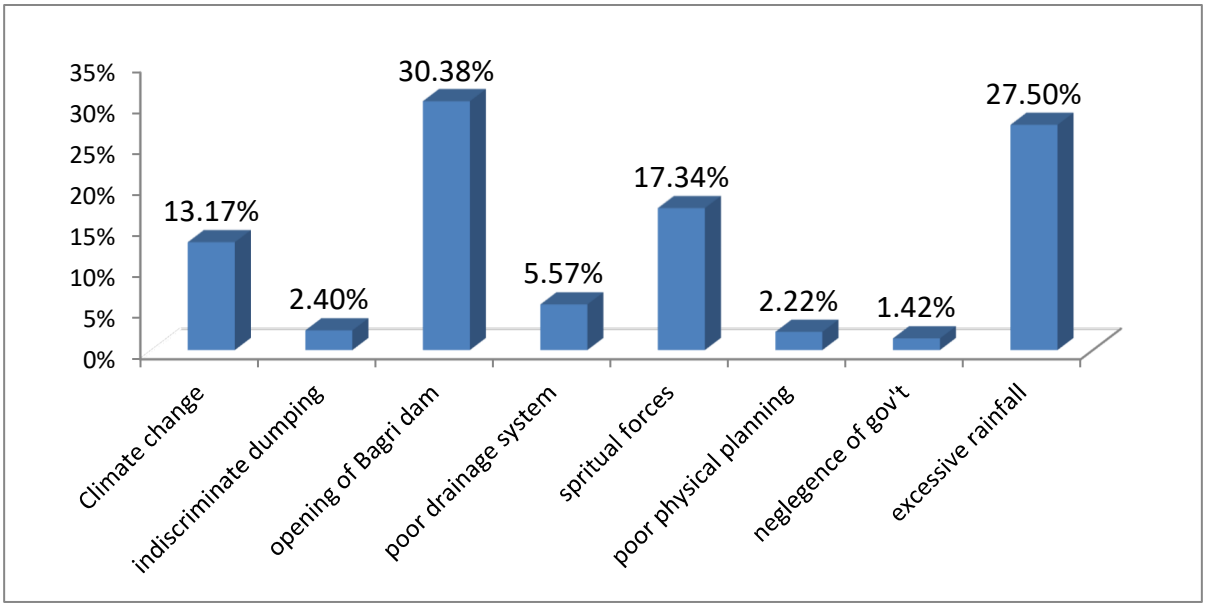

Figure 7.0 Perceptions on the Causes of Flood in the Study Area

Conditions of exposure and vulnerability of communities

From the study, 89.1% of the respondents lived in flood-prone areas, usually in low-laying or valley areas. Whiles 10.9% of these people are living in uplands within the community.

These people have varied reasons why despite the yearly occurrences of flood in these areas, they continue to stay there. About 41% of respondents stated that they were born in the community and wanted to maintain and preserve their ancestral land. Therefore, they could not move out or migrate to live with their kin. They found it inappropriate to move for continuity and maintenance of family ties. Also, 34% were concerned about maintaining family ties. They indicated they could not leave their family behind and migrate because relatives and close family members have refused to move to other areas despite the perennial flood.

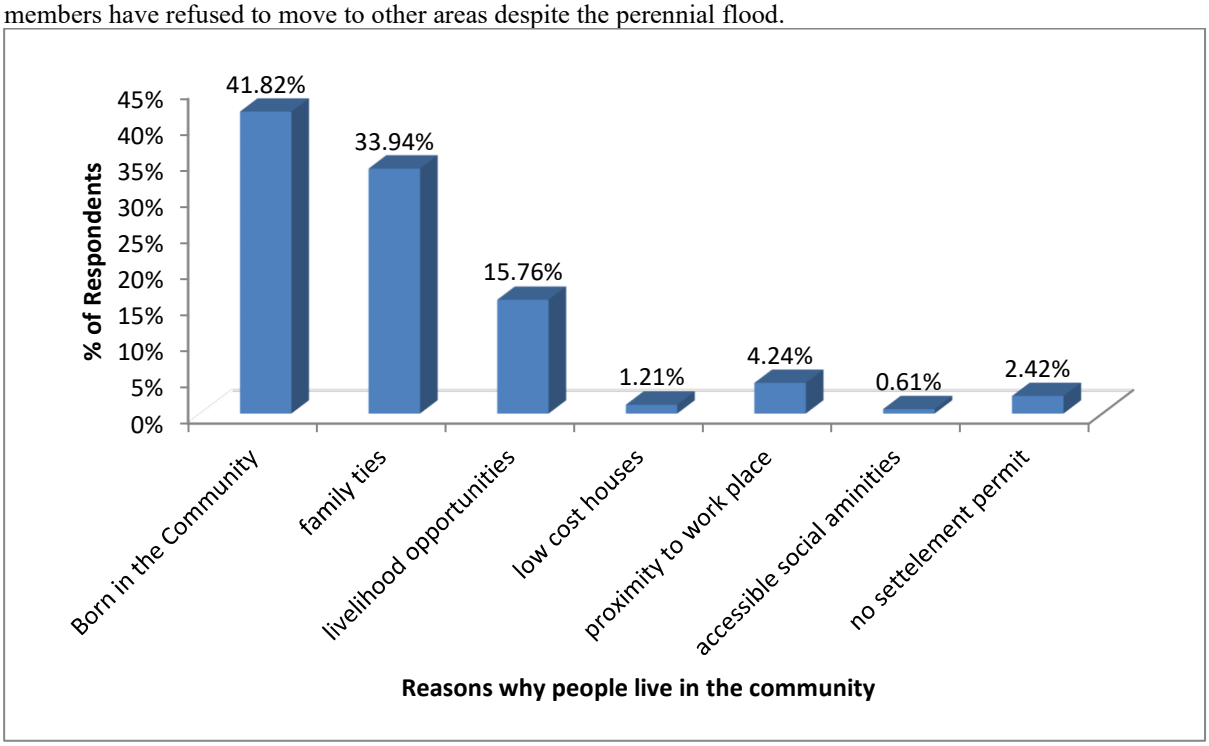

Fig. 8.0 Conditions of exposure and vulnerability of communities

About 16% of respondents were concerned about protecting and preserving their source of livelihood. Respondents indicated that moving out of their communities will imply that their source of livelihood will be lost because they will have to start life all over again or may not be able to secure land at the relocated areas. The rest of the 8% of the respondents lived in the flood-prone areas for the following reasons: low cost of houses, proximity

to work location, accessible social amenities, and because the place requires no settlement permit.

It was noted in the study that flooding in the community occurred in the rainy season and once a year because of the single rainfall regime.

Fig. 9.0 below shows that the group that was mostly affected by the occurrence of flood in the community was women. About 47% of respondents stated that women were mostly hit during flood and about 23% said that children were mostly affected by the occurrence of flood in their community. About 21%, 7% and less than 1% respectively mentioned men, the youth and the aged as the groups that were severely affected by flood.

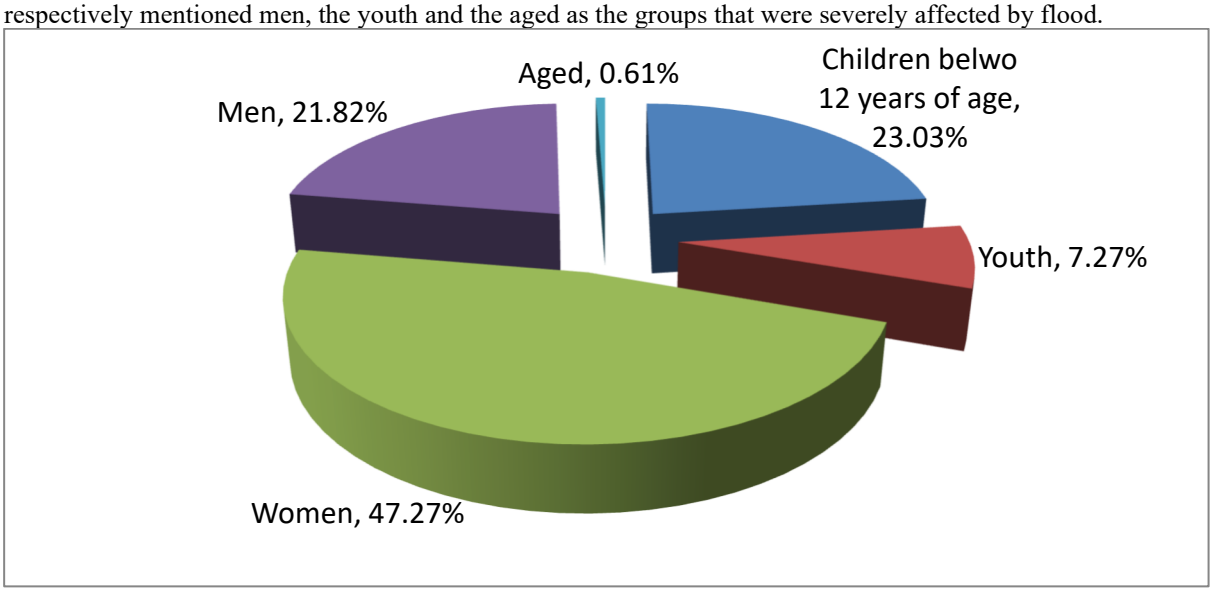

Figure 9.0 Vulnerable groups that are affected by flood.

Causes of vulnerability

Vulnerability, according to respondents, was the inability of persons to absorb the shocks of natural disasters. About 71% of the respondents indicated that their vulnerability was due to residing in flood-prone areas since the community topography is low laying area. Also, 27% of respondents believed that the community's vulnerability is attributed to poverty. External shocks quickly hit poor people. Another vulnerability in the study area was the lack of an alternative source of livelihood. About 61% of respondents indicated that they were struck when the flood occurred because of the absence of an alternative source of livelihood.

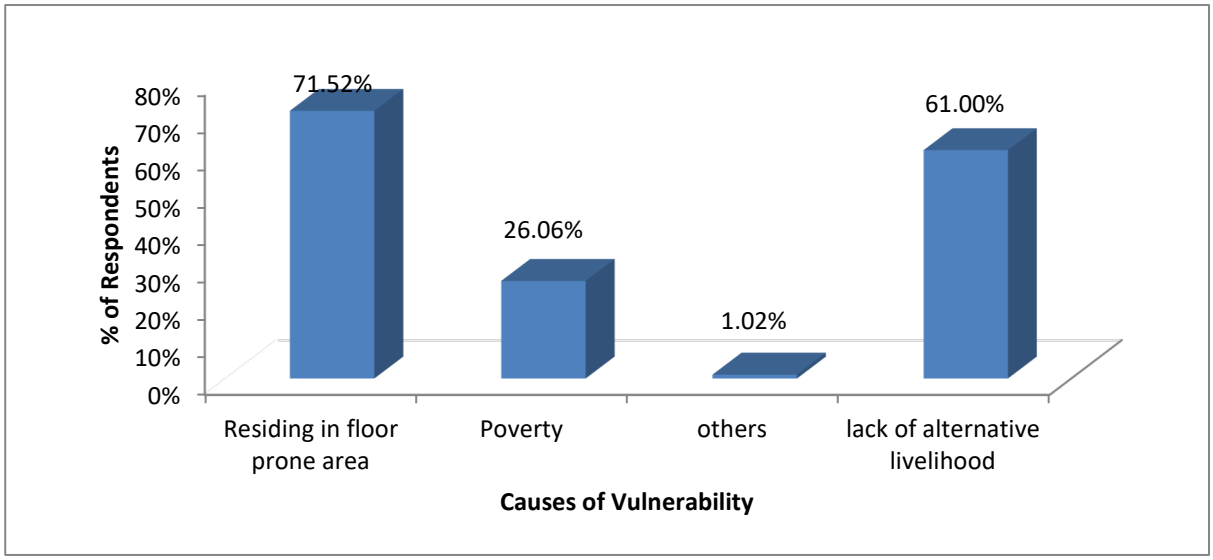

Fig. 10.0 Causes of Vulnerability

Effects of Flood on Victims

Data analysis revealed that about 25% of respondents mentioned that flooding destroyed their farms resulting in low crop yield or total crop failure. About 20% of respondents indicated that the roof of their house buildings was usually ripped off, and 15% mentioned that the occurrence of flood led to damage and loss of household appliances

and other personal possessions. About 14% stated that flood leads to the collapse of their buildings. Respondents who mentioned the outbreak of disease and other losses as the effects of flood constituted about 12% each.

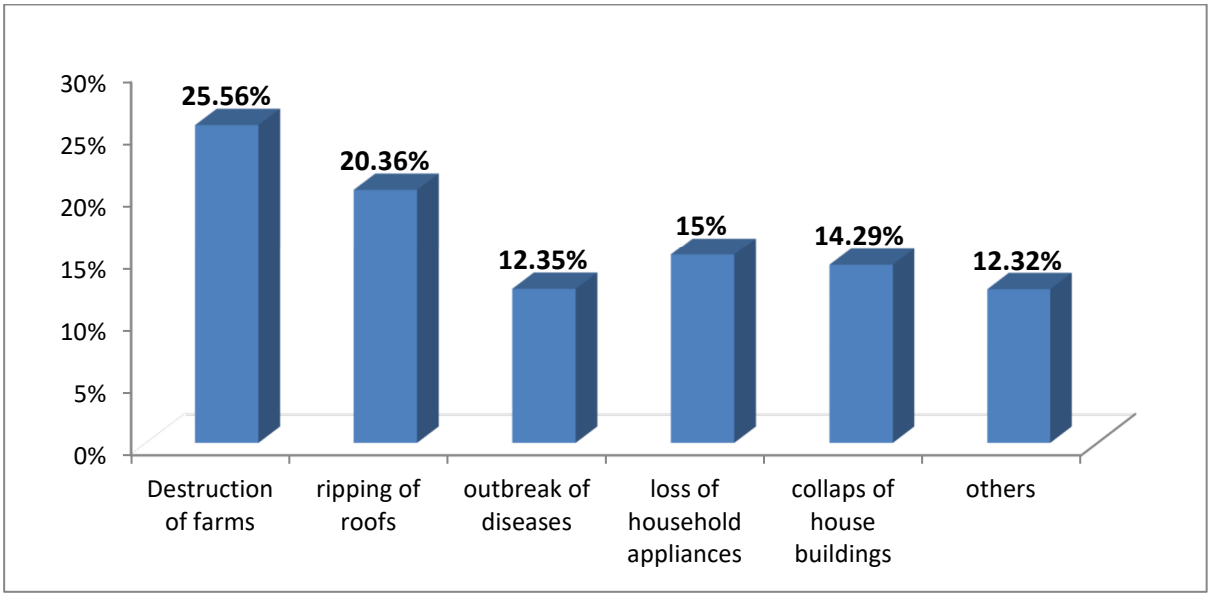

Fig 11.0 The Effects of flood

From the field, 84% of respondents indicated that properties and some lives were lost whenever there was a flood in the community. As and when a flood occurs, victims cannot ameliorate themselves from the unfortunate situation. They live with it until the waters find their way. Others stated that the family quickly moved to a highland area when confronted with such a challenge. Some sold their belongings to support themselves in these challenging times. Table 4.0 below shows the effects of the flood on agriculture.

Table 4.0 Table Showing Effects of Flood on Agriculture

No.	Name Of Community	Pop Affected	Affected Farm Produce			Structures Destroyed (Buildings)
			Poultry	Crops (Acres)	Livestock	
1	Tolgu	178	10	45	20	14
2	Buglang	234	95	48	15	12
3	Bihi-Naayili	145	30	30	23	5
4	Dalun	1,598	103	145	95	26
5	Yuni	189	23	23	12	10
6	Golazoli	340	67	34	19	9
7	Ganvuliga	199	15	50	21	10
8	Nawuni	269	78	42	9	8
9	Dalun-Kukuoo	210	45	19	16	10
TOTAL		**3,362**	**466**	**436**	**230**	**104**

Source: Field Survey (2020)

Perception of Prevention of Flood in the Study Area

With the prevention of flood in these communities, 59 out of 165 respondents representing 36%, believed that flood could be prevented, whiles 64% did not believe there could be anything done to prevent the flood situation in the communities. Some respondents stated that rainfall is a natural phenomenon and that nothing can be done about it and the communities must settle around the river to farm. Those same people indicated that before a flood can be prevented or avoided in the area, the government of Ghana and its counterpart in Burkina Faso should meet and discuss the yearly water spillage of Bagri Dam. Until concrete and deliberate measures are put in place by governments, NADMO, and the District Assembly, flooding will continue to occur in this community and many other communities settled along the river in Ghana.

The respondents noted that the adverse effect of flood in the community could be minimized through relocation or resettlement to highlands. Some respondents explained that they could only build high walls around their houses to prevent the water from entering their rooms while trying to prevent their crops from destruction.

Building structure and Age of Building

Most respondents (93.3%) said they are/were aware of the risk of flood, yet they stayed in the area for reasons

stated earlier. Flood information was obtained from television and local radio stations.

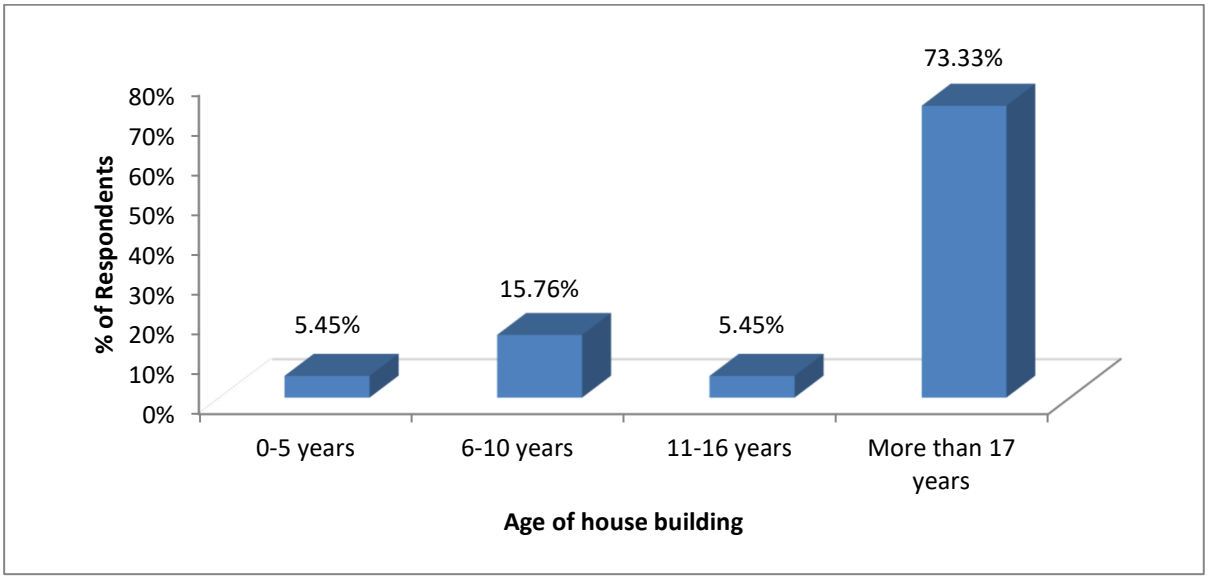

Fig 12.0 Building structure and Age of Building

From the data analysis, 73.3% of the respondents indicated that they had lived in the community for more than 17 years and that the houses were either family or personally owned. About 15% of respondents had lived in their community for 6 to 10 years, and about 5% had stayed there for between 11 to 16 years. The analysis further revealed that about 5% of respondents had lived in their community for less than six years. This explains why residents remained in their communities despite the yearly flood.

The poor quality of materials used, and the structural problems coupled with heavy rains led to the total collapse of several buildings across the district. Poverty in technology, locational decisions, and finance makes it difficult for individuals to acquire improved and proper building materials to construct flood-resistant structures.

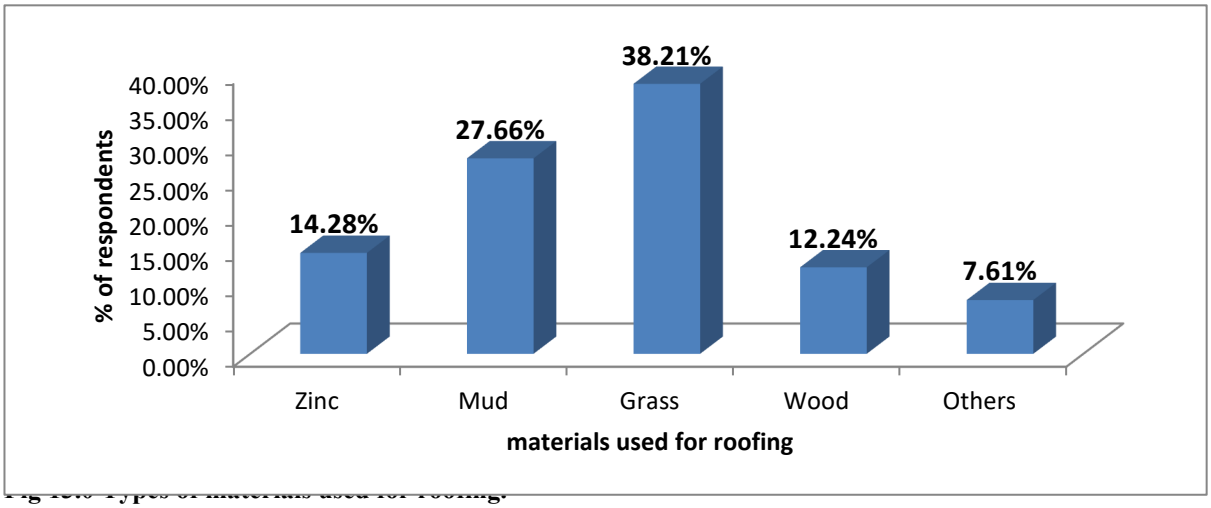

Fig 13.0 Types of materials used for roofing.

Spacing and Age of Buildings

According to the field survey, space between houses is stated below in table 5.0. About 43% of the respondents said the space for the building is 51 m to 100 m. Houses with spaces between them, that is 200 meters are about 29% of the houses, whiles about 24% of houses have spaces between them to be less than 50 m, and about 3% of houses have spaces between them to be more than 200 meters.

Table 5.0 Space between buildings

Spaces between buildings (meters m)	Frequency	Percentage (%)
Less than 50m	40	24.24
51m – 100m	71	43.03
101m – 200m	49	29.09
More than 200m	5	3.03
Total	**165**	**100**

Source: Field Survey (2020)

From the above (Fig 13.0), 38.21% of respondents used grass to roof their houses, and 27.66% used mud for roofing. About 14.28%, 12.24%, and 7.61% used roofing sheets (zinc), wood, and other materials for roofing. The mud and grass roofs were regularly replaced when they were leaking because these materials are not costly to replace as compared to the zinc roof. Out of the 14.28% of respondents who used roofing sheets (zinc) to roof their houses, 75% of those houses with zinc roofs were licking and in bad condition and therefore were not habitable during heavy rains. The remaining 15% of houses roofed with zinc were not leaking. About 81% of grass roofs were leaking, and 19% were not leaking. About 25% and 29% of mud and grass roofs were leaking, and 75% and 71% were not leaking, respectively.

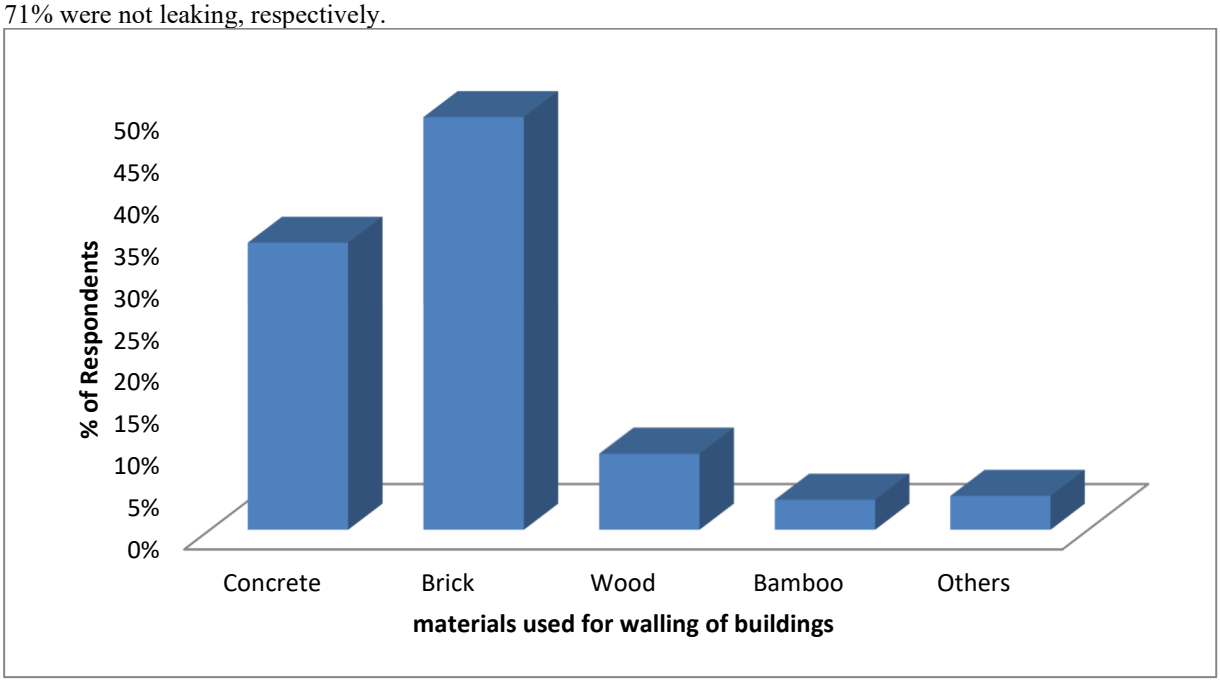

Fig 14.0 Types of materials used for walling of buildings.

From the study (Fig 14.0), 34.22% of respondents used concrete for walling their buildings. The rest use bricks (49.18%), wood (9.03%), bamboo (3.56%), and others (4.01%) in walling their houses. These houses located around flood-prone areas were easily destroyed by flood. Apart from concrete, other materials cannot withstand the pressure from these floods.

The study revealed that 20.66% of respondents used concrete to floor their buildings. Farm produce was also stored in houses that were floored with mud, bare ground, and mixed (bare ground and mud) were exposed to destruction by flood. The study also gathered that most of their farm produce was stored in these houses because the government provides no warehouse. About 10% of households had separate storerooms for farm produce, and 90% of households stored their farm produce in their bedrooms and kitchens. These practices exposed farm produce to water during heavy rains and floods. Most of these farm produces were destroyed during flood periods because they were not stored in proper warehouses.

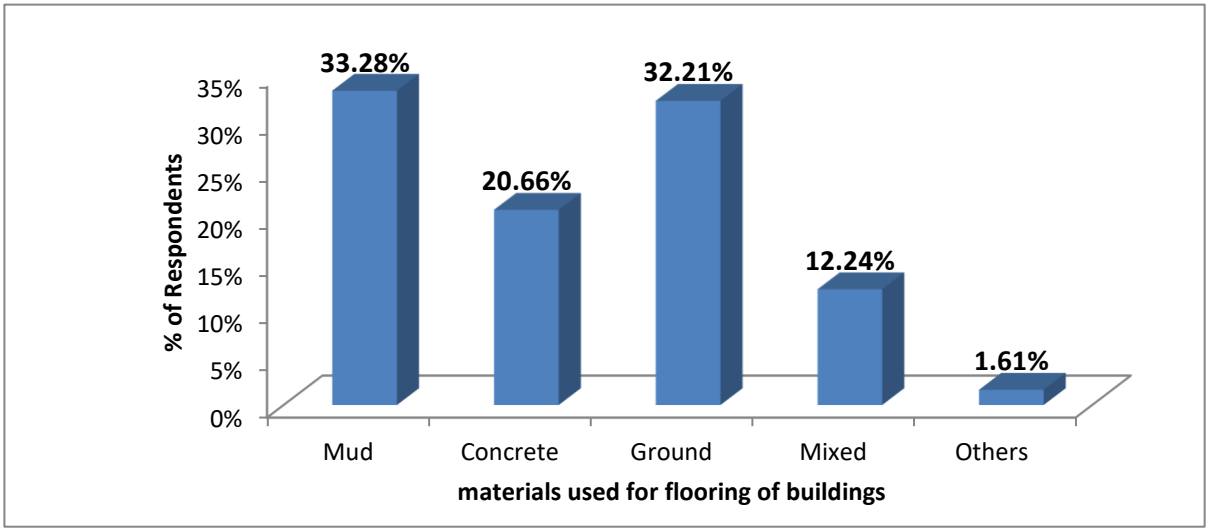

Fig 15.0 Types of materials used for flooring of buildings.

Coping mechanisms of communities

From the study, 72.6% of respondents agreed they could always evacuate their families from flood areas to highlands with their belongings. Respondents viewed coping strategies as strategies to prevent one's properties and life from being affected much by the activities of the flood.

The intensity of the flood sometimes left victims with no option but to throw their hands in despair. Also, the highly effective alternative is moving to higher land. It was noted that these measures were ineffective in dealing with flood situations, as some properties and crops were still destroyed. Respondents expressed that, as long as there were flood occurrences each year, there was also some shortage of foodstuff as farms and crops were taken over by rainwater. Even stored grains were destroyed when water entered their houses. When this happened, they had no option but to buy foodstuff from the market or wait for support from NADMO.

From the field, about 80% of respondents mentioned that they never migrated elsewhere when there was a flood. The remaining 20% of the respondents indicated that they moved to other places for a short while and returned. However, there still needed to be a fact or data about how long they stayed away before returning. Females headed households were usually engaged in the movement since they were the most vulnerable whenever there was a flood. Both women and children migrated out of the community.

Here are the various livelihood coping mechanisms adopted by the people before and after the flood disaster. Some of them are as follows: pito brewing, petty trading, fish mongering, harvesting crops prematurely, weaving thatch for local roofing, planting of early maturing or flood resistance crops, livestock selling, moving to other communities and cities, relying on food harvested from previous years, fishing, basket weaving and doing laborer work. The study also revealed that fishing was a primary coping mechanism for crop and animal farmers in the events of flood disasters in the area because the flood came with abundant fish.

The most challenging issue when there was a flood was assistance or support from an external source; this was lacking and very disturbing because victims became restless. Sometimes the support comes but is inadequate. Fig 16.0 below shows the assistance given to flood victims.

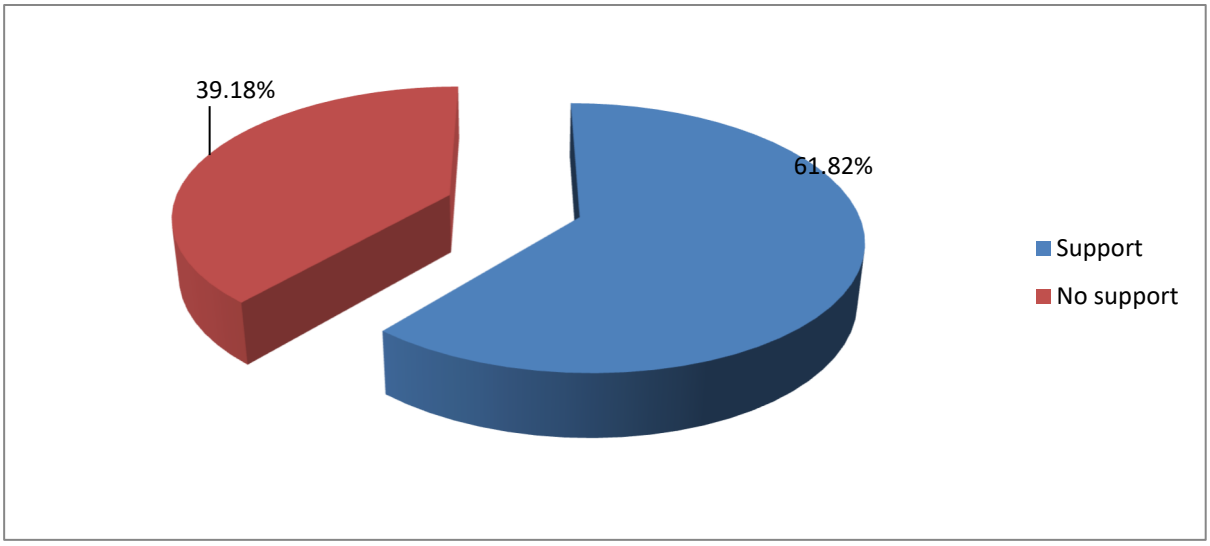

Fig 16.0 Assistance giving to people affected by flood.

About 61% of respondents had ever received support, and 39% had never had support from any source when the flood occurred. Out of the total respondents who indicated they ever had support, 67% of respondents mentioned that they ever had support from NADMO, 9% had support from either NGOs, friends, or relatives, whiles 24% said they had received support from other external sources. However, all respondents stated that these supports came very late and were inadequate to salvage their plight. Since the flood was a yearly occurrence in the district, community members always anticipated it meanwhile they stated that they had never prepared for it. According to them, they only relocated to highlands anytime flood occurred.

Perception of public interventions

Community members had various ways of looking at interventions and varied opinions on interventions for flood victims. From the data, respondents said a wide range of institutions and groups could assist in preventing floods in the district.

The data analyzed revealed that about 45% of respondents mentioned the District Assembly as one of the state institutions responsible for preventing floods in the district. According to respondents, community members had the responsibility to prevent the flood. Therefore, 32% of respondents agreed that people affected by floods should take the initiative of evacuating to higher land for temporary settlement and move permanently to higher grounds or build houses with materials that can withstand floods. Community Base Organizations (CBOs) also play a crucial role in ameliorating the plight of flood victims. The data analyzed revealed that about 21% of respondents said CBOs were responsible for preventing floods in the district. Figure 17.0 below illustrates the respondent's perception about who should manage the effects of floods in the district.

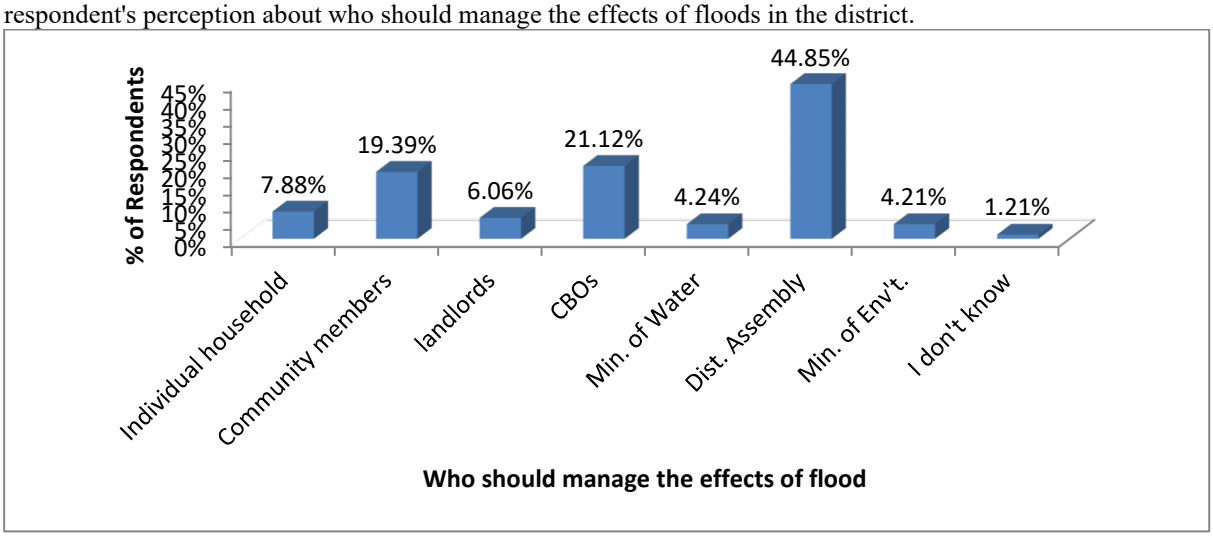

Fig 17.0. Perception of management of the effects of flood

From the field, all the respondents (100%) said they had no form of insurance on either their crops or farmlands. However, most (90%) respondents had no savings with any bank. Whiles 10% did save with some financial institution.

The district has no storage facility to store and protect farmers' crops from going bad or perishing on the farms. Therefore, farmers resort to traditional storage modes like barns and cocoa sacks.

Respondents stated that, anytime flood occurred, some of the materials they needed included cement and concrete to construct perfect flood-prone floors. Clay, zinc, and grasses/thatch were also needed for roofing their houses, whereas concrete, brick clay, wood, and bamboo were needed to build an average village house.

Discussion of Findings

Perception of the Causes of Flood

The study revealed that most respondents attributed floods to human-induced factors. This is attested by the fact that about 30% of respondents attributed flood in the area to the opening of the Bagri Dam in Burkina Faso. This agrees with the findings of Zhang et al. (2008) and ActionAid (2005) that human activities driven by socioeconomic factors are responsible for the recent increasing flood risk. The finding also corroborates the assertion of White (1945) that floods are "Acts of God," but flood losses are "largely acts of man." White (1945) further argues that although humans have been victims of natural flooding, their presence and stay near rivers and flood plains contribute to the problem.

The study uncovered that many respondents attributed the flood to natural forces that are difficult to predict and deal with. This is manifested in the fact that about 27% of respondents attributed the occurrence of floods in the study area to excessive rainfall experienced during the rainy season. The finding supports the findings of Dixit (2003), who argues that flood disasters are inherently a feature of natural hazards and that floods occur when the soil and vegetation capacity cannot absorb all the downpours allowing the water to run off the land in quantities that exceed stream channels. White (1945) also corroborated this finding by suggesting that floods are an "Act of God" and can be caused by heavy rain or prolonged rainfall within a short period over a spatial unit.

Effects of Flood of Food Crops

The data analyzed revealed that the flood destroyed farm crops, leading to low crop yield and sometimes 100% yield loss.

Also, respondents indicated that floods resulted in the ripping off the roof of their buildings, damage, and loss of property, the collapse of buildings, and the outbreak of disease and other losses. The findings are consistent with that of Parker (2000), that flood can cause several different damages, which include direct tangible losses, tangible indirect losses, and intangible human and other losses. The losses caused by flooding are not only economic but also can be physical, ecological, and social. The findings are corroborated by Ghana News Agency's (2007) report that the Government of Ghana announced Five Million Ghana cedi (5,000,000) support for the three Northern Regions and parts of the Western region hit by floods. A significant portion of the amount was to procure relief items for the victims. Also, Nelson (2007) suggested that flooding could lead to the occurrence of epidemics such as cholera, typhoid, and malaria in communities along the river.

Conditions of Exposure and Vulnerability of Communities

From the data collected and analyzed, it revealed that most respondents are living in flood-prone areas. Such areas are usually in low-laying or valley areas. Respondents stated that they were born in the community and could not move out or migrate to live with their kin. A significant number of respondents indicated that they continue to live in flood-prone areas because they were born there and would want to maintain and preserve their ancestral land. However, some of the respondents were more concerned about maintaining family ties.

The study uncovered that the vulnerability of most respondents is due to residing in flood-prone areas and poverty. Page (2000) corroborates the study's findings by arguing that communities in developing countries are vulnerable to floods because of socioeconomic conditions in terms of poverty and lack of development. According to Page (2000), external shocks easily hit poor people. Another cause of vulnerability in the study area is the lack of an alternative source of livelihood since many respondents indicated that they are hit badly when flood occurs because of the absence of alternative sources of livelihood. According to Vaz (2000), rural areas depend heavily on agriculture as the only primary source of livelihood and are more affected by the consequences of a flood than urban areas.

Coping Mechanisms of Communities

The field survey results have revealed that residents can always evacuate their families with other belongings from flood areas to highlands. Respondents viewed coping strategies as steps or processes to prevent one's properties and life from being affected much by the activities of the flood. The findings of Blaike et al. (1994) corroborate that all coping strategies for adverse events which are perceived to have precedent consist of actions before, during, and after the event.

Despite the annual occurrence of floods, most respondents indicated that they never migrated elsewhere when floods occurred. However, those who migrated during the flood indicated it was usually for a short period. Female-

headed groups or households generally engaged in the movement since they were the most hard-hit whenever there was a flood. Both women and children migrated out of the community.

The role of state institutions in curbing floods in Kumbungu District

The works of some of these institutions are far below what is expected of them as their mandate. They are found within the district and the region. They are mandated to ensure that such disasters are controlled or prevented from occurring in the district. However, these institutions are surrendered with several challenges affecting their performance. For instance, the Town and Country Planning Department and the National Disaster Management Organization (NADMO) are mandated to prevent people from establishing unauthorized structures. Unfortunately, these institutions cannot discharge their duties effectively, resulting in the development of buildings along the White Volta, posing a severe threat to the lives of habitants of such buildings. These have resulted in the annual flood disaster occurrence in these communities. These institutions are challenged with inadequate financial resources, inadequate qualified human resources, political interference, and inadequate logistics.

Conclusion and Recommendations

From the discussions, respondents were aware of the main reasons their communities flooded yearly: when the Bagri dam is opened in Burkina Faso. Also, poverty and the protection of people's livelihood play a key role in explaining why residents remain in the communities even though the communities get flooded yearly. Finally, public intervention has not effectively mitigated the effects of floods on victims.

Buildings along the White Volta have exposed these communities to flood dangers. The opening of the Bagre Dam and the heavy rains due to climate change has increased the level of the river, which overflows into these communities, destroying lives and properties. Also, the failure of mandated bodies to put into force rules and regulations to safeguard the river as well as the lives and properties of people living around the river has resulted in the occurrence of floods annually in these communities and the exposure of the communities to such an environmental risk or hazard. These people have to suffer the risk or danger of floods, leading to a vicious cycle of poverty. It is the responsibility of the authorities in the district to relocate these people to higher grounds, which unfortunately has not been possible due to specific challenges.

Government and key stakeholders should provide the necessary social amenities at the new higher grounds designated for these communities to relocate. These will motivate these people to move with their families. Some of these social amenities include hospitals, schools, and water. These are essential for human survival.

The government should also consider introducing alternative livelihood strategies in the new settlement area. These will prevent them from going back to settle along the White Volta.

Government should consider constructing mini dams that will trap the excess water. This will be used for farming during the dry season.

Ruling political parties should not interfere with the duties of NADMO. Politics should be separated from the work of these institutions. Workers should be employed only based on their skills and qualification but not due to political affiliation. Relief items should also be distributed to victims and not diverted.

The District Assembly should collaborate with the Ministry of Food and Agriculture (MoFA) and other agricultural agencies to support and encourage communities to increase the area cultivated on the upland to enhance food security in the district.

Mitigation measures initiated by communities should be supported and promoted to build community resilience.

The various institutions mandated to control and prevent flood in the district and the region such as NADMO, Town and Country Planning Department, MoFA, etc., should be well-resourced to enable them discharge their functions effectively and efficiently. Their offices should be equipped with the necessary logistics and equipment, such as computers, printers, motorbikes, vehicles, cameras, speed boats, life jackets, etc. They should also employ professionally qualified workers, and the government should increase, and release funds allocated to these institutions.

Stakeholders should educate communities about flood risk, which is becoming severe due to climate change. These communities should be educated on the causes of these floods and be made aware that flood is preventable.

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Conflicts of Interest

The authors declare no conflict of interest.

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