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Assessment of the Effect of Flood Disaster on Food Security In Bade Local Government Area, Yobe State, Nigeria

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ABSTRACT

Bade Local Government in Yobe State, Nigeria, has experienced an increase in the frequency and severity of seasonal floods, threatening the livelihoods of local farmers. These floods disrupt agricultural activities and exacerbate regional food insecurity. This study aimed to describe the socio-economic characteristics of respondents in the study area, identify the types of crops most vulnerable to flooding, and assess the impact of flooding on farmers' income, availability of livestock feed, livestock health and productivity, as well as nutritional quality of crops and livestock. It also examined the mitigation strategies employed by rural households in the study area. Data were collected from 171 farming households using a structured questionnaire and analyzed using descriptive statistics and regression analysis. Findings revealed that the majority of household heads were between the ages of 40 and 59 years (71.93%), while 21.64% were between 20 and 39 years old. The lowest percentage (6.43%) comprised respondents aged 60 years and above. The study also found that the highest source of capital was personal savings (99.42%), with only 0.58% depending on bank loans. Millet (99%) was the most vulnerable crop to flood damage, followed by beans (95%), pepper (92%), and sesame (79%). Approximately 87% of the respondents reported that flooding affected their income and reduced their ability to purchase quality food, while 13% (22 respondents) indicated that they were not significantly affected. Notably, all 171 respondents (100%) acknowledged early warning systems as an effective mitigation strategy. The findings suggest that interventions should focus on improving water management, promoting climate-smart agriculture, and strengthening social safety nets to safeguard food security in flood-prone areas. Additionally, priority should be given to the construction and maintenance of flood control infrastructures such as dams, dikes, and drainage systems. The promotion of climate-smart agricultural and resilience practices, such as planting resistant crop varieties and early maturing crops, is also recommended. Furthermore, encouraging livelihood diversification, enhancing early warning systems, and fostering disaster preparedness among residents are critical steps toward building community resilience in the study area.

Keywords: Agriculture, Climate Change, Flood Disasters, Food Security, Household.
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INTRODUCTION

Food is a fundamental human need, and food security is essential for the sustainability of people's livelihoods. Food security is a state of having reliable access to a sufficient quantity of affordable and nutritious food (Adebayo, 2023). It is critical to building and sustaining a healthy economy and achieving social and environmental wellness (Fanzo, 2019). Food security is an issue of global importance that all nations must strive towards achieving (Osabohien et al., 2018). Consequently, there have been several global partnerships and initiatives, most notably by the United Nations, targeted towards achieving food security. Unfortunately, most of these initiatives have not yielded the desired results as a large number of people remain hungry and malnourished.

Food insecurity is a long-standing problem in Nigeria. Successive governments have struggled unsuccessfully to meet the local food needs of Nigeria's growing

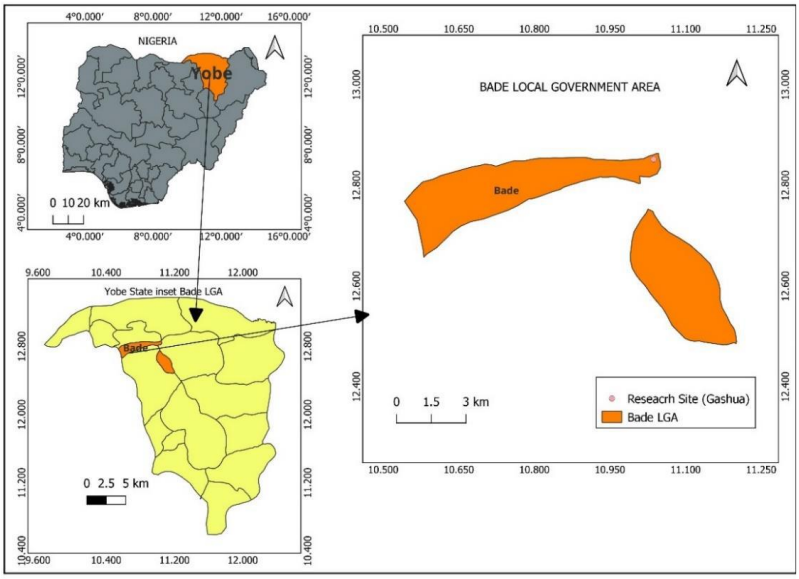

Figure 1. Map showing the Study location.

population. Reports indicate that seven out of ten Nigerians do not have access to adequate food (World Economic Forum, 2022). The country's demand for food far outstrips its production levels. Nigeria still relies heavily on food imports, spending about 10 billion US dollars annually, to meet its food and agricultural production shortfalls (World Economic Forum, 2022). There is growing concern that climate change will further hinder the ability of many nations, particularly those in Africa-to meet their food demands. In Nigeria, the impact of climate change, especially on precipitation patterns, has led to increased frequency and severity of flooding. One of the most devastating occurrences in recent history was the 2012 flood, during which 363 people were reported dead, over 2.3 million were displaced, and more than 16 million were adversely affected (Echendu, 2020).

Flooding in northeastern Nigeria-particularly in the Bade Local Government Area of Yobe State-is not a new phenomenon. Whenever heavy floods occur, the community is severely affected due to its geographical location and the topography of the surrounding river system (Yobe River). Floods impact both individuals and communities, and have social, economic, and environmental consequences. The consequences of floods—both negative and positive—vary significantly depending on the location, severity of the flooding, and the vulnerability and value of the natural and built environments affected.

Flooding in Yobe State has become an almost annual occurrence. As flood events appear to be increasing in frequency or shifting in seasonality and intensity, their impact on agriculture and food security warrants serious attention, especially from the academic community and policymakers (Nka et al., 2015). Many studies have looked at the impact of flooding on food security (Idoko, 2016; Achoja et al., 2019; Sadiq et al., 2019; Jonathan et al., 2020). However, there is a lack of research that specifically examines the impact of flooding on the various components of food security in a comprehensive manner. This highlights a critical gap that the present study seeks to address. Specifically, the study aims to: Describe the socio-economic characteristics of respondents in the study area, Identify the types of crops most vulnerable to flooding in the study area, assess the effects of flooding on farmers' income, availability of livestock feed, livestock health and productivity, as well as nutritional quality of crops and livestock in the study area; and examine the mitigation strategies employed by rural households in the study area.

METHODOLOGY

Study Area

he study was conducted in March 2025 in Bade Local Government Area (LGA), with Gashua-its largest town, serving as the focal point (Figure 1). Bade LGA covers an area of 772 km² and is located at coordinates 12°52′5″N, 11°2′47″E. Gashua lies along the Yobe River, a few miles downstream from the confluence of the Hadejia and Jama'are Rivers. The average elevation is about 299 m. The hottest months are April and May with temperature ranges of 38-42° °C. In the rainy season, June-September, temperatures fall to 23-28° Celsius, with rainfall of 500 to 1000mm. Bade Local Government Area is known for the production of crops such as rice, sorghum, millet, soybeans, cowpea, sesame, ground

nut, and livestock such as fish, cattle, sheep, goats, horses and camels. About 80% of the inhabitants of this region depend on produce from local farms for their daily meals.
The Bade and Duwai languages are spoken in Bade Local Government Area. Bade is one of the seven languages of the Chadic family indigenous to Yobe State. The town lies near the Nguru-Gashua Wetlands, an economically and ecologically important ecological system in the Sahel Savanna Region. Its agricultural production is, however, not large-scale nor is it mechanized. There are 10 wards under Bade Local Government Area: Sugum/Tagali, Dagona, Sarkin Hausawa, Lawan Fannami, Zango, Katuzu, Lawan Musa, Gwio-Kura, Usur/Dawayo and Sabon Gari wards. All the 10 wards were included in the study.

Sampling, Data Collection Technique and Data Analysis

Sampling Technique

The study employed a purposive sampling technique to select 1% of the farming households affected by flooding from each of the 10 wards. Out of the 20,000 registered farmers in Bade Local Government Area, 1% were 200 farmers. Non-responsive farmers were 29.

Sample Size

A sample size of 171 farming households was used in the study.

Data Collection

Primary data were collected through a structured questionnaire administered via face-to-face interviews with farm households.

Research Design

The study adopted a cross-sectional (or survey) design, enabling data collection at a single point in time to assess the effect of seasonal floods on food security.

Data Analysis

Data analysis encompassed descriptive statistics and econometric methods, facilitating a comprehensive examination of the data, including summarizing findings, identifying patterns, and quantifying relationships between variables of interest using Stata.

Method of Data Analysis

Both descriptive (frequency, percentage and mean) and regression models were used for analyzing the data generated from the study.

Multiple Regression Model

Regression analysis was used to ascertain the contributions of selected farmers' socioeconomic characteristics to the flooding effect on food security. The multiple regression equation estimated model is given as:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X^3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + e \text{ ------(1)}$$

where,

Y = flooding effect on food security
A = Constant
X1 = Age (in years)
X2 = Sex (Male = 1, Female = 0)
X3 = Educational level (Number of years attended school)
X4 = Household size (Number of persons in the household)
X5 = Farm size
X6 = Farming experience (in years)
e = error term, assumed to be independent and normally distributed.

The model shows the coefficient of multiple determination (R^2), which explains the 'goodness of fit' for the relationship between the dependent and independent variables in the equation.

RESULTS AND DISCUSSION

Descriptive Statistics of Socioeconomic Variables

The socio-economic data (Table 1) indicates that all households in the study area are headed by males (100%) who were all Muslims. This reflects the traditional cultural norm where males are typically considered the heads of families, thus demonstrating the prevalence of male involvement in agricultural activities in rural Nigeria (Komolafe, 2021). The respondents largely depend on farming (98.83%) as their primary source of income and livelihood. This implies that the majority of households are highly vulnerable to both flooding and food insecurity, as their main source of livelihood is directly impacted by climate-related events. The table presents an age distribution showing that the majority of household heads were between 40 and 59 years old (71.93%), followed by those aged 20 to 39 years (21.64%), while the smallest proportion (6.43%) comprised respondents aged 60 years and above. Marital status among the sampled population revealed that approximately 99.42% were married, while the remaining 0.58% were single. This implies that smallholder farmers in the study area have household responsibilities (Adekola et al., 2023).
Among the 171 sampled respondents, 45.61% had 31 to 40 years of farming experience, while 28.07% had 21-30

Table 1: Distribution of respondents according to socioeconomic characteristics (n=171)

Variables	Frequency	Percent
Sex		
Male	171	100.00
Age (in years)		
20 – 39	37	21.64
40 – 59	123	71.93
≥ 60	11	6.43
Marital Status		
Married	170	99.42
Single	1	0.58
Household Size		
1 – 10	136	79.53
11– 20	35	20.47
Farming Experience (in years)		
1-10	11	6.43
11-20	29	16.96
21-30	48	28.07
31-40	78	45.61
>40	5	2.92
Level of Education		
Primary	46	26.90
Secondary	77	45.03
Tertiary	26	15.20
No Formal	22	12.87
Religion		
Muslim	171	100.00
Source of capital		
Personal saving	170	99.42
Bank loan	1	0.58
Major Occupation		
Farming	169	98.83
Civil servant	2	1.17
Total	**171**	**100.00**
Size of farmland (hectare)		
1-10	142	83.04
11-20	29	16.96
Type of labor		
Both (Family and hired)	171	100
Problem of food need		
Never	1	0.58
Sometimes	168	98.25
Always	2	1.17

Source: Survey (2025).

years of farming experience. Moreover, approximately 16.96% reported 11-20 years, while the lowest percentage (6.43%) accounted for respondents who had 1-10 years of farming experience. In terms of education or literacy levels, 45.03% of household heads had secondary education, making it the largest group. Additionally, 26.90% had primary education, 15.20% had completed tertiary education, and 12.87% had no formal education. The level of education influenced the farmers' rate of adoption of improved practices, aligning with the findings of Alene et al. (2007), who reported a positive relationship between farmers' adoption of improved agricultural practices and food security. In this study, the highest source of capital was personal savings (99.42%), while only 0.58% depended on bank loans.

Types of Crops Mostly Affected by Flooding

According to the respondents (Table 2), millet (99%) was the most vulnerable crop to flood damage in the study area, followed by beans (95%), pepper (92%), and sesame (79%). Sorghum was the least vulnerable crop (3%) to flood damage in the study area. This study corroborates the reports of Akwotajie (2023), who listed maize, rice, millet, sorghum and groundnut as the crops that were mostly vulnerable to flooding in the Kassena

Table 2: Types of crops most vulnerable to flood damage in the study area.

Crop types	*Frequency	Percent
Beans	163	95.32
Sorghum	5	2.92
Millet	170	99.42
Sesame	135	78.95
Pepper	158	92.40

*Multiple Response.

Table 3: Effect of flooding on livestock health and productivity in the last year's season (2024).

Effects of flooding	*Frequency	Percent
Low productivity	57	33.33
High mortality	63	36.84
Increased malnutrition	13	7.60
Disease susceptibility	18	10.53
Reduced growth/Emanciation	60	35.09

*Multiple Response.

Table 4: Effect of flooding on the nutritional quality of crops and livestock in the study area.

Variables	*Frequency	Percent
Never experience flooding	26	15.20
Reduction in crop quality	68	39.77
Reduction in food palatability	32	18.71
Loss of nutrients	70	40.94
Low productivity in animals	86	50.29

*Multiple Response.

Nankana Municipal of Ghana. Another study by Musah and Abayomi (2013) found that food crops, including maize, sorghum, millet, ground nuts, yam, cassava and rice were mostly vulnerable to seasonal flooding in Tolon/Kumbumgu District of the Northern Region of Ghana.

Effect of Flooding on Food Production and Income

The results in Table 3 show that 63 (37%) of the respondents reported that floods could result in high mortality of livestock, while 35% reported reduced growth/ emaciation. Another set of respondents (33%) indicated low productivity of livestock. Additionally, 11% reported that disease susceptibility may be caused by flooding, while 8% indicated increased malnutrition among livestock in the study area due to flooding. This finding is consistent with the reports of Jonathan et al. (2020) and Udemezue et al. (2019), which indicate that flooding has a negative impact on food production in Southern Nigeria.

As shown in Table 4, half of the respondents (50%) agreed that low productivity in animals could result from flooding, while 41% reported that loss of nutrients in crops may be attributed to the flooding effect. Also, about 40% agreed that flooding can bring about a reduction in crop quality, while 19% listed a reduction in food palatability. About 15% said they have never experienced flooding in the study area. This study corroborates the report of Akukwe et al. (2018), where 49% of the respondents in selected agrarian communities of South eastern Nigeria agreed that flooding had a negative effect on the quality of crops produced and food consumed.

Regarding the consequences of flooding on the availability of livestock feed (Table 5), 53% of the respondents agreed that flooding increased the cost of livestock feed, while 45% agreed that flooding brought about a general feed shortage. Additionally, 36% of the respondents reported that they do not own any livestock, while only a small proportion (3%) identified underfeeding of animals as a consequence of flooding on livestock feed availability.

The respondents were asked, *"Has flooding in the past affected your income and ability to purchase good food apart from your farm produce?"* The data obtained (Table

Table 5: Effect of flooding on livestock feed availability.

Effects	*Frequency	Percent
Increased in the cost of livestock feed	91	53.22
Underfeeding of animal	5	2.92
General feed shortage	78	45.61
Do not own livestock	62	36.26

*Multiple Response

Table 6: Effect of flooding on income and ability to purchase good food **(n=171).**

Variables	Frequency	Percent
Yes	149	87.13
No	22	12.87
Total	171	100

Source: Survey (2025).

Table 7: OLS regression model of the effects of floods on farmers' food security level using the FCS food security model.

Variables	*Coefficients*	*Std. Err.*	*t. stat.*	*p. value*	[95% Conf.	Interval]
Age	-19.5314	15.38826	-1.27	0.206	-49.9339	10.87105
Marital status	785.8992	1140.034	0.69	0.492	-1466.46	3038.257
Household size	42.38864	36.24858	1.17	0.244	-29.2275	114.0047
Major occupation	-2472.57	1133.079	-2.18	0.031	-4711.19	-233.953
Education level	140.0695	93.41897	1.5	0.136	-44.4978	324.6369
Source of income	-329.074	1591.153	-0.21	0.836	-3472.71	2814.558
Year of farming experience	-6.00536	15.47746	-0.39	0.699	-36.5841	24.57337
Number of farmland	207.4528	156.5969	1.32	0.187	-101.935	516.8404
Farm size	143.2824	58.44166	2.45	0.015	27.81958	258.7452
Labor cost	0.004949	0.000839	5.9	0	0.003292	0.006606
Access to extension service	-0.63534	0.337536	-1.88	0.062	-1.30221	0.031525
Borrow food	270.2033	186.7841	1.45	0.15	-98.825	639.2316
Flood effect on livestock	-1181.62	246.1553	-4.8	0	-1667.94	-695.289
Flood type	-1.21091	0.378071	-3.2	0.002	-1.95787	-0.46396
Quantity of farm foods destroyed	1.787082	1.014829	1.76	0.08	-0.21791	3.792074
Quantity of stored farm foods destroyed	0.317571	0.20975	1.51	0.132	-0.09683	0.731972
Properties destroyed	-0.22583	0.287015	-0.79	0.433	-0.79289	0.341219
Consumption of regular protein	6031.325	3886.372	1.55	0.123	-1646.96	13709.61
Number of obs = 171	F (18, 152) = 28.25	Prob > F = 0.0000	R-squared = 0.7699	Adj R-squared = 0.7426	Root MSE = 1089.4	

6) revealed that 149 respondents (87%) reported that flooding had negatively impacted their income and ability to purchase quality food, while 22 respondents (13%) disagreed. This is similar to the report of Yahaya et al. (2024) in a study conducted in Benue State, Nigeria, where about 81% of the respondents reported a decrease in their income or difficulties in accessing food due to flooding. Also, about 96% of the respondents reported a significant flooding effect on farm income in a study conducted in selected agrarian communities of southeastern Nigeria (Akukwe et al., 2018).

Effect of Flooding on Farmers' Household Food Security

This study utilized the food consumption Score (FCS) model to have access to the food security level of different farm families within the study area (Table 7).

Table 8: How community level initiatives help to mitigate flood impact on food security.

Mitigation strategies	*Frequency	Percent
Early Warning System	171	100
Floodplain management	-	-
Community-based food storage facilities	-	-

*Multiple Response.

This study aligns with the findings of Stephen and Samuel (2013), who reported that families with higher incomes and access to credit are more food secure. Higher income enables farm families to purchase food when their own production is compromised by flooding, thereby allowing them to meet household food demands and better cope with such challenges. Furthermore, access to credit positively influences food security by enabling farm families to diversify into non-farm enterprises. This diversification generates additional income beyond farming activities, thereby enhancing household food security.

Choosing farming as a major occupation had a positive influence on the level of food security, indicating that household heads choosing farming as their major occupation were more food secure than those who chose farming as their secondary occupation. The positive impact of farming as the primary occupation of household heads can be attributed to their full commitment to agricultural activities, which enhances food security within the household.

Farm size exhibited a positive influence on food security, indicating that farm families with larger landholdings tended to be more food secure. This can be attributed to the fact that larger farm sizes often allow for increased production, higher income, and greater capacity to adapt effectively to challenges such as flooding.. This finding is in line with the work of Okyere et al. (2013). Labor costs, on the other hand, showed a significant negative influence at 1% level. This suggests households with a larger labor cost are less food secure compared to smaller labor cost. This finding is congruent with the work done by Bayene and Muche (2010).

As expected, access to extension services had a significant impact on household food security. Household heads who were associated with extension officers were believed to achieve higher yields and manage flood-related challenges more effectively, thereby enhancing food security within their households. In addition, farming households that maintain regular contact with extension agents are better equipped to handle unexpected situations arising from natural disasters, due to the timely advice, training, and support they receive. Accessibility to extension services will allow farm households to have access to farming inputs such as seeds, fertilizers, and equipment, which will increase food availability within their household. This finding supports the work of Salima et al. (2023), which suggests that access to extension services increases farmers' knowledge base, enhances agricultural productivity, generates higher income, and ultimately improves household food security over time.

The flooding effect on farmers' livestock had a negative coefficient significant at 1% level. This indicated that households that experienced greater flooding effects on their livestock are more likely to face food insecurity. Flood type also had a negative impact on food security in the study area. The study found that prolonged flood duration had a significant adverse effect on both crops and livestock, which in turn severely impacted the food security of farm families. This finding aligns with prior expectations that flooding causes substantial damage to agricultural production and livestock in the study area.

The quantity of farm produce destroyed by flooding was statistically significant at the 10% level and had a positive sign. As expected, the greater the quantity of crops destroyed by floods, the higher the level of food insecurity. Specifically, the results imply that a one-unit increase in the quantity of farm food destroyed by flooding leads to a 1.787% increase in household food insecurity. This regression analysis gives insights on the relationships between flooding effects and farmers' food security in the study areas, with supported findings by prior researchers.

Adaptation/ mitigation strategies adopted by farming households

When asked, *"How can your community-level initiatives help mitigate the impact of flooding on food security?"* the data obtained (Table 8) revealed that all 171 respondents (100%) identified the early warning system as a key strategy.

Of all the four options provided for the respondents (Table 9), planting of flood-tolerant varieties (99%) was the most favoured on-farm mitigation strategy, followed by adoption of improved drainage system (98%).

The results in Table 10 show the strategies employed to minimize the impact of flooding on food security of households in the study area. Planting flood-tolerant varieties is practiced by most households (about 77%) to reduce the effects of flooding on their food security. Some of the surveyed households also adopted the use of sandbags (about 75%), while about 14% constructed

Table 9: On-farm mitigation strategies farmers can adopt to minimize flood damage to crops.

Mitigation strategies	*Frequency	Percent
Crop diversification	-	-
Raised bed planting	-	-
Planting flood tolerant varieties	170	99.42
Improved drainage system	169	98.83

*Multiple Response.

Table 10: Intended strategies to implement in order to minimize the impact of flooding on food security.

Strategies	*Frequency	Percent
Plant resistant crop varieties	132	77.19
Use of sandbag	128	74.85
Provide barrier to the farm	24	14.04
Seek government intervention	3	1.75
Improve drainage system	5	2.92
Changing the planting and harvesting time	9	5.26

*Multiple Response.

barriers to prevent water from entering their farmland, thereby reducing the extent of flooding as much as possible. About 2% of the respondents relied on seeking government intervention, while 3% practiced an improved drainage system to mitigate the effects of flooding. Also, 5% of the households adopted a method of adjusting their planting and harvesting periods- specifically, early planting to allow for early harvesting before the advent of heavy rains- in order to reduce the effects of flooding. This observation is in consonance with the study conducted by Jonathan et al. (2020), which highlighted that farming households in the Southern Guinea Savanna Zone of Nigeria practiced terracing and adopted early harvesting to mitigate the effects of flooding.

CONCLUSION AND RECOMMENDATIONS

The study revealed that flooding had a negative impact on food security, primarily through its adverse effects on livestock production, including high mortality rates, low productivity, reduced feed availability, increased malnutrition, stunted growth, and greater susceptibility to diseases The study also showed that flooding had negative effects on farmers' income, reduced crop quality, quantity and food palatability, and led to loss of crop nutrients. To address these challenges, interventions should focus on improving water management, promoting climate-resilient agriculture, and strengthening social safety nets to safeguard food security in flood-prone areas.

Based on the findings of this study, the following recommendations are made:

- Governments should construct and maintain flood control structures like dams, dikes, drainage systems, etc in the study area.
- Encouragement and promotion of smart agricultural and resilience practices such as
flood-resistant crop varieties, early-maturing crops, and livelihood diversification.
- Early warning structure and disaster preparedness should be inculcated into the residents in the
study area. The strategies embedded in the recommendations can provide immediate and long-term flood-secure future for the farming households, thereby mitigating the adverse effects of flooding on food security.

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