

Original Research Paper

Exploring the Impact of Floods on Rural Communities on Emerging Food Security Challenges in Ghana

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Abstract: The article analyzed the impact of floods on rural communities on emerging food security challenges in Ghana using the Bawku West District of the Upper East Region of Ghana as a case study. Flooding has become the most destructive natural hazard which affects rural livelihoods, especially subsistent farmers. The data for the study were obtained through the use of the mixed method. 150 households were sampled for the study. This was done using simple random sampling. The primary data were obtained using questionnaires, interview guides, and focus group discussions while the secondary data were acquired from the National Disaster Management Organization (NADMO) and Ministry of Food and Agriculture (MOFA). The data were analyzed using binary regression and content analysis. Photographs were used to support the findings. From the finding, it was realized that rural communities' livelihood activities were vulnerable to flooding and over the years several households have lost their source of livelihood to the floods. This has resulted in food insecurity. The result of impact of the flood on livelihood activities has resulted in coping strategies being adopted by the respondents in the area to reduce the impact of the flood on their livelihoods.

Keywords: Floods, Rural Communities, Livelihoods, Coping Strategies, Food Security

Introduction

Throughout history flood plains usually support human settlement due to their fertile alluvial soil which promotes agricultural activities (Abi, 2007). According to Pacione (2009), many civilizations in the past (i.e., Egyptian civilization) flourished as a result of the fertile alluvial soil deposited on the banks of the Nile River due to the annual floods of the river which promoted agricultural activities. However, floods affect more people than any other weather-related hazard worldwide (Alexander *et al.*, 2011). Over the years, several parts of the world have been affected by floods as a result of climate change (Asamoah, 2018). This has led to the loss of lives and livelihoods.

The variability in climate is likely to bring about an increase in the number of flood disasters which will affect agricultural activities as well as the ecosystem (Yiran and Stringer, 2017). Climate change is seen as a global issue but its impacts are felt more in developing countries due to its vulnerabilities and inability to cope with the effect of the changes. This is because; these countries relied on rain-fed agriculture for their survival (Kurukulasuriya *et al.*, 2006; Mendelsohn, 2014). This, therefore, has a major impact on

the production of crops due to changes in temperature and rainfall patterns which usually result in drought and floods.

Recent statistics in the sub-region have seen an intense rise in the occurrence of floods (Armah *et al.*, 2010). For example, in 2007, the Volta and Niger rivers overflowed their banks leading to severe flooding in which about 1.5 million people were severely affected and several farmlands washed away (Armah *et al.*, 2010; Yiran and Stringer, 2016). The United Nations for the Coordination of Humanitarian Affairs (UN OCHA) report revealed that these rivers got flooded again in 2009 which affected approximately 940,000 people in more than twelve countries in the western part of Africa and resulted in about 193 lives lost as well as properties amounting to \$152 million destroyed (UN OCHA, 2009). A similar case was recorded in 2012 along the river Niger which led to 81 and 137 people losing their lives in Niger and Nigeria respectively and displacing approximately 600, 000 people (Integrated Regional Information Network {IRIN}, 2012).

In Ghana, rural agriculture contributes about 35% to the country's Gross Domestic Product (GDP) as well as

generates nearly 30-40% of foreign exchange earnings (Ghana Fact Sheet, 2006; Daily graphic, 2007). According to the reports, it also employs about 55% of the population (Ghana Fact Sheet, 2006; Daily graphic, 2007). Notwithstanding these benefits, this system of farming is marred by perennial flooding, especially among communities located along the White Volta River which is affecting the activities of farmers as well as their source of livelihood.

Studies have shown that the perennial flooding of the White Volta has greatly impacted poor communities' livelihoods, especially food security in the Upper East Region (Coulombe and Wodon, 2010). This is because these rural communities rely on subsistent agriculture for their survival and source of income generation (Yaro, 2004). Again, the United Nations 2009 report about risk and poverty as a result of climate changes noticed that rural communities in the UER suffer the most and are more vulnerable to natural hazards, especially flooding. This means that these farmers are always the hardest hit during flood events since they lack the coping capacity to handle the loss of property and income.

Despite the high devastating impact of flooding on food security in the region, several studies have investigated the impact of the flood on the environment, ecosystem, and livelihood changes of the people (Blench, 2006; Armah *et al.*, 2010; Musah *et al.*, 2013; Sebastian, 2014; Sidibe *et al.*, 2016). These studies, however, tend to neglect the issue of food security which is essentially the backbone of every household's survival, and the achievement of Sustainable Development Goal 2 of ending hunger. Research that tends to include food security is skewed to the impact of drought on food production. More studies need to be conducted to ascertain how the annual floods could affect the key indicators of food security like food availability, access, stability, and utilization. Also, there is the need to understand the coping strategies of the households toward ensuring food security as about 70% of the population's source of survival depends on the produce obtained from the farm (GSS, 2012). This study fills the knowledge gap by investigating the impact of the floods on rural communities' livelihoods especially food security and how households cope during such situations (food insecurity) with the hope of realizing the United Nations SDGs goals one and two of reducing poverty and ending hunger by the year 2030.

Materials and Methods

The Bawku West District (Fig. 1) was carved out of the then Bawku District in 1988 by the local government act of Legislative Instrument (LI) 1442 (GSS, 2014). The

district is located in the north-eastern portion of the UER, with Zebilla as its administrative capital (GSS, 2014). It lies between latitudes 10°30'N and 11°10'N and longitudes 0°20'E and 0°35'E (UNDP, 2011). The district is bounded to the North by the Republic of Burkina Faso, to the East by Binduri District, to the West by Talensi and Nabdam Districts, and to the South by East Mamprusi District.

The area covered by the district is roughly 1,070 square kilometers representing about 12% of the total landmass of the UER (GSS, 2014). This makes it the fourth biggest district in the region in terms of land area (GSS, 2014). The district is drained by the White Volta River and its tributaries as shown in Fig. 1. The river usually becomes flooded during the peak of the rainy season due to heavy rainfall coupled with the spillage of the Bagre dam thereby affecting crops production (Forkuo, 2011; UNDP, 2011).

Climate

The district is found in the Sudan savannah ecological zone of the country which is characterized by a stretch of lowlands and grasslands (GSS, 2014). The climate in the area is relatively dry, with one rainy season in a year which starts in May and ends in October (Sidibe *et al.*, 2016). This is followed by a long dry season lasting about 6 to 7 months (GSS, 2014). The annual rainfall recorded in the district is about 956-C which varies from season to season (GSS, 2014). However, the district is interrupted by erratic rainfall patterns, thereby exposing the area to dry spells, droughts, and floods (Nicholson, 2005). Flooding in the district is closely linked to heavy rainfall which usually reaches its peak between August and September. This period is usually worsened by the spillage of excess water from the Bagre dam (Fortuo, 2011).

Soil

The district (Fig. 4) is made up of different soils: Luvisols, Lixisols, Leptosols, Gleysols, and Fluvisols which have been weathered from the Birrimian rock. Most of the soil is fertile and supports plant growth. These soils are susceptible to flooding and over the years several areas' farmlands have been destroyed by flooding (UNDP, 2011). However, there are less important soils such as Lithic Leptosol and GleysolsLixisol which dominate in the district as shown in Fig. 4 and do not promote the cultivation of certain types of crops (UNDP, 2011).

The soils type found in the portion of the White Volta basin in the district are Savannah Gleisol and Alluvial intergrades. These soils are highly fertile and support the cultivation of different types of crops including maize, sorghum, millet, etc. (Obeng, 2000). Because of this, most farming activities in the district are done along the river banks. However, most of these soils are liable to seasonal flooding.

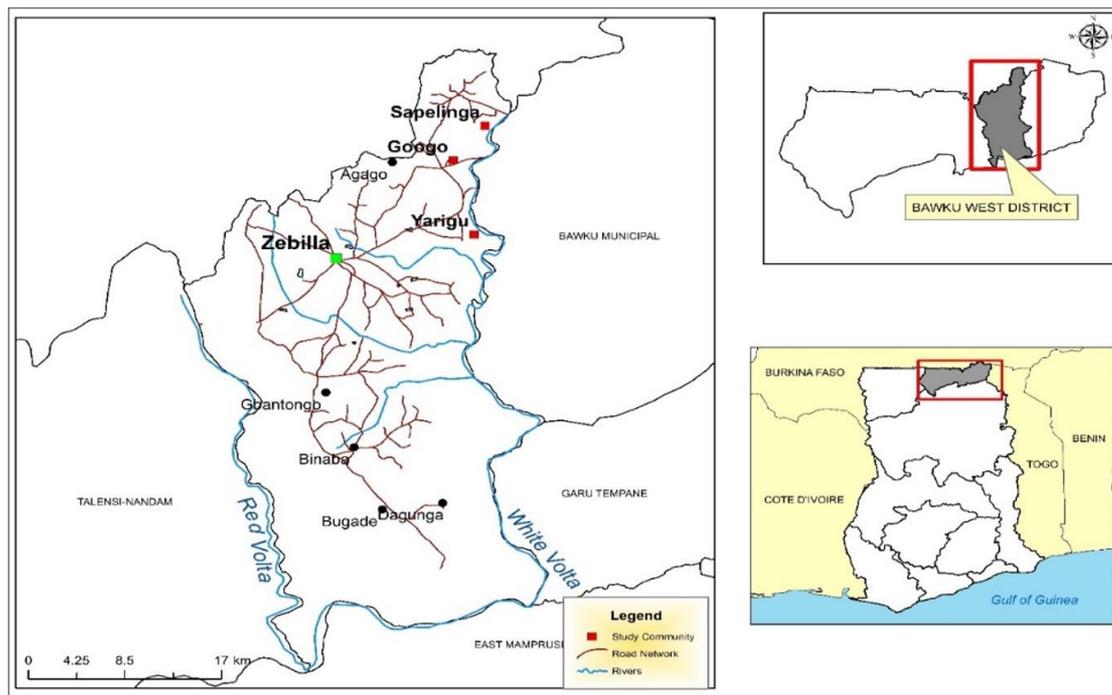


Fig. 1: Locational map of the study area

Socio and Economic Characteristics

Small-scale agriculture is the predominant economic activity in the areas. It employs not less than 60% of the people (GSS, 2012). This system of farming is rain-fed dependent although some small and medium-scale irrigation schemes are practiced along the White Volta basin (Sidibe *et al.*, 2016). As a result of the over-reliance on rainfall, most farming activities are done in the rainy season between May and October. Crops cultivated in the rainy season include cereals, tomatoes, and vegetables. Because of the heavy reliance on rainfall as indicated earlier, any changes in climatic events will result in production loss (MOFA, 2009). Over the years this affected food production and hence food availability as well as the income of the people.

Apart from the production of crops, most households also reared livestock and fowls. The animals and fowls kept include goats, cattle, donkeys, pigs, sheep, and fowls especially guinea fowl rearing which is quite prominent in the areas (Asamoah, 2018). These animals are sold during times of difficulty, like food shortages to alleviate the household from such a situation. Some of the inhabitants are also engaged in carpentry, masonry, grinding mill operation, smock weaving, fishing, and dry season farming as a means of livelihood.

Also, Atoaba (2011) opine that petty trading activities are carried out by some people, especially women. According to him, these activities (trading) take the form of pito brewing,

rice processing, dawadawa making, pottery, firewood harvesting, chop bar operation, and others. The proceeds obtained from these businesses are used to support the household head during times of food crises arising from climate change or other human activities. According to Blench (2006), seasonal migration is very prominent in the areas. Most people migrate to the southern part of the country to work during the dry season as a source of employment and return to their place of origin when the rainy season starts to farm or send remittances back home to support farming and other activities. Having looked at the study area in general, it is now appropriate to discuss the research design and methods of data collection and analysis.

Data and Methods

The data for the article draws on the mixed method which comprises quantitative and qualitative studies which were subsequently integrated into the analysis process. These data (quantitative and qualitative) were drawn randomly from five selected communities situated along the White Volta River namely; Goggo, Timonde, Yarigu, Kubore, and Galaka. It is important to establish the fact that communities along the river basin are always flooded any time there is torrential rainfall coupled with the spillage of the Bagre dam (Forkuo, 2011; Sidibe *et al.*, 2016). Firstly, a questionnaire survey was conducted among 150 individual household heads in the five communities. This is shown in Table 1.

Table 1: Distribution of sample for study communities

Community	Number of households	Sample size
Googo	274	75
Timonde	238	65
Yarigu	194	53
Biringo	137	37
Galaka	205	56

Source: Fieldwork (2021)

Table 2: Focus group discussion and issues discussed

Community	Number of participants			Issue discussed	Date
	Male	Female	Total		
Googo	8	4	12	Flood, livelihood activities & coping strategies	12/11/2020
Timonde	6	5	11	Flood, livelihood activities & coping strategies	7/8/2020
Yarigu	6	6	12	Flood, livelihood activities & coping strategies	7/8/2020
Biringo	9	3	12	Flood, livelihood activities & coping strategies	20/12/2020
Galaka	7	5	12	Flood, livelihood activities & coping strategies	17/10/2020

Source Fieldwork

Simple random sampling was used in identifying the households for the survey. Also, in-depth interviews were conducted amongst 50 households. These people were not part of the questionnaire survey. Systematic random sampling was applied in sampling the households. At the household level, stratified random sampling was applied for interviewing respondents. Thus, the interview covers various respondents such as males, and females, opinion leaders such as chiefs, assemblymen, community chief farmers, women groups, etc. The data obtained were based on the effects of the floods on the people's livelihoods especially food security and the coping strategies adopted by the households to ensure food security during such times.

In addition to the questionnaire and interview, Focus Group Discussions (FGDs) were conducted amongst five discussants in the five communities. In all, five FGDs were conducted, one from each community. This is shown in Table 2.

The discussants were drawn from opinion leaders, chief community farmers, selected households including females, and various youth groups. The discussants were made up of about 8 to 12 people each discussion. An FGD guide was used for guiding the discussions. Overall, the FGDs enabled in-depth discussions and analysis of local perspectives on the effect of the floods on food production.

Questionnaires were analyzed using SPSS while the in-depth interviews and the FGDs were subjected to content analysis. Results were produced as tables, charts, and photographs supported with explanations from the FGDs and in-depth interviews.

Results and Discussion

The results were presented in two parts. The first aspect looked at the effects of floods on food security and the second part discussed the results of the coping strategy of households in dealing with food insecurity in security.

Effects of Floods on Rural Communities Livelihoods

The effect of flooding was analyzed taking into consideration, its impact on livelihood activities in the area. Flooding was identified to impact negatively on many livelihood activities in the area. Several livelihood activities were identified in the area. From the questionnaire survey, it was revealed that major and minor livelihood activities were carried out by the respondents. From Table 3, agricultural activities especially subsistent farming was the main livelihood activity in the area. As indicated in Table 3, this system of farming employed more than 50% of the people in the area. This confirms the report by the Ghana Fact Sheet (2006) that subsistent farming employs more than any system of farming and contributes about thirty percent of the country's income earnings. Also, the WHO (2010) states that subsistent farming is the most commonly practiced among the rural poor in Ghana and forms an important part of assessing household food availability.

However, it was observed that as population growth is becoming eminent in the area, land as a natural asset especially fertile land is diminishing by the day. The mode of acquisition of land in the area is through inheritance, where a male child usually inherits the father (Yiran, 2014). The issue of acquiring land for farming in the area is becoming a challenge. This is affecting farming activities in the area. According to the respondents, agricultural lands are becoming less productive which poses a challenge to the people's livelihood especially as the product obtained from this sector serves many purposes (Boundia, 2015).

Flooding was noted to be the prevalent factor affecting farming activities in the area. Flooding in the area is seasonal (Derbile *et al.*, 2016). It was observed that floods usually occur at the peak of the rainy season where the rainfall is usually torrential. This period also marked the time when the Bagre dam in Burkina Faso is usually spilled (Forkuo, 2011). During an interview with an

elderly man in Timonde, he indicated that, in recent years, the erratic nature of the rainfall coupled with the perennial spillage of the Bagre dam is a threat to their food security and source of finance. He said-; "The produce obtained from the farm is what I and my family rely on until the next season. In recent times, we are not dependent on farm produce alone; we have to buy from the open market to survive. This is a challenge for us since we do not have the resources to do so". His views were complemented by the opinions of other respondents during a focus group discussion in which they opined that the annual spillage of the Bagre dam resulting in flooding has retarded food production in the area. They further explained that this phenomenon has forced many people, especially the active labor force to migrate to other places to look for non-existing white color jobs. According to them, these have the potential to negatively affect food production. The shortfalls in food production will lead to low food supplies, resulting in price hikes in the market. Figure 2 shows the impact of the 2020 spillage of the Bagre dam on farmlands in the area.

Although flooding was identified to be prevalent in the area, other environmental hazards such as drought, dry

spells, and environmental degradation were equally noted to pose a threat to food production in the area. According to Akudugu *et al.* (2012), climate change resulting in climatic variabilities such as drought and dry spells are challenges confronting subsistent farmers in the area. Farmers are usually confronted with drought at the beginning of the planting season (Amikuzino and Donkoh, 2012). From the discussion with the farmers during focus groups, it was revealed that the planting season in the area is now unpredictable in recent times. This is because; the rains usually come late and stop abruptly. In their view, the late onsets of the rains affect the early planting and germination of the crops that are planted. In their view, the planting season has been shifted further which is recipe for disaster concerning food production. They indicated that they are therefore confronted with the double effect of drought at the beginning of the season and flooding during the peak of the rainy season (Yiran and Stringer, 2016). These phenomena coupled with a rapid decline in soil fertility as a result of inappropriate human activities pose a great threat to food production in the area. Figure 3 shows withered farmland as a result of drought.

Table 3: Livelihoods activities among the inhabitants in the study communities

Livelihood	Googo N = 53	Timonde N = 65	Yarigu N = 53	Biringo N = 37	Galaka N = 65
Farming	37	46	33	22	42
Petty farming	7	5	5	4	8
Tailoring	1	-	3	2	3
Pito brewing	2	4	2	2	-
Rice processing	2	3	2	1	3
Shea butter making	3	2	1	2	-
Hairdressing	1	1	-	2	4
Carpentry	1	2	2	-	3
Masoning	3	2	5	2	2

Source Fieldwork

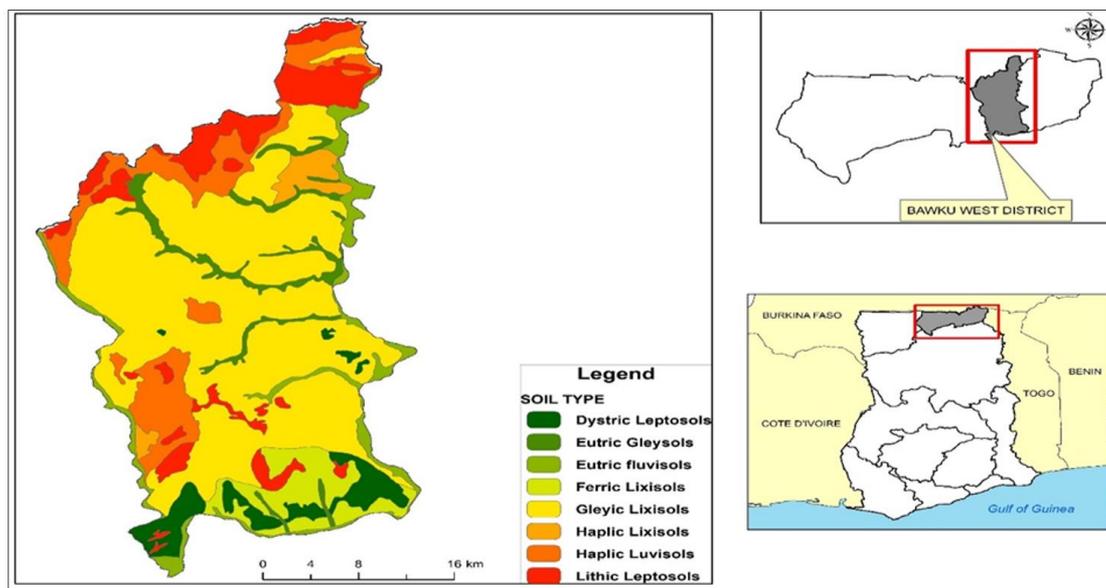


Fig. 2: Soil map of the study area



Fig. 3: Maize farm destroyed in googo source: Fieldwork



Fig. 4: Withered maize in yarigu source: Fieldwork

Animal production is not spared during flood occurrence. Rearing of animals and poultry keeping is an important source of livelihood among many people in northern Ghana, particularly in the Upper East Region (Asamoah, 2018). These animals serve as a source of income security and are also used in cultural activities. Animal and poultry that are kept include cattle, donkeys, pigs, rabbits, goats, sheep, guinea fowl, fowl, ducks, etc. The animals are also affected during the occurrence of floods. Table 4 shows the destruction of animals and poultry in various communities from 2019 to 2020.

As shown in Table 4, Biringo recorded the highest number of casualties for the two years with a total of 495 deaths of both livestock and poultry. Also, Googo and Galaka recorded the least casualties because most of their animals, especially the poultry, are kept in their homes unlike the other communities (Yarigu, Biringo, and Timonde) which reared the poultry on their farms.

Again, the influence of drought and floods lead to the emergence of diseases which affects the production of these animals. According to Derbile *et al.* (2016), many of these diseases arise as a result of extreme climatic events such as drought and floods. It was identified that changes in the weather conditions create an enabling environment for the emergence of diseases and pests to thrive.

Besides subsistent farming, there were other livelihood activities carried out in the various communities. However, these activities were operated on a small-scale basis. During the focus group discussion with the participants in all the communities, it was revealed that, because of financial constraints, they are not able to carry out these ventures on a large scale. Again, they indicated that the items sold depended on the produce obtained from the farm since some of the food crops are sold after harvest to buy the products to sell. Therefore, any destruction of the crops by floods and other climatic variables will not only affect food security in the area but also affect the financial strength of the people.

The respondents were engaged in activities such as petty trading, pito brewing, rice processing, dawadawa making, etc., as shown in Table 3. However, it was indicated most of these activities are dwindling in recent times due to the unavailability of raw materials. Also, in instances where these materials exist, it becomes very expensive to purchase due to limited supply. For instance, it was opined by the respondents that the 2007 flood disaster which led to the destruction of thousands of farmlands brought untold hardship to many households. Many households could not access foods in the market and those who depend on the produce obtained from the farm as a raw material quit their businesses because of the hike in prices due to limited supply. During a focus group discussion with the participants, it was observed that most people who were into pito brewing, rice processing, and petty trading quit their business because of inadequate finance and limited supplies of raw materials.

Factors Associated with Food Security

The various food security indicators were put together to ascertain which one is contributing more to food insecurity in the study communities. This was done using binary regression. Table 5 shows the analysis of predictors of factors associated with food insecurity in the study areas. Based on the results as shown in Table 5 on food availability as a predictor of food insecurity, it was observed that respondents who were engaged in self-production of food were 2.5 times more likely to be food stable in terms of food security as compared to those who received food aid from institutions, friends and family members. The results were found to be statistically significant [OR = 2.5

(95% CI: (0.12, 3.21), $p = 0.001$). This implies that any shortfalls in the production of food resulting from this source will significantly affect individual households' food security in the area. The respondents in FGDs observed that the availability of food through their production is the vehicle upon which they can benefit from the other components of food security; thus, a reduction in production from this source has the potential to expose them to food insecurity. However, it is important to note that food obtained from this source has declined over the years due to the influence of floods which has affected food security among household respondents in the study area.

On the part of food accessibility, the results also showed that respondents who were farmers were 2.2 times more likely to experience food insecurity as compared to those who were having other forms of activities that generated income for them and the results were

statistically significant [OR = 2.2 (95% CI: (0.12, 3.21), $p = 0.03$]. This implies that households which depend on subsistent farming as a livelihood source are more likely to be food insecure. It was indicated by the respondents that their ability to access food in the market during a period of food insecurity, especially in the lean season, depends on the produce obtained from their farms since other income-generating activities are limited in the area (Asamoah, 2018). According to them, a decrease in production resulting from floods will impact negatively their ability to purchase food in the open market during food shortages. As a result of this, many households in the area were not food stable. Table 5 shows that subsistent farmers who experienced natural disasters such as floods were 2.5 times more likely to experience food insecurity and the results were found to be statistically significant [OR = 2.5 (95% CI: (0.12, 3.21), $p = 0.04$].

Table 4: Flood destruction on animal production

Location	Destruction of cattle and poultry by flood from 2017-2018				Total
	2019		2020		
	Livestock	Poultry	Livestock	Poultry	
Googo	67	121	89	144	421
Timonde	85	167	97	134	483
Yarigu	66	187	78	152	483
Biringo	73	193	68	161	495
Galaka	82	112	59	129	382
Total	373	780	391	720	2,264

Source Fieldwork

Table 5: Binary regression analysis of factors associated with food insecurity

Variables	Food production					
	OR	(95% CI)	P-value	AOR	(95% CI)	P-value
Food availability						
Food aid	1		0.005	1		0.001
Self-production	0.48***	(0.07, 3.10)		2.5	(0.12, 3.21)	
Food accessibility						
Non farming activities	1		0.005	1		0.03
Farming activities	0.48**	(0.07, 3.10)		2.2	(0.12, 3.21)	
Food utilization						
Skipping meals	1		0.007	1		0.061
Reduction in the quality and quantity of meal	0.04	(0.01, 0.63)		0.70	(0.01, 1.68)	
Food stability						
Access to enough food	1		0.05	1		0.03
Absence of natural disaster	0.48**	(0.07, 3.10)		2.5	(0.12, 3.21)	

Table 6: Measures to deal with food insecurity

Measure	Googo N = (75)	Timonde N = (65)	Yarigu N = (53)	Biringo N = (37)	Galaka N = (56)
Skipping meals	45(60.0%)	30(46.1%)	22(41.5%)	12 (32.4%)	27 (48.2%)
Reduction in the quality and quantity of meal	17(22.6%)	10(15.4%)	29(54.7%)	21 (56.8%)	21 (37.5%)
Restrict adult consumption of food for children	13(17.3%)	25(38.5%)	2(3.7%)	4 (10.8%)	8 (14.3%)

Source: Fieldwork (2021)



Fig. 5: Pepper farm in yarigu source Fieldwork

Coping Strategies

Several coping mechanisms were applied concerning the farming system and in times of food insecurity. From the discussions with the respondents, it was identified that new varieties such as early maturing crops were now planted in place of the traditional food crops. Traditional crops such as millet, sorghum, and guinea corn were in the decline because of their inability to adapt to climatic variability especially floods. For instance, most of these crops tussle during the time that the floods do occur which disrupts the crops. According to respondents, when this happens, the crops are not able to develop proper seedlings. This makes it difficult for them to be used in the next rainy season. A 58-year-old farmer in Biringo summarized this by indicating that "I do not plant millet or sorghum again; because the weather situation in recent times does not support the cultivation of these crops. Maize has taken over, because, sometimes, we can harvest them before the floods come". Although the new varieties of crops have taken over the indigenous crops, it was identified that these crops cannot also withstand changes in climatic variability. More so, culturally, these new varieties cannot be used for the performance of traditional activities.

With regards to periods of food insecurity, the participants opined that they usually rationalize food to ensure that there is sufficient food for them. As shown in Table 6, one of the ways of rationalizing food by most of the respondents was to skip some meals to preserve food for the days ahead. The WFP (2012) study of food security in Northern Ghana also found that households responding to a shortage in food had no option but to skip meals served in a day. This practice has the potential to cause malnutrition which could negatively affect the health and well-being of households (GSS, 2012). From Table 6, Googo and Timonde practiced this method to a larger extent as compared to the other communities. The

respondents reported that they see this measure as a sufficient way of reserving food than the others.

Also, as shown in Table 6, the other communities adopted this measure as a second option. The reason given by the respondents was that they practiced this strategy when they have virtually no food in their barns and have to resort to buying from the open market. This validates MOFA (2009) report that during severe food insecurity situations, women and men have to skip meals to feed their children. This tends to cause malnutrition among individual households in the area.

It was also observed that others rely on support received from other social networks such as family members, friends, group members, and other close associates. It was gathered that during such times when they are hard hit, extended family members, friends, and neighbors usually come to their aid. They contribute food items, money, and other items for them, especially those who are hard hit. It was noticed that this kind of support helps relieve the affected people from the initial shock of the flood events and binds them together as family or neighbors. This corroborates Yiran (2016) assertion that during natural disasters such as floods, other people come to the aid of the affected victims by offering their support to them. Other networks such as religious and social groupings (men and women associations) are operative in these communities and usually come to the aid of their members any time they are hit by the flood disaster by providing them food items, money, or labor. However, it was observed that these social benefits are dwindling in these communities as development is spreading to these areas. Again, it was noted that the help was insufficient to cover the loss. They, however, stated that it cushioned the initial shock.

Dry season farming is also practiced as a way of dealing with food insecurity in the area. The farming is done along the White Volta basin since there are few irrigational schemes in the area. Crops such as vegetables and other commercial crops were cultivated and later sold and part of the proceeds were used to buy food. Figure 5 depicts a pepper farm in Biringo which depicts a coping strategy which generates income for some households in the dry season.

Conclusion and Recommendation

The article concludes that several livelihood activities in the Bawku West District are climate dependent and are therefore vulnerable to changes in climatic variables especially flooding. The most affected area is the agricultural sector among subsistent farmers who form the bases upon which other livelihood activities survive.

The major contribution of this study is empirical in nature. The analysis revealed that although the area is confronted with multiple climatic hazards which affect the livelihood activities, particularly the agricultural

sector, floods contribute major significant destruction as the damage is always devastating and has the potential to make it difficult for the people to cope with the situation since their livelihoods other than farming is dependent on how well the agricultural sector is striving.

The article recommends that the rural economy should be diversified since the majority of the inhabitants obtain their main livelihoods from farming, which means that they will continue to be vulnerable to flooding. This, therefore, calls for the need for more support from the government and other Non-Governmental Organizations (NGOs) in the form of loans for smallholder farmers to venture into other non-farm small-scale businesses. Again, there should be capacity building through training on livelihood activities other than farming. This will enable the inhabitants to develop skills to engage in other income-generating activities which will raise income to acquire food during food insecurity. All these processes would bring about diversification of income and in the process would contribute to reducing the family's vulnerability to food insecurity.

Limitation of the study

Despite the intriguing findings of the study, certain obstacles militated against the research process. One such problem was the difficulty in the availability of data, both quantitative and qualitative, especially from government institutions (NADMO and MOFA) even though they were informed by way of sending letters. This hampered the study process since these institutions were key in the research process. Also, the financial constraint was a factor that hampered the study. The study involved traveling from one community to another since these villages are widely apart from one another. Research assistants were contracted to help in the data collection and they were given remuneration on daily basis as well as fueling their motorbikes and this was a challenge. More so, it was not easy translating the various terminologies in the study into the local language for the respondents to understand. However, these problems were overcome in the long run. For instance, with the problem of the availability of data, documents were obtained from these institutions which were of greater importance to the study.

In a future study of this kind, it will be important to obtain data high-quality data, particularly on the various livelihood activities by analyzing community by community instead of investigating the villages as a whole. This would bring forth the levels of livelihood loss as a result of the floods and how they cope in such situations.

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Author's Contributions

John Aloba Atubiga: Designed the study and wrote the background information. JAA performed the analysis and wrote the first draft of the manuscript.

Eric Donkor: Collected the data from the field. Author ED did the proof writing of the manuscript. All authors read and approved the final manuscript.

Ethics

This research maintained high integrity, transparency and quality throughout the study. While seeking information from the respondents, permission was obtained first before interrogating any respondent. In addition, informed consent of the respondents was sought first. The study maintained high level of anonymity and confidentiality of the respondents and their names did not appear anywhere whatsoever. Participation in the study by respondents were voluntary as they were not coerced to take part in the study.

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