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Assessing the Farmer's Perception on the Flood Risk Disasters in Alkaleri Local Government Area of Bauchi State

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Abstract: The farmer's perception of the flood risk disasters in Alkaleri Local Government Area of Bauchi State was assessed in this study. The impacts of flooding disasters, emergency response measures used by the farmers in flood disasters, prevention measures used by the farmers in flood disasters, and perception of farmers on flooding disasters within the study area were all considered. A total of three hundred and ninety-nine (399) structured questionnaires were administered to the respondents in the study area. The results obtained were analyzed using descriptive statistics. The result revealed that the impacts of flood disasters have caused damage to property, farmlands, crops, livelihood and income, and health issues. In regards to emergency response measures, more than 70% of the respondents disagreed with emergency response measures used by the farmers in flood disasters while on preventive measures used by the farmers in flood disasters, 60% of the respondents agreed that the construction of physical barriers (e.g., bunds, dykes, levees), adopting flood-resistant crop varieties or livestock breeds, implementing proper land management practices (e.g., contour ploughing, terracing), installing drainage systems (e.g., ditches, subsurface drains), developing early warning systems for floods. Furthermore, on the perception of farmers on flooding disasters, 70% of the respondents observed that flood disasters have a significant impact on farms, crop or livestock damage, livelihoods of farmers, long-term environmental damage, and vulnerability of farmers in the study area. It was concluded that Alkaleri LGA is prone to flood disasters due to a lack of emergency response and preventive measures. There is a need for orientation and enlightenment to the farmers and residents on emergency response and preventive measures to mitigate the effects of flood disasters once they occur. Similarly, there is inadequate involvement from the state and local government authorities to plan the management and provide preferred solutions to mitigate the effects of the flood when it occurs.

Keywords: Alkaleri Local Government Area; Bauchi State; Farmer's perception; Flood risk

Introduction

Floods are natural hydrological event characterized by the overflow of water onto land that is normally dry, resulting from various causes such as heavy rainfall, rapid snowmelt, storm surges, or the failure of water containment systems like dams or levees. There are one of the common disasters causing serious economic losses in various parts of the world (Ramakrishna et al., 2014). It has been described as a condition of complete or partial inundation of normally dry areas due to overflow of tidal, inland water or rapid accumulation of runoff (Jeb et al., 2008). The immediate effect of this natural disaster includes the destruction of crops, loss of livestock, damage to properties, food insecurity, and

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loss of lives among the affected communities (Alam, 2010; Islam et al., 2017; Okeleye et al., 2023). Furthermore, the hazard of flooding is an annual phenomenon that has displaced millions every year worldwide and claimed lives and properties (Bronstert, 2003). Globally, estimated damages of $70.72 billion were associated with hydrological (flood-related) disasters in 2011, thereby making floods the second most damaging catastrophe for that year while flood-related events have an annual average damage of $21.39 billion between 2001 and 2010 (Guha-Sapir et al., 2011).

Flooding is one of the most devastating natural disasters affecting agricultural productivity, livelihoods, and infrastructure in Nigeria, particularly in rural farming communities. In recent years, the frequency and intensity of floods have increased due to climate change, deforestation, poor urban planning, and inadequate drainage systems (Ali et al., 2016). Furthermore, Nigeria experienced several devastating floods as a result of climate change which has affected millions of people and resulted in fiscal losses amounting to billions of US dollars (NEMA, 2013).

Flooding and the means of addressing its challenges are issues of utmost concern (Obeta, 2014). Serious damages from flood incidences and the vulnerability of rural smallholder farmers due to low capital have perpetually impacted negatively on their welfare and their ability to employ diverse adaptation techniques hence mitigating subsequent shock events is usually left to the government (Otun et al., 2016). Jasper et al. (2012) and Etuonovbe (2011) confirm that Nigeria experiences floods every year, particularly flash floods and dam-related floods during the rainy season. Flood hazards occur naturally, but the extent of the impact, damage, and losses is due to human activity, according to Action Aid International (2006). Flooding currently poses a yearly threat to lives and property in many urban and rural areas of Nigeria. It is generally agreed that the most intense widespread and devastating flood that ever-affected Nigeria is the 2012 flood, which as usual occurred downstream of many dams located in dry and semi-humid areas. It is strange, therefore, that all the dam-related occurrences of floods in Nigeria, within the last decade, particularly those of 2012 are being explained as the consequences of climate change that have brought about excessive rainfall (Olofin, 2008).

However, diminishing agricultural output in Nigeria is undoubtedly concerning and poses a significant challenge to the government, which must feed a population of around 200 million. Agronomic approaches and farm strategies are already being adapted (CEC, 2009), as noted by Adedapo et al. (2020). To fulfill Nigeria's expanding food demand, agricultural practices and output must be modified to cope with flooding. Evidence shows that farming systems and farming technologies within the Nigerian regions affected by flooding have been changing in response to the effects of flooding (Adebayo, 2014). The consequence of this is the reduction of agricultural productivity, which in turn would ultimately have a significant effect on smallholder farmers' food security, income, and general well-being (Hertel et al., 2010). Additionally, too many weather conditions such as thunderstorms, heavy winds, and floods damage farmland and can cause crop failure among small-scale farmers (Ajao et al., 2011). In the past years (2012 to be specific) there have been incidences of heavy flooding in various parts of Nigeria that held the lives of the rural farmers to ransom and their assets, income, production activities, transport, and health were automatically exposed to negative impacts. Following the flooding incident, the government, in collaboration with Non-Governmental Organizations (NGOs), came to the aid of rural smallholder farmers in need. According to Ajibade et al. (2015), Nigerian farmers are involved in agriculture on a subsistence level, with the majority of them being small-scale farmers (holders). It is even more interesting to note that the majority of these farmers do not actively pursue insurance policies, which would provide some sort of safety net in the event of adverse and unexpected circumstances. This will make them fall back upon nothing when there are unforeseen circumstances like floods.

Considerate damages from flood incidences and the vulnerability of rural smallholder farmers due to low capital have perpetually impacted negatively on their welfare and their ability to employ diverse adaptation techniques hence mitigating subsequent shock events is usually left to the government (Otun et al., 2016). Floods are the most common and severe catastrophes in Alkaleri LGA, affecting thousands of people and generating economic damage of millions of naira each year. Flood catastrophes pose a significant threat to agricultural productivity in the Alkaleri LGA. The implication is that a flood's detrimental impact on agriculture will automatically impair food production, food prices, and farmer income, thus disrupting food security (Bandara et al., 2022; Haq, 2014). Alkaleri LGA is mostly an agrarian community that is prone to flooding, with agriculture providing a living for the vast majority of small-scale households. Despite government efforts to improve flood risk management systems in Bauchi State and Alkaleri LGA in particular, floods have become the most severe natural disaster, causing significant tangible impacts and economic damage/losses by damaging houses and infrastructure and destroying agricultural lands (Alhassan, 2021).

Method

Location and Size

Alkaleri is a Local Government Area of Bauchi State, Nigeria. Its headquarters are in the town of Alkaleri (or Alkalere) on the A345 highway in the northern part of the Local Government Area. It has an area of 5,918 km2 and a population of 329,424 at the 2006 census. The predominant ethnic group in the area are the Fulani with some Kanuri, Dugurawa, Guruntawa and Labur "Jaku" people present. The districts of the local government are Pali, Duguri, and Gwana. Major towns and villages of the local government like Fanti, Gar, Gokaru, Guma, Gwaram etc. including the local government headquarters, Alkaleri are located in the Pali district.

Figure 1. Map of Bauchi State showing the study area Alkaleri Local Government

Climate

The rainy season in Alkaleri is oppressive and cloudy, the dry season is partly cloudy, and it's hot all year round. The average annual temperature fluctuates between 59 °F and 101 °F, rarely falling below 54 °F or rising over 105 °F With an average daily high temperature of 98 °F, the hot season lasts for 2.4 months, from February 24 to May 4. With an average high of 100 °F and low of 76 °F, April is the hottest month of the year in Alkaleri. The cool season lasts for 2.7 months, from July 11 to October 3, with an average daily high temperature below 88°F. The coldest month of the year in Alkaleri is January, with an average low of 60°F.

Geology

The geology of Alkaleri Local Government in Bauchi State, Nigeria, is characterized by the Kerri Kerri Formation, which is part of the Gongola Basin. This formation is composed of fine-grained sandstones, clays, and silts, and is capped by laterite and dark red sandstones. Additionally, a significant kaolin deposit, formed by the decomposition of igneous rocks, is found in Alkaleri, according to Research Gate.

Key Geological Features of Alkaleri

Kerri Kerri Formation: the dominant geological unit is the Kerri Kerri Formation, a sequence of sedimentary rocks including sandstones, clays, and silts.

Laterite and Red Sandstones: The Kerri Kerri Formation is capped by laterite and dark red sandstones.

Kaolin Deposit: A kaolin deposit of considerable economic importance is located in Alkaleri.

Sedimentary Origin: The kaolin deposit is likely a sedimentary deposit formed by the decomposition of igneous rocks, either through in situ kaolinization or by transported material.

Undulating Terrain: The area exhibits a highly undulating terrain with hills and ridges in the northern part.

Soil and Vegetation

Alkaleri has light-textured and sandy soils that drain rapidly with low moisture retention capacity which may lead to the leaching of plant nutrients. The alluvial deposits of fine-coarse sands, silts, and clays are found in layers that form the floodplains along the lower course of stream channels. The soils are formed from the intensive weathering of the Basement Complex rocks (Orazulike, 1992). There is extensive leaching, low plant nutrients, and susceptibility to water erosion that has left scars on gullies in the area. The inherently infertile soils of the tropics become degraded chemically and organically when utilized. Soil nutrients except for aluminium and iron decrease substantially, this gives the ferric red soils or the Kerri-Kerri formation that have lost the topsoil organic matter (Amos et al., 2014). This is attributed to traditional agricultural practices such as slash and burn over the years that have made the soils susceptible to soil erosion reduced the water holding capacity and increased surface water flow leading to pluvial flooding. These soils that have been subjected to degradation are mostly; nitosols, leptosols, cambisols, or luvisols (Ikusemoran et al., 2018). The vegetation is the Sudan savanna type which has replaced the Guinea savannah of the 1970s due to anthropogenic activities and climate change with many tree species becoming extinct (Mbaya, 2016). It is characterized by; shrubs, scattered trees, and grasses. The predominant tree species include the locust bean tree (Parkia clappertoniana), Baobab (Adansonia digitata), Tamarind (Tamarindus indica), Date palm (Phonis doctylifera} and Neem (Azadirachta indica}. Vegetation and soils have mutual as well as reciprocal relationships through which soils support the growth of plant species by providing necessary nutrients and moisture to the plants and also serving as a medium to which plants anchor their roots. On the other way, vegetation usually protects the soil from undergoing degradation and desertification by stabilizing the soil, it also helps in

maintaining the water and nutrient cycling and minimizing water and wind erosion. The use of fuelwood as the primary source of energy for cooking has become a major issue as the exploitation of trees increases year in and year out which in turn affects the natural vegetation cover thereby contributing to global warming and climate change. The majority of households in Nigeria use energy from dirty sources such as fuelwood and charcoal (Maina et al., 2019).

Population of the Study

Alkaleri Local Government Area is characterized by a dense population. By the 1991 National Population Census, it had a population of 257,871 people with a population growth rate of 3.9% (National Population Commission, 1991) which when projected with Newman's (2001) formula to 2025 stood at 632815. This is the estimated population of Alkaleri inhabitants with the area hosting members of diverse ethnic affiliations. It is characterized by mixed ethnolinguistic groups such as Fulbe, Kanuri, Dugarawa and Hausa, Labur, Jukun and minorities such as Igbo, Yoruba. The Hausa language is commonly spoken in the LGA while the religion of Islam is widely practiced in the area.

Socioeconomic Activities

Agriculture forms the backbone of Alkaleri LGA's economy, as it does in much of Bauchi State. The fertile land and favourable climate conditions make the area suitable for cultivating a variety of crops, including maize, millet, groundnuts, and soybeans (Monday et al., 2013). Additionally, Alkaleri LGA is known for its robust livestock farming, with cattle, goats, and poultry being some of the primary livestock rose. The LGA also serves as a trading hub for neighbouring communities due to its strategic location. The LGA hosts several markets and trading centers where both agricultural and non-agricultural products are bought and sold.

The economic landscape of Alkaleri Local Government Area (LGA) in Bauchi State revolves around agriculture, and livestock farming supported by fertile land and favourable climatic conditions. Additionally, Akaleri LGA's role as a trading hub and the convergence of diverse communities in markets could increase interactions and contribute to conflicts.

Reconnaissance Survey

A reconnaissance survey will be carried out to be well acquainted with the study area in terms of geographical setting, and the socio-cultural characteristics of the inhabitants. During the survey, visitation of some of the community leaders in the study area will carry out to seek permission to carry out the study. Also, a review of multiple policy documents from the Federal and State Ministry of Agriculture and Livestock Service Department, NEMA and SEMA.

Types and Sources of Data

The socio-demographic characteristics of the respondents, the impacts of flooding, the emergency response measures; the future prevention measures. The perception of farmers to flood disasters in the study area.

Source of Data

The sources of data for this study include both primary and secondary sources. A structured open-ended and close-ended questionnaire will be used to elicit data from the farmers on the socio-cultural and demographic characteristics, impacts of flooding, emergency response measures, future preventive measures, and the perception of farmers to flood disasters in the study area, while oral interview will be conducted with farmers who could not read or write to get credible information that will be used for the study.

Sample Size and Sampling Techniques

The study area as of 1991 had a population of 257,871 with a growth rate of 3.9%. The Newman formula was used to project the population to 632815 (2025). To determine the total number of questionnaires to be administered to each respondent. Therefore, according to Yamane (1967), 399 copies of the questionnaire will be administered to farmers proportionately to the population of each community under Alkaleri LGA. To obtain the proportion of questionnaire to be administered to each ward, the simple arithmetic formula for proportion determination will be used to determine the number of respondents to be selected from each ward.

$$\text{Ward Sample Size } (n_i) = \frac{Ward\ Population(P_i)}{Total\ Population\ (N)} \quad (1)$$

The population and sample size for each ward (community) is presented in Table 1.

Table 1. Sample Size of the Study

Wards	Population 1991	Population 2025 Projected	Sample Size
Pali	23,693	48,569	39
Gar	25,336	51,937	44
Yalo	24,331	49,878	41
Gwaram	27,354	56,073	51
Yuli/Lim	27,331	56,029	51
Futuk	23,121	47,398	37
Alkaleri	80,813	165,665	56
Maimadi	25,892	53,078	46
Total	257,871	632,815	399

The purposive sample method was used to select some communities from the local government area affected in the study area. Similarly, the purposive sampling method will be used to select major communities and a questionnaire will be distributed in the study area focusing on the places with data available for the study. The reason for this choice of the communities in these local government areas is that amongst all other local governments, these communities in the local government area were among the top communities in the local government areas that had the worst record incident cases of flood in the states. A Systematic random sampling technique was also used to select the respondents in the study area's various wards (community). The procedure involves selecting observations in a regular sequence from an initial purposively determined starting point (Walford, 2011). Therefore, the study team was purposively selecting the first household which will be randomly selected followed by every third house in the area. Where the household head declines access to members of the study team or is absent, the study team moves to the next house until the target population sample is reached. This sampling technique was adopted to eliminate or reduce any possible bias and clustered responses for the generalization of the study findings.

Techniques of Data Analysis

The data will be obtained and analysed base on the objectives as follows:

Objective 1

To determine the impacts of flooding in the study area. To determine the flood risking in the study area, data acquired through a questionnaire and analysed using descriptive statistics, and the result will be presented using descriptive statistics such as frequency distribution, percentage, table, and charts.

Objective 2

To identify the emergency response measures used by the farmers in the study area. Data for this objective will be obtained through oral interviews and a structured questionnaire. The Data will be analysed using descriptive statistics such as frequency distribution, percentage, tables, and charts.

Objective 3

To identify the future prevention measures used by the farmers in the study area. Data for this objective will be obtained through oral interviews and a structured questionnaire. The data will be analyzed using descriptive statistics such as frequency distribution, percentages, tables, and charts.

Objective 4

To assess the perception of farmers of flooding disasters in the study area. Data for this objective will be obtained through a structured questionnaire. The data will be analyzed using descriptive statistics such as frequency distribution, percentages, tables, and charts.

Result and Discussion

Result

Data Analysis

The total number of questionnaires disbursed were 405 and 399 (98.5%) were returned. All the analysis in this chapter was based on frequency and percentage.

Sex of Respondents

The term sex of respondents refers to the gender identity of individuals who participate in a survey, study questionnaire, or any data collection process. It is used to categorize respondents into male or female categories based on their self-identified gender.

Table 2. Sex of the Respondents

Sex	Frequency	Percentage
Male	331	83%
Female	68	17%
Total	399	100%

Table 2 shows that 83% of the respondents were males while 17% were females. This implies that a significant proportion of the respondents were males. This could be attributed to gender roles and in Northern Nigeria, traditional gender roles and norms may lead to different levels of participation in numerous activities. Men may be more encouraged or expected to take on leadership roles and serve as the breadwinners of their families. This often implies that men are often the primary breadwinners in the study area, so when conflict disrupts farming or herding activities, it can have severe economic consequences for men. Loss of crops, livestock, and livelihoods can disproportionately affect male family members. This can be attributed to the fact that the heads of households in the study area are typically men due to Hausa/Fulani cultural traditions in which females are mostly dependent on men for household needs and wants. The head of the house provides for his family; however, females are responsible for taking children and other household activities. In the same line, Kiyawa et al. (2017) found more male respondents in the Kano Metropolis. This is because the majority of the households in the study areas have similar characteristics in terms of culture and religion and also geographical location in the northern part of Nigeria.

Age, Level of Education, Occupation and Marital Status

Table 3 shows the age, level of education, occupation, and marital status of respondents in the study area.

Table 3. Age, Education, Occupation, and Marital Status of Respondents

Age	Frequency	Percentage
18-30	79	19.7
31-43	110	27.5
44-56	168	42.1
57 and above	43	10.7
Total	399	100
Level of Education		
No formal	96	24
Qur'anic	5	1.3
Primary	176	44.2
Secondary	69	17.2
Tertiary	53	13.3
Total	399	100
Occupation		
Civil service	18	4.5
Farming	268	67.1
Trading	41	10.2
Artisan	73	18.2
Total	399	100
Marital Status		
Single	101	25.3
Married	226	56.7
Divorced/Separated	19	4.7
Widow/Widower	53	13.3
Total	399	100
Duration		
1-6 years	44	11
7-14 years	56	14
15-21 years	60	15
22-28 years	96	24
29 above	143	36
Total	399	100

The table 3 reveals that 19.7% of the respondents were between the ages of 18-30 years, 27.5% were between the ages of 31–43 years, 42.1% of the respondents were between the ages of 44–56 years and the remaining 10.7% were 57 years above. The present study disagrees with that of Yongolo et al. (2023) in Tanzania whose study found the majority of respondents (65.3%) were between the ages of 20 to 35 years indicating that the majority of the people in the study area were youth. On the educational attainment of respondents, 24.0% had no formal education, 1.3% had Qur'anic education, 44.2% had attended primary school, 17.2% attended secondary school and 13.3% attained tertiary education. On the marital status of the respondents, 25.3% of respondents were single. While the majority 56.7% were married, 4.7% were either divorced or separated from their spouses while 13.3 % lost their husbands or wives. The present study is in agreement with the findings of Akeh et al. (2023), who found that the majority of their respondents (66.76%) were married in Maiduguri. This similarity can be attributed to the fact that both studies focused on household heads in their respective study areas. Regarding how long they have been living and farming in the area, a total of (11%) of the respondents said 1-6 years, (14%) of the respondents said 7-14 years, (15%) of the respondents said 15-21 years, (24%) of the respondents said 22-28 years, while 36% majority of the respondents said 29 years and above. Reasons for such residency duration could be as a result most land is inherited from their four fathers, and they have been staying in the area throughout their lives. Analysing the distribution of residency duration can provide valuable insights into the demographic characteristics and dynamics of the study area, which can be useful for various purposes, including community planning, resource allocation, and policy development.

Results of Research Questions

Research question one

How do farmers in the study area perceive flooding?

Table 4 shows that according to the perception of farmers to flood disaster in the study area, 72% of the respondents strongly agreed that flood disaster has a significant impact on their farm. 12.8% agreed, 10.3 were undecided and 1.4% disagreed and 3.2% strongly disagreed. This can result in food insecurity, poverty, and increased economic vulnerability. Consequently, this destruction of crops and livestock can lead to food shortages and increased food prices in affected regions. This can result in food insecurity and malnutrition, particularly among vulnerable populations. On whether flood disasters have caused financial losses to farmers, 70.3% of the respondents strongly agreed, 20.4% agreed, and 9.3% undecided while 0% disagreed and strongly disagreed respectively. This loss of assets has a severe economic impact on farmers, who depend on their farming activities for income and sustenance. Also, floods have disrupted local and regional markets. Farmers face challenges accessing markets to sell their products due to insecurity or transportation difficulties. This can also result in income losses and reduced economic activity. On whether flood disasters have resulted in crop or livestock damage on farmlands, 62.5% of the respondents strongly agreed, 25.2% agreed, 1.6% were undecided 4.4% disagreed and 6.3% strongly disagreed. This can result in food insecurity, poverty, and increased economic vulnerability. Consequently, this destruction of crops and livestock has also led to food shortages and increased food prices in the study area. Furthermore, 75.3% of the respondents strongly agreed while 20.6% agreed that flooding disasters have disrupted farming operations in the study area. This is

because farmers rely on agriculture for their livelihoods. Also, floods often disrupt agricultural activities such as crop cultivation and livestock rearing which has led to a reduction in agricultural production and income. In addition, regarding whether flood disasters have affected the livelihoods of farmers in the study area, 80.2% strongly agreed with the opinion, 17.7 agreed and 2.1 were undecided, while 0% disagreed and strongly disagreed respectively. Furthermore, on how flood disasters have caused long-term environmental damage in the study area, 65.6% of the respondents opined that flood disasters have caused long-term environmental damage which leads to poverty and unemployment.

Table 4. Perception of Farmers to Flooding Disasters

Categories	SA (%)	A (%)	N (%)	D (%)	SD (%)
Flooding disasters have had a significant impact on my farm.	72.3	12.8	10.3	1.4	3.2
Flooding disasters have caused financial losses for me as a farmer.	70.3	20.4	9.3	0	0
Flooding disasters have resulted in crop or livestock damage on my farm.	62.5	25.2	1.6	4.4	6.3
Flooding disasters have disrupted my farming operations.	75.3	20.6	4.1	0	0
Flooding disasters have affected the livelihoods of farmers in the study area.	80.2	17.7	2.1	0	0
Flooding disasters have caused long-term environmental damage in the study area.	65.6	25.2	9.2	0	0
Flooding disasters have increased the vulnerability of farmers in the study area.	74.4	10.3	8.4	2.7	4.2

Research Question Two

What are the impacts of flood disasters in the study area?

Table 5 show the evidence that when respondents were asked if they had experienced flooding in the study area, 70% said yes while 30% of respondents said no. The reason is that most of the farmers agreed that loss of farmland and properties is the major effect of flood in the study area. On how many times have the respondents experienced flooding in the past 5 years, 40% of the respondents said they had experienced flood for a period of 2 to 3 years in the study area while 10% of the respondents had never experienced the flood risking on their farmland. In regard to damage caused by floods which lead to property in the study area, 87% said yes floods have damaged a lot of properties while 13% of respondents said no. On flood effect on livelihood or income in the study area, 60% of the respondents said yes, concerning the effects of the flood on livelihood and income while 40% said no. On whether they have experienced the loss of crops or agricultural produce due to flooding, 74% of the respondents said yes, they have lost crops and agricultural produce due to flood while 26% said they have not lost any crops or agricultural produce. Lastly, concerning whether family members have faced any health issues as a result of flooding, 56% of the respondents said yes, they have faced health issues as a result of flooding while 44% said no they have not faced any health issues during flooding.

Table 5. Impacts of Flooding Disaster in the Study Area

Variables	Frequencies	Percentages
Have you experienced flooding in your study area?		
Yes	280	70
No	119	30
Total	399	100
If yes, how many times have you experienced flooding in the past 5 years?		
1-2 years	120	30
2-3 years	161	40
3-4 years	80	20
4 years above	38	10
Total	399	100
Has flooding caused damage to your property?		
Yes	349	87
No	50	13
Total	399	100
Has flooding affected your livelihood or income?		
Yes	241	60
No	158	40
Total	399	100
Have you experienced loss of crops or agricultural produce due to flooding?		
Yes	295	74
No	104	26
Total	399	100

Variables	Frequencies	Percentages
Have you or your family members faced any health issues as a result of flooding?		
Yes	225	56
No	174	44
Total	399	100

Research Question Three

What are the emergency response measures the farmers use during flooding disasters in the study area?

From table 6, the respondents are aware of potential emergencies or disasters that will affect their farmlands at the rate of 30% of them said yes while 70% of respondents said no. Most of the respondents are not aware of potential emergencies or disasters that will affect their farmland. Regarding whether they have an emergency response plan in place for their farm, 60% of the respondents said no emergency response plan while 40% said yes, they have an emergency response plan in place for their farm. If they have an emergency response plan, what is the emergency response plan? 60% were through evacuation procedures, 25% were through communication protocols and the remaining 15% were through emergency supplies. On how they received emergency alerts or warnings in the area, 20% of the respondents said were through mobile phones while 30% were through radio, and the majority, 50% were through community notifications. On whether they have a designated communication plan with other farmers in the area during emergencies, 60% of the respondents said yes while 40% said no. On insurance coverage for farms against natural disasters or emergencies, 24% of the respondents said yes, they have insurance while 76% said they don't have insurance coverage for farms against natural disasters or emergencies within the study area. Is there any training or education received on emergency preparedness and response measures for farms, 26% said yes while 74% of the respondents said no.

Table 6. Emergency Response Measures Used by Farmers during Flooding Disaster

Variables	Frequencies	Percentages
Are you aware of potential emergencies or disasters that can affect your farm?		
Yes	119	30
No	280	70
Total	399	100
Do you have an emergency response plan in place for your farm?		
Yes	159	40
No	241	60
Total	399	100
If yes, please briefly describe your emergency response plan		
Evacuation procedures	240	60
Communication protocols	99	25
Emergency supplies	60	15
Total	399	100
How do you receive emergency alerts or warnings in your area?		
Mobile phone	80	20
Radio	120	30
Community notifications	199	50
Total	399	100
Do you have a designated communication plan with other farmers in your area during emergencies?		
Yes	241	60
No	158	40
Total	399	100
Do you have insurance coverage for your farm against natural disasters or emergencies?		
Yes	94	24
No	305	76
Total	399	100
Have you received any training or education on emergency preparedness and response measures for farms?		
Yes	104	26
No	295	74
Total	399	100

Research Question Four

What are the future prevention measures used by the farmers in the study area?

Table 7 shows that the future prevention measures used by the farmers in flood disasters were identified in the study area and the result is presented as thus: when respondents were asked whether the construction of physical barriers (e.g., bunds, dikes, levees) by farmers has been a future prevention measure used by the farmers in a flood disaster in the study area, 50.0% of the respondents strongly agreed that construction of physical barriers has been the major prevention measures used by the farmers in flood disaster, 20.1% of the respondents agreed with the opinion, 12.2% disagreed while 14.7% of the respondents strongly disagreed and the remaining 4.7% were undecided. On implementation of proper land management practices (e.g., contour ploughing, terracing) in the study area, the respondents show that 36.0% of the respondents strongly disagreed with the opinion, 25.6% disagreed, 10.5% agreed while 19.5% strongly agreed and 18.4% remained undecided. This means that the majority of the respondents disagreed with the implementation of proper land management practices in the study area. Furthermore, on the installation of drainage systems (e.g., ditches, subsurface drains) in the study area, 60.2% strongly disagreed, 30.1% disagreed, and 9.1% undecided while 0% strongly agreed and agreed respectively. This implies that there is no good drainage system within the study area. In addition, on whether the adoption of flood-resistant crop varieties or livestock breeds has been the future prevention measures used by the farmers in flood disasters, 27.2% of the respondents strongly agreed, 22.6% agreed, 14.2% were undecided and 15.6% disagreed while 20.4% strongly disagreed. On the question of whether there are developed early warning systems for floods in the study area, 42.6% strongly disagreed with the opinion, 20.4% disagreed, 8.3% were undecided 12.9% agreed and 15.6% strongly agreed. On the rate at which flood disasters have increased the vulnerability of farmers in the study area, 67.2% strongly agreed with the opinion, 28.6% agreed, 4.2% undecided and 0% agreed and strongly agreed respectively.

Table 7. Future Prevention Measures Used by the Farmers in Flood Disaster

Effect	SA	A	U	D	SD
Construction of physical barriers (e.g., bunds, dikes, levees)	50.0	20.1	4.7	12.2	13.0
Implementing proper land management practices (e.g., contour ploughing, terracing)	19.5	10.5	8.4	25.6	36.0
Installing drainage systems (e.g., ditches, subsurface drains):	0	0	9.7	30.1	60.2
Adopting flood-resistant crop varieties or livestock breeds.	27.2	22.6	14.2	15.6	20.4
Developing early warning systems for floods.	15.8	12.9	8.3	20.4	42.6
Flooding disasters have increased the vulnerability of farmers in the study area.	67.2	28.6	4.2	0	0

Discussion

This research work is aimed at assessing the farmer's perception on the flood risk disasters in Alkaleri Local government area of Bauchi State. To achieve this aim, the following research questions were answered.

The research question on the perception of farmers on flooding disaster: according to the perception of farmers to flood disaster in the study area, 72% of the respondents strongly agreed that flood disaster has a significant impact on their farm. 12.8% agreed, 10.3 were undecided and 1.4% disagreed and 3.2% strongly disagreed. This can result in food insecurity, poverty, and increased economic vulnerability. Consequently, this destruction of crops and livestock can lead to food shortages and increased food prices in affected regions. This can result in food insecurity and malnutrition, particularly among vulnerable populations. On whether flood disasters have caused financial losses to farmers, 70.3% of the respondents strongly agreed, 20.4% agreed, and 9.3% undecided while 0% disagreed and strongly disagreed respectively. This loss of assets has a severe economic impact on farmers, who depend on their farming activities for income and sustenance. Also, floods have disrupted local and regional markets. Farmers face challenges accessing markets to sell their products due to insecurity or transportation difficulties. This can also result in income losses and reduced economic activity. On whether flood disasters have resulted in crop or livestock damage on farmlands, 62.5% of the respondents strongly agreed, 25.2% agreed, 1.6% were undecided 4.4% disagreed and 6.3% strongly disagreed. This can result in food insecurity, poverty, and increased economic vulnerability. Consequently, this destruction of crops and livestock has also led to food shortages and increased food prices in the study area. Furthermore, 75.3% of the respondents strongly agreed while 20.6% agreed that flooding disasters have disrupted farming operations in the study area. This is because farmers rely on agriculture for their livelihoods. Also, floods often disrupt agricultural activities such as crop cultivation and livestock rearing which has led to a reduction in agricultural production and income. In addition, regarding whether flood disasters have affected the livelihoods of farmers in the study area, 80.2% strongly agreed with the opinion, 17.7 agreed and 2.1 were undecided, while 0% disagreed and strongly disagreed respectively. Furthermore, on how flood

disasters have caused long-term environmental damage in the study area, 65.6% of the respondents opined that flood disasters have caused long-term environmental damage which leads to poverty and unemployment. This corroborates the findings of Adelakun et al. (2015) who asserted that poverty and unemployment were the result of long-term environmental damage to farmers in Oyo State Nigeria. Poverty and unemployment can make communities more economically vulnerable. When livelihoods are at stake, any disruption by flood can cause crop destruction or loss of livestock due to flood severe that leads to economic consequences. This can lead to heightened tensions as people become increasingly desperate to protect their means of survival. On the rate at which flood disasters have increased the vulnerability of farmers in the study area, 74.4% strongly agreed with the opinion, 10.3% agreed, 8.4% were undecided 2.7% agreed and 4.2% strongly agreed. This is following the findings of Idoko (2016) whose results showed that Dagiri community areas lying along the banks of River Usman where lots of farming activities take place are most vulnerable to flood disasters. The continuous violation of land use planning, population explosion, and poor-quality materials used in the construction of buildings increase the towns' vulnerability to flood hazards. In such contexts, adaptation measures should be considered thoroughly to increase resilience and adaptive capacity, reduce vulnerability at the farm level, and secure rural livelihoods (Adger et al., 2009; Gbetibouo, 2009).

Research question two: what are the impacts of flood disasters in the study area? When respondents were asked if they had experienced flooding in the study area, 70% said yes while 30% of respondents said no. The reason is that most of the farmers agreed that loss of farmland and properties is the major effect of flood in the study area. In collaboration, Jonathan et al. (2020) revealed that the majority of the respondents revealed that about 45% and 62% of the farming households who experienced flood and farming households, who did not, were food secure respectively. On how many times have the respondents experienced flooding in the past 5 years, 40% of the respondents said they had experienced flood for a period of 2 to 3 years in the study area while 10% of the respondents had never experienced the flood risking on their farmland. In regard to damage caused by floods which lead to property in the study area, 87% said yes floods have damaged a lot of properties while 13% of respondents said no. This is in line with the findings of Olagun (2004), who found that flooding is caused by rainfall, snow, melting ice, and hurricanes. He further stated that the common features of flooding are the destruction of lives and properties, and direct loss includes those which result from loss of lives and destruction of properties while indirect damage is manifested from the breakdown of human activities during floods. On flood effect on livelihood or income in the study area, 60% of the respondents said yes, concerning the effects of the flood on livelihood and income while 40% said no. The finding is contrary to that of Guha-Sapir et al. (2012) whose findings revealed the estimated damages of $70.72 billion were associated with hydrological (flood-related) disasters in 2011, thereby making floods the second most damaging catastrophe for that year while flood-related events an annual average damage of $21.39 billion between 2001 and 2010. Again, the immediate effect of natural disasters includes the destruction of crops, loss of livestock, damage to properties, food insecurity, and loss of lives among the affected communities (Alam et al., 2010; Islam et al., 2017; Okeleye et al., 2016). On whether they have experienced the loss of crops or agricultural produce due to flooding, 74% of the respondents said yes, they have lost crops and agricultural produce due to flood while 26% said they have not lost any crops or agricultural produce. Lastly, concerning whether family members have faced any health issues as a result of flooding, 56% of the respondents said yes, they have faced health issues as a result of flooding while 44% said no they have not faced any health issues during flooding.

Research question three: What are the emergency response measures the farmers use during flooding disasters in the study area? Respondents are aware of potential emergencies or disasters that will affect their farmlands at the rate of 30% of them said yes while 70% of respondents said no. Most of the respondents are not aware of potential emergencies or disasters that will affect their farmland. Regarding whether they have an emergency response plan in place for their farm, 60% of the respondents said no emergency response plan while 40% said yes, they have an emergency response plan in place for their farm. If they have an emergency response plan, what is the emergency response plan? 60% were through evacuation procedures, 25% were through communication protocols and the remaining 15% were through emergency supplies. On how they received emergency alerts or warnings in the area, 20% of the respondents said were through mobile phones while 30% were through radio, and the majority, 50% were through community notifications. On whether they have a designated communication plan with other farmers in the area during emergencies, 60% of the respondents said yes while 40% said no. On insurance coverage for farms against natural disasters or emergencies, 24% of the respondents said yes, they have insurance while 76% said they don't have insurance coverage for farms against natural disasters or emergencies within the study area. Is there any training or education received on emergency preparedness and response measures for

farms, 26% said yes while 74% of the respondents said no. These corroborate the findings of Fabiyi et al. (2013) who stated that Ilajes, Itshekiris, and Ijaw tribes who live in coastal rural communities discovered that the communities have undocumented knowledge of local meteorologist which are based on observation and traditional practices and belief systems. This local knowledge helps them to predict flooding on a seasonal and long-term basis.

Research question four: What are the future prevention measures used by the farmers in the study area? respondents were asked whether the construction of physical barriers (e.g., bunds, dikes, levees) by farmers has been a future prevention measure used by the farmers in a flood disaster in the study area, 50.0% of the respondents strongly agreed that construction of physical barriers has been the major prevention measures used by the farmers in flood disaster, 20.1% of the respondents agreed with the opinion, 12.2% disagreed while 14.7% of the respondents strongly disagreed and the remaining 4.7% were undecided. This agrees with the findings of Umoh (2013), who found out that in the states of Akwa Ibom, Ondo, and Rivers states, it was observed that land management practice particularly the use of mounds was commonly used by farmers to mitigate the effects of flooding. A total of 30% of male farmers and 39% of female farmers adopt this method. On implementation of proper land management practices (e.g., contour ploughing, terracing) in the study area, the respondents show that 36.0% of the respondents strongly disagreed with the opinion, 25.6% disagreed, 10.5% agreed while 19.5% strongly agreed and 18.4% remained undecided. This means that the majority of the respondents disagreed with the implementation of proper land management practices in the study area. Furthermore, on the installation of drainage systems (e.g., ditches, subsurface drains) in the study area, 60.2% strongly disagreed, 30.1% disagreed, and 9.1% undecided while 0% strongly agreed and agreed respectively. This implies that there is no good drainage system within the study area. In addition, on whether the adoption of flood-resistant crop varieties or livestock breeds has been the future prevention measures used by the farmers in flood disasters, 27.2% of the respondents strongly agreed, 22.6% agreed, 14.2% were undecided and 15.6% disagreed while 20.4% strongly disagreed. This is similar to the findings of Umoh (2013) who revealed that in the wetland regions of Ondo state, farmers plant flood-resistant or flood-tolerant varieties of crops, also farmers have diversified their income-earning activities to cope with environmental hazards. On the question of whether there are developed early warning systems for floods in the study area, 42.6% strongly disagreed with the opinion, 20.4% disagreed, 8.3% were undecided 12.9% agreed and 15.6% strongly agreed. This result follows Anugwara et al. (2013) who stated that the Kogi state government advised residents of communities along the river banks to relocate sequel to a warning that water would be released from Kainji and Jebba Dams. The government also called on the people of the state to clear their drainages to allow for the free flow of water and to avoid flooding. On the rate at which flood disasters have increased the vulnerability of farmers in the study area, 67.2% strongly agreed with the opinion, 28.6% agreed, 4.2% undecided and 0% agreed and strongly agreed respectively. This is following the findings of Idoko (2016) whose results showed that Dagiri Community areas lying along the banks of River Usman where lots of farming activities take place are most vulnerable to flood disasters. The continuous violation of land use planning, population explosion, and poor-quality materials used in the construction of buildings increase the towns' vulnerability to flood hazards.

Conclusion

It is important to note that the impacts of flood disasters have caused damage to property, farmlands, crops, livelihood or income, agricultural produce, and health of respondents in the study area. This is due to poor environmental planning. The study confirmed that emergency response measures used by the farmers in flood disasters in terms of awareness for potential emergencies or disaster effects, emergency response plans, emergency alerts or warnings systems, insurance coverage against natural disasters, and training/education on emergency preparedness are poor which exposed the community to any disaster when it occurs. Additionally, future preventive measures used by the farmers in flood disasters such as the construction of physical barriers (e.g., bunds, dikes, levees), adopting flood-resistant crop varieties or livestock breeds, implementing proper land management practices (e.g., contour ploughing, terracing), installing drainage systems (e.g., ditches, subsurface drains), developing early warning systems for floods and Afforestation measures for the long-term environmental plan in the study area were fair and there is need for improvement. Lastly, concerning the perception of farmers on flooding disasters, farms have suffered financial losses, crop or livestock damage, long-term environmental damage, and livelihood vulnerability to flood disasters in the study area. It is concluded that while most farmers are aware of flood risks, many lack adequate preparedness measures due to limited resources, insufficient government support, and reliance on traditional coping mechanisms. Strengthening flood mitigation policies, providing

climate-resilient farming inputs, and constructing flood control infrastructure (e.g., embankments, drainage systems) are essential for long-term resilience.

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Conceptualization, M.A.A., methodology, M.A.A., validation, R.A.B; formal analysis, H.S.; investigations. M.A.A.; resources, R.A.B.; data curation, H.S.: writing original draft preparation, M.A.A.; writing review and editing, M.A.A: visualization, R.A.B. All authors have read and agreed to the published version of the manuscript.

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