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A SURVEY-BASED ASSESSMENT OF THE EFFECTS OF FLOODING ON ARABLE CROP PRODUCTION IN JOS SOUTH LOCAL GOVERNMENT AREA OF PLATEAU STATE, NIGERIA

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ABSTRACT

This study assessed the effects of flooding on arable crop production in Jos South Local Government Area of Plateau State, Nigeria. A descriptive survey design was adopted, involving 118 arable crop farmers selected through purposive and simple random sampling from four flood-prone communities. Data were collected using structured questionnaires and analysed using descriptive statistics, including frequencies, percentages, means, and ranks. Findings revealed that farmers were predominantly male, mature, married, and educated, with substantial farming experience, indicating a strong capacity to implement adaptive strategies. Flood impacts were most severe on tomatoes (19.3%), okra (16%), and rice (14.3%), highlighting the vulnerability of both staple and high-value crops. Farmers adopted sustainable practices such as cover cropping, agroforestry, and integrated pasture management, alongside adaptation strategies including livestock production, farm channel construction, and crop diversification. However, challenges such as excessive rainfall, low yields, and pest infestations continued to limit productivity. The study concluded that flooding significantly disrupts arable crop production, but farmers' resilience and sustainable practices help mitigate its effects. It recommends improved drainage infrastructure, strengthened extension services, increased access to credit, and the promotion of climate-resilient farming techniques to enhance sustainable agricultural production in the study area.

Keywords: Climate Change Adaptation, Smallholder Farmers, Flood Vulnerability, Arable Crop Production, Adaptation Strategies

INTRODUCTION

Flooding is among the most destructive environmental hazards globally, posing serious threats to agricultural productivity, food security, and rural livelihoods (Intergovernmental Panel on Climate Change (IPCC, 2022); (Food and Agriculture Organization of the United Nations (FAO), 2021). Increased rainfall intensity, climate variability, and inadequate

land and water management have heightened the frequency and severity of flood events, leading to widespread crop damage, soil degradation, and reduced farm output, particularly in developing countries where agriculture is highly climate-dependent (World Bank, 2023).

In Nigeria, flooding has become increasingly recurrent and destructive, affecting both urban and rural areas (National Emergency Management Agency (NEMA), 2022). Agricultural communities are especially vulnerable, as floods often cause extensive crop losses, disrupt farming activities, and reduce household incomes, particularly in regions with poor drainage systems and fragile landscapes (FAO, 2021). These impacts are pronounced in areas with poor drainage system and fragile landscape, where farmers have limited capacity to copy with climate-related shocks and it undermines national food security and rural economic stability (Adelekan *et al.,* 2022).

Plateau State, located in Nigeria's North-Central region, is known for its favorable Agro-climatic conditions, including cool temperatures, moderate rainfall, and fertile volcanic soils, which support diverse arable crop production (Nigerian Meteorological Agency (NiMet), 2022). Jos South Local Government Area (LGA) is a major agricultural hub where farmers cultivate maize, beans, potatoes, rice, and vegetables that contribute significantly to local food supply and livelihoods (National Bureau of Statistics (NBS), 2022). However, recent shifts in rainfall patterns and increasing extreme weather events have altered these previously stable production conditions (IPCC, 2022).

Flooding in Jos South LGA has been intensified due to the combine effects of heavy and prolonged rainfall, inadequate drainage infrastructure, and the area's distinctive highland topography (NiMet, 2022; NEMA, 2022). The rainy season, which peaks between June and October, often produces rainfall volumes that exceed the capacity of existing drainage system, resulting in surface runoff and localized flooding. Steep slopes and narrow valleys accelerate runoff, causing floodwaters to accumulate in low-lying farmlands. These conditions expose arable crops to waterlogging, soil erosion, sediment deposition, and delayed farm operations, all of which reduce crop yields and productivity (FAO, 2021; World Bank, 2023).

While existing studies have documented the general impacts of flooding on agriculture in Nigeria and other regions, most focus on broad national trends, urban flooding, or disaster management responses. There is limited empirical evidence specific to Jos South LGA, particularly regarding the crop-specific impacts of flooding, farmers' adaptive and sustainable practices, and the socio-economic factors influencing their resilience. This lack of localized, farm-level data constrains the design of effective, context-specific policies and interventions.
Therefore, this study aims to assess the effects of flooding on arable crop production in Jos South Local Government Area of Plateau State by examining crop vulnerability, farmers' adaptive strategies, and associated constraints. By addressing these gaps, the study provides evidence to inform policy formulation, extension programming, and community-based interventions aimed at enhancing agricultural resilience and food security in flood-prone areas.

STATEMENT OF THE PROBLEM

Arable crop production in Jos South Local Government Area (LGA) of Plateau State has been increasingly threatened by recurrent flooding, which poses significant challenges to agricultural productivity and food security. Changes in rainfall patterns, coupled with inadequate drainage infrastructure and the area's highland

topography, have intensified flood events, exposing farmlands to frequent inundation. These floods disrupt the environmental conditions necessary for optimal arable crop growth and sustainable farming practices. Flooding negatively impacts soil quality by washing away nutrient-rich topsoil, reducing fertility, and altering soil structure, thereby limiting the capacity of farmland to support healthy crop development (FAO, 2015; IPCC, 2022). Prolonged waterlogging further impairs root growth, restricts oxygen availability, and reduces nutrient uptake, resulting in lower crop performance and significant yield losses. Flood-prone conditions also create a favorable environment for the proliferation of pests and crop diseases, compounding production challenges for farmers. The cumulative effect of these challenges is a decline in crop output, reduced household income, and heightened vulnerability to food insecurity in the study area. Despite the severity of these impacts, there is limited empirical evidence quantifying how flooding affects arable crop production in the area, which hinders the development of effective mitigation and adaptation strategies. This study therefore seeks to assess the effects of flooding on arable crop production in Jos South LGA to inform policy and community-level interventions.

AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to assess the effects of flooding on arable crop production in Jos South Local Government Area of Plateau state. The specific objectives are:

1. To examine the socio-economic characteristics of respondents in the study area.
2. To identify the different arable crops affected by flooding in the study area.
3. To determine sustainable practices that enhances crop productivity and soil fertility in the study area.
4. To assess the adaptation strategies by farmers to mitigate the effects of flooding on arable crop production in the study area.
5. To investigate the constraints faced in controlling the effects of flooding in the study area.

THEORETICAL FRAMEWORK

This study is anchored on the Vulnerability and Resilience Theory, which is widely applied in environmental and agricultural research to understand how communities respond to natural hazards such as flooding. Vulnerability refers to the degree to which a system, population, or community is susceptible to, or unable to cope with, the adverse effects of environmental hazards (Adger *et a*l., 2005). In the context of arable crop production, vulnerability is influenced by factors such as soil quality, crop type, farming practices, access to resources, and socio-economic characteristics of farmers. Flooding in Jos South Local Government Area (LGA) increases farmers' vulnerability by directly affecting soil fertility, crop health, water availability, and overall farm productivity.

Resilience, in contrast, is the capacity of individuals, communities, or systems to absorb, adapt to, and recover from environmental shocks while maintaining essential functions (Folke *et al.,* 2004). In agricultural settings, resilience is demonstrated through adaptive strategies such as crop diversification, adoption of sustainable farming practices, construction of drainage channels, and the use of flood-tolerant crops. These strategies enable farmers to cope with flooding, reduce losses, and sustain productivity despite recurrent environmental challenges. By applying the Vulnerability and Resilience Theory, this

study examines the interplay between farmers' exposure to flooding (vulnerability) and their adaptive responses (resilience). The framework provides insight into how socio-economic factors—such as age, education, farm experience, and household size—interact with environmental stressors to influence farmers' capacity to sustain arable crop production. It also informs the identification of strategies that enhance resilience, including institutional support, extension services, and the adoption of sustainable agricultural practices. Thus, the Vulnerability and Resilience Theory is highly relevant to this study as it links environmental hazards, socio-economic characteristics, and adaptive capacity to agricultural outcomes. It provides a conceptual lens for analyzing the effects of flooding on arable crop production in Jos South LGA and for recommending interventions to strengthen farmers' capacity to cope with climate-related challenges.

METHODOLOGY

The study adopted a descriptive survey research design to investigate the effects of flooding on arable crop production in Jos South Local Government Area (LGA) of Plateau State, Nigeria. The study area, situated between latitude 9°56′00″N and longitude 8°44′00″E, spans approximately 1,743 km² and is characterised by highland terrain, seasonal rainfall, and intensive arable farming activities. The population comprised all arable crop farmers in Jos South LGA who were directly affected by flooding. A total sample size of 118 arable crop farmers was used in this study. Purposive sampling was first employed to select four flood-prone farming communities—Vwang, Du, Kuru, and Gyel—because of their high involvement in arable crop production and frequent exposure to flooding. Subsequently, simple random sampling was used to select farmers from each community to ensure that every eligible farmer had an equal chance of participation, thereby improving representativeness and reducing sampling bias. Primary data were collected through a structured questionnaire administered via face-to-face interaction, with sections capturing respondents' socio-economic characteristics, the effects of flooding on arable crop production, and adaptation strategies adopted by farmers.

The validity of the research instrument was established through expert review by specialists in the Agricultural Extension Management department. To ensure reliability, a pilot test was conducted among 20 farmers in a nearby community, and a Cronbach Alpha coefficient of 0.82 confirmed the internal consistency of the questionnaire. The procedure for data collection involved direct administration of instrument to respondents with the assistance of trained enumerators familiar with the local dialect, ensuring clarity and completeness of responses. Ethical consideration were adhered to when engaging with respondents; informed consent was sought and the researcher urged the respondents they could withdraw at any time at their freewill, each respondents were treated with outmost professionalism to ensure accurate and valid responses. Data collected were analysed using descriptive statistical tools, including frequencies, percentages, means, ranks and mean scores, to summarise respondents' characteristics and evaluate the impacts of flooding on arable crop production within the study area.

RESULT

Table 1. Socio-Economic Characteristics of the Respondents

Variable	Frequency	Percentage
Gender		
Male	79	66.9
Female	39	33.1
Age		
18-25	13	11
26-35	21	17.8
36-45	41	34.7
46 year above	43	36.5
Educational level		
Primary	14	11.9
O'level	49	41.5
Higher education	55	46.6
Marital status		
Single	27	22.9
Married	81	68.6
Widows/ widowers	10	8.5
Years of farming experience		
1-10years	21	17.8
11-20years	70	59.3
21-30years	21	17.8
30-40years	6	5.1

Source: field survey 2025

Table 1 shows that farming was predominantly undertaken by males, who constituted 66.9% of the sample, with females representing 33.1% indicating that farming in the study area are male dominated. Most farmers were mature adults aged 36 years and above, accounting for 71.2% of respondents, suggesting that arable crop production relied on middle-aged, older experienced individuals. Education levels were relatively high, as nearly 88% of farmers had attained O'level or higher, indicating that the respondents are relatively educated. The majority of respondents were married (68.6%), which may enhance household labour availability for farming activities. In terms of farming experience, over half of the respondents (59.3%) had 11–20 years of practice, reflecting substantial practical knowledge in crop production.

Table. 2 Arable Crops affected by Flooding in the study Area

SN	Crops ravage	Frequency	Percentage
1	Sorghum	5	4.2
2	Acha	7	5.8
3	Sweet potatoes	13	10.9
4	Cabbage	9	7.6
5	Okra	19	16
6	Tomatoes	23	19.3
7	Carrots	3	2.5
8	Millet	4	3.4
9	Rice	17	14.3
10	Beans	11	9.2
11	Cucumber	8	6.7

Source: field survey 2025

Table 2 shows that tomatoes (19.3%), okra (16%) and rice (14.3%) were the most impacted, indicating that flooding significantly threatens both cash crops and staple crops, followed by sweet potatoes (10.9%), though the damage is not severe as top three but still face yield reduction. while crops such as carrots (2.5%) and millet (3.4%) experienced minimal damage because they are resilient to flood condition

Table 3: Sustainable Practice Enhancing crop Productivity and Soil Fertility in the Study Area.

SN	Sustainability practice enhance crop productivity	Frequency Yes	(%)	Frequency No	(%)
1	Crop rotation	82	69.5	36	30.5
2	Conservation Tillage	93	78.8	52	21.2
3	Mixed cropping	76	64.4	42	35.6
4	Mixed farming	79	66.9	39	33.1
5	Cover crop	101	85.6	17	14.4
6	Agro-forest	99	85.6	19	16.1
7	Intergrade past management	105	83.9	13	11.0

Source: field survey 2025

Table 3 reveals that the majority of farmers adopted cover cropping (85.6%), agroforestry (85.6%), and integrated pasture management (83.9%), while conservation tillage (78.8%), crop rotation (69.5%), mixed farming (66.9%), and mixed cropping (64.4%) were also widely practised. These indicated that farmers were aware of and actively implemented techniques that improved soil health and crop yields.

Table 4; Adaptation strategies Employed by Farmer to mitigate the Effects of flooding on Arable Crop Production the Study Area

Adoption strategies	Frequency	Percentage (%)	Ranking
Diversification of crop	31	26.3	3rd
Livestock production	41	34.7	1st
Cooperative member	6	5.1	5th
Creating farm channels	34	28.8	2nd
Accessing loan from banks	12	10.0	4th

Source: field survey 2025

Table 4 reveals that livestock production is the most commonly adopted strategy, reported by 34.7% of respondents and ranked 1st because it is alternative livelihood when crop is threatened by flood, the second most frequently adopted strategy is creating farm channels (28.8%), ranked 2nd. Crop diversification was reported by 26.3% of respondents and ranked 3rd, showing that farmers plant different types of crops to reduce the risk of total crop loss in the event of flooding. Accessing loans from banks was adopted by 10.0% of farmers, ranking 4th.The least adopted strategy is membership in cooperatives, recorded at 5.1% and ranked 5th.

Table 5. Constraints Faced by Arable Crop Farmers Due to Flooding in the Study Area

SN	Constraints	Frequency	Percentage (%)	Ranking
1	Excessive rainfall	42	35.6	1st
2	Topography	10	8.5	4th
3	Pest and disease	28	23.7	3rd
4	Road and damage	3	2.5	6th
5	Low harvest	30	25.4	2nd
6	Loss of farm land and livestock	5	4.2	5th

Source: field survey 2025

Table 5 shows the constraints faced by arable crop farmers revealed that excessive rainfall (35.6%) was the most significant challenge, followed by low harvests (25.4%) and pest and disease infestations (23.7%). Other challenges such as topography (8.5%), loss of farmland and livestock (4.2%), and damaged roads (2.5%) were less prevalent. These results indicate that environmental factors, particularly extreme rainfall, posed the greatest threat to crop production, exacerbating yield losses and limiting farmers' capacity to sustain productive operations.

DISCUSSION

The study established that flooding significantly affected arable crop production in Jos South Local Government Area, where the socio-economic characteristics of respondents shows that arable crop farming is predominantly male-dominated and practiced mainly by farmers aged 36 years and above. This reflects the labor-intensive nature of crop production and the reliance on experienced farmers. The relatively high educational attainment among respondents supports findings by Ojo *et al*. (2021), which indicate that education enhances farmers' capacity to adopt improved farming practices and respond effectively to climate-related risks. In addition, the long years of farming experience observed suggest the presence of indigenous knowledge that supports farmers' resilience to flooding, consistent with the social-ecological resilience framework proposed by Adger *et al.* (2005).

The results on crops affected by flooding reveal that vegetables and water-sensitive crops such as tomatoes, okra, and rice are the most severely impacted. This aligns with reports by FAO (2015, 2021) and IPCC (2022), which note that flooding leads to waterlogging, soil nutrient loss, and increased disease incidence, thereby reducing crop yields. Conversely, crops such as millet, sorghum, and acha were less affected, indicating their relative tolerance to flood conditions.

Farmers adopted sustainable practices such as cover cropping, agroforestry, conservation tillage, and integrated pasture management, these practices enhance soil fertility, reduce erosion, and improve moisture regulation, thereby supporting crop productivity in flood-prone environments. Similar benefits of sustainable land

management practices have been widely documented in the literature (FAO, 2015). Adaptation strategies employed by farmers indicate a strong reliance on livestock production, drainage channel construction, and crop diversification. These strategies reflect farmers' efforts to diversify income sources and reduce exposure to flood risks. However, low participation in cooperatives and limited access to formal credit suggest weak institutional support, a challenge also identified by Adelekan *et al.* (2022) in flood-risk management studies in Nigeria. Excessive rainfall, low harvest, and increased pest and disease incidence emerged as the major constraints facing farmers. These challenges significantly undermine agricultural productivity and emphasize the need for improved drainage systems, pest management strategies, and institutional support mechanisms. Overall, while farmers in the study area demonstrate adaptive capacity, strengthening extension services, access to credit, and flood-resilient agricultural infrastructure is essential for enhancing long-term resilience and sustainability.

CONCLUSION

The study established that flooding in Jos South Local Government Area significantly disrupts arable crop production, particularly affecting both staple and high-value crops such as tomatoes, okra, and rice. While farmers' socio-economic characteristics, adoption of sustainable practices, and adaptation strategies mitigate some impacts, challenges such as excessive rainfall, low harvests, and pest infestations continue to constrain productivity. The findings underscore the urgent need for integrated interventions that enhance resilience, safeguard livelihoods, and sustain agricultural productivity in flood-prone areas.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

1. The Government and community leaders should invest in constructing and maintaining effective drainage systems, water channels, and embankments to reduce the severity of flooding on farmlands.
2. Agricultural research institutions and extension services should introduce and encourage the adoption of crop varieties that can withstand waterlogging and excessive moisture.
3. Agricultural Extension Services agents should be deployed to the area to educate farmers on sustainable farming practices, early warning signals for floods, and improved adaptation strategies.
4. Government agencies, microfinance banks, and cooperative societies should provide accessible and affordable loans to farmers, enabling them to invest in flood-control measures and recover quickly from flood impact.

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