JOURNAL OF AGRICULTURAL ECONOMICS, EXTENSION & SCIENCES
Official Journal of the College of Agricultural Economics and Extension
www.jaees.org
www.uam.edu.ng
Jaees Vol. 11 No.2 2025, Page 146-158
ISSN (Print) 2545-5179, ISSN (Online) 2714-5018

EFFECTS OF FLOOD DISASTER ON YIELDS AND INCOME OF SMALL-SCALE MAIZE FARMERS IN GOMBE STATE, NIGERIA

[1]Garba, M., [1]Abubakar, U., [1]Abdullahi, S., [2]Yusha'u, I. I., [1]Babaji, A.U. and [1]Mohammed, A.M.

1. Department of Agricultural Extension and Rural Development, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi
2. Ministry of Agriculture and Rural Development, Abubakar Umar Secretariat Bauchi

E-mail: gmohammed@atbu.edu.ng **+2348063390244**

Abstract

The study assessed effects of flood disaster on yields and income of small-scale maize farmers in Gombe State, Nigeria. A multi stage sampling technique was used in selecting 172 respondents. Data were collected using structured questionnaire and analysed using descriptive and inferential statistics such as mean, frequency, percentage and paired t-test, respectively. The study revealed that majority (77.9%), of the respondents were producing crops and owned their land through inheritance (66.9%),with average yield and income of 9 bags and ₦468,756, respectively. Less than half (48.3%) and 38.4% of the respondents experienced flood disaster for a period of 1-2 years and 3-4 years, respectively. Majority (61.6%) of the respondents indicated that flood disaster occurs annually with destruction of farm produce as the major (95.9%) damage. The result further indicates a significant difference (P<0.001) in maize yield (9 bags) and income (₦583,308.12) before and after flooding. The major constraints to mitigating the effect of the disaster in the study area were, poor government intervention (85.5%), inadequate diversification opportunities (58.7%) and lack of insurance cover (52.3%), which were ranked 1st, 2nd, and 3rd ,respectively. The study concluded that flood disaster had negative effects on yields and income of the respondents. It was recommended that farmers should be encouraged to participate in agricultural extension services, which will educate them on the effects of climate change and adaptation strategies such as insurance cover. Multi-sectoral approach to flood mitigation as opposed to single sector should be promoted as there are inter-linkages in terms of flood impact on various aspects of the society.

Keywords: Flood, Disaster, Effects, Yields, Income.

1.0 Introduction

Agricultural production remains the primary source of livelihood for most rural communities in developing countries (Serote *et al*., 2021). It provides a source of employment for more than 60% of the population in sub- Saharan Africa (SSA) (Giller *et al*., 2021). Climate change is increasingly recognized as a major challenge to agriculture worldwide, particularly in developing countries, where small-scale farmers are highly vulnerable to its impacts (Ren *et al.,* 2019). However, small-scale farmers in Nigeria face numerous challenges, including inadequate access to resources, limited technological know-how and environmental hazards such as flooding (Kamara *et al*., 2020). Floods often lead to significant damage to crops, livestock, infrastructure and livelihoods, affecting the food security and income of small-scale farmers in the region (United Nations Development Programme (UNDP), 2019).

Flood is one of the most common types of disaster 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 flood of normally dry area due to overflow of tidal, inland water or rapid accumulation of runoff (Mmom and Ayakpo, 2014). Etuonovbe (2017) defined flood as the overflowing of the normal confines of a stream or other body of water or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods (United Nations Disaster and Reduction (UNISDR), 2018). The immediate effect of this natural disaster includes destruction of crops, loss of livestock, damage to properties, food insecurity, loss of lives among the affected communities (Alam *et al*., 2010; Islam and Wong, 2017; Okeleye *et al*., 2016). 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 (National Emergency Management Agency (NEMA), 2013).

Maize (*Zea mays*) is one of the most important crops in Nigeria that contributes to household food security (Muhammad *et al.,* 2020). It is the Nigerian second leading staple food crop apart from rice with increasing domestic demand and plays key role in food security and generation of income for most farmers (Akpabio *et al.,* 2021). Maize has recently surpassed cassava as Nigerian's most important food crop in terms of

calories and nutritional contents (carbohydrate, protein, vitamins and minerals) consumed and serves as a main source of income to producers in the maize growing area (Minocha *et al.,* 2019). Tweneboah (2000) regarded the maize contribution to the growth of Nigerian's economy in various ways, namely; in the provision of food for the increasing population and supply of adequate raw materials to a growing industrial sector such as major source of employment and generation of foreign exchange earnings.

It is important to note that, while the vulnerability to climate change impacts is higher in lower-middle- and low-income countries, particularly Africa, the readiness to improve resilience ranks very low in such countries (Notre Dame Global Adaptation Index (ND-GAIN), 2021). A recent report, for example, shows that Nigeria is one of the top ten of the most exposed countries to the effects of climate change, with about 6% of its land area estimated to be exposed to extreme weather events (World Bank, 2019). It was on this note that, the study was carried out to assess the effects of flood disaster on yields and income of small-scale maize farmers in Gombe State, Nigeria. The study was guided with following research questions;

i. What is the nature of damage caused by the flood disaster?
ii. What are the effects of flood disaster on yields and income of the respondents? and
iii. What are the constraints faced by respondents in mitigating flood disaster?

1.0 The Objective of the Study

The broad objective of this study was to assess effects of flood disaster on the yields and income of the respondents in the study area. The specific objectives of the study were to**:**

i. ascertain the nature of damage caused by the flood disaster;
ii. determine the effects of the flood disaster on yields and income of the respondents; and
iii. identify constraints faced by the respondents in mitigating flood disaster.

3.0 Methodology

3.1 The Study Area

The study was carried out in Gombe State, Nigeria. The State is located in Northeastern Nigeria and it is one of the areas prone to recurrent flood disasters, which have been exacerbated by climate change (Nigerian Metrological Agency (NIMET), 2018). Gombe State is located between Longitude $10^{\circ}15^{1}$-$10^{\circ}50^{1}$N and Latitude 11° 00-11° 45^{1}E of the Greenwich meridian. It lies within the North East region of Nigeria and occupies a total land area of about 20,265 km^2. The number of inhabitants of the area has a projection population of 3,822,081 based on 3.2% annual population growth (NBS, 2021). The major ethnic groups are Tera, Bolewa, Hausa, Fulani, Tangale, Lunguda, Waja, Kamo, Kanuri, Jukun, Peroshonge, Cham, Dadiya, and Tula. The State shares boundary with Yobe State to the North, Adamawa and Taraba States to the South, Borno and Bauchi States to the West. The State is administratively divided into 11 Local Government Areas, which include: Akko, Balanga, Billiri, Dukku, Funakaye, Gombe, Kaltungo, Kwami, Nafada, Shongom and Yamaltu Deba. The mean annual rainfall ranges from 800 mm to over 900 mm with rainfall duration of 4-5 months. The mean minimum daily temperature recorded ranges from 13.6°C to 31.9°C in January and 9.0°C to 28.5°C in August. (Gombe State Agricultural Development Programme (GSADP), 2018).

The vegetation type in the area is predominantly natural growing trees which are found on heavier soil. The area is characterized by shrubs savannah on fertile soil, short grass and thorny vegetation on cetaceous sediments. All the rivers are seasonal (GSADP, 2018). The area is gentle undulating plains, both east and west of an escarpment, which is defined by localized sandstone hills. Gombe State is mainly an agrarian State, and some of the major crops grown include food crop like sorghum, rice, millet, maize, cowpea, sweet potatoes, cassava and a wide variety of vegetables such as tomato, pepper, onion, melon etc. Also, other crops like groundnut, soya beans, benn seeds and cotton are being produced. Other activities of the peasants include hunting, fishing and carving. Livestock rearing including cattle, sheep, goats and poultry contribute immensely to the economy of the study area.

A multi-stage sampling technique was used for the study. In the first stage, the Local Government Areas (LGAs) in the State were clustered into the three agricultural zones of Northern, Central, and South zones. In the second stage, purposive sampling technique was used in selecting 1 LGA from the central zone being the largest LGA and with high intensity of maize production and also more vulnerable to flooding, 2 LGAs from each of the Northern and Western zone, making a total of five (5) LGAs. The selection was based on the intensity of maize production. Thus, the selected LGAs were Dukku, Kwami, Akko, Balanga and shongom. In the third stage, 172 respondents were randomly and proportionately (30%) selected as the sample size for the study. The sample size selection was based on the list of registered maize farmers obtained from each of the selected LGAs as seen in Table 1.

Table 1: Sample Size Selection Plan

State	Zones	LGAs	Sampling frame	Sample Size (30%)
Gombe	Northern zone	Kwami	102	31
		Dukku	100	30
	Central zone	Akko	163	49
	Western zone	Balanga	118	35
		Shongom	90	27
		Total	**573**	**172**

Source: Gombe State Agricultural Development Programme (GSADP, 2023)

Data were collected using structured questionnaire, administered to the respondents. A total of 172 copies of questionnaire were administered to the selected maize farmers that served as the respondents of the study. Data collected were analysed using descriptive and inferential statistics. Descriptive statistics such as mean and frequency distribution were used to analyze objectives i, and iii. Paired t-test was used to examine the effect of flood disaster on yield and income of the respondents in the study area (Objective ii). Thus, the formula specified as:

$$t = \frac{\sum d}{\frac{\sqrt{n(\sum d^2) - (\sum d)^2}}{n-1}}$$

Where d = difference per paired value
n = number of samples

4.0 Results and Discussion

4.1 Nature of damage caused by the flood disaster

4.1.1 Respondents' Years of Experience and Frequency of Flood Disaster

Table 2 revealed the distribution of respondents based on the years and frequency of flood disaster occurrences in the study area. It shows that the majority (61.6%) of the respondents experienced flood disaster annually. Furthermore, Table 2 also indicates that almost half (48.3%) of the respondents experienced flood disasters every 1-2 years, while 38.4% experienced it for 3-4 years, respectively. This pattern implies that maize farmers in the study area faced recurrent challenges from floods, which can hinder their ability to sustainably cultivate maize and maintain stable incomes. Annual occurrences of flood disasters could have severe impact on maize production and income. These frequent disasters can lead to crop damage, loss of yields, and increased production costs due to recovery efforts. This agrees in line with Olufayo *et al*. (2019) who stated that frequent flood occurrences significantly affect crop yield and income of farmers in Nigeria. The study further emphasizes that annual floods pose a greater risk to agricultural productivity, as they can lead to soil erosion, waterlogging, and nutrient loss, thereby reducing crop yields. Similarly, Olayemi *et al*. (2017) reported that recurrent floods disrupt farming activities and result in substantial economic losses for maize farmers. The majority of respondents experiencing annual floods indicate a high likelihood of crop damage and reduced yields, leading to income instability. Farmers facing flood disasters every 1-2 years or 3-4 years are likely to encounter recurring challenges in maintaining sustainable maize cultivation and income levels.

Table 2: Distribution of Respondents according to Years and Frequency of Flood Disaster Occurrences (n = 172)

Variables	Frequency	Percentage
Years of flood disaster occurrences		
1-2	83	48.3
3-4	66	38.4
5-6	13	7.6
7-8	8	4.7
9-10	2	1.2
Frequency of flood disaster occurrences		
Biennial	32	18.6
Quadrennial	27	15.7
Annual	106	61.6
Once in a while	7	4.1

4.1.2 Duration and Months of Flood Disaster Occurrence

Table 3 revealed the distribution of respondents according to the duration and months of flood disaster occurrence. Majority (60.4%) of the respondents experienced floods in August-September, which corresponds to the peak of the rainy season in Nigeria. This finding is in line with the seasonal distribution of floods in the region, as reported by Olalekan *et al*. (2015), who note that floods in Nigeria are most prevalent during the peak of the rainy season. About 38.4% of the respondents experienced floods for a relatively short duration of less than a week and 27.3% experienced floods for 1-2 weeks. This finding is consistent with studies by Adelekan (2010) and Filani *et al*. (2016) which indicate that short-duration floods are common in Nigeria and are often associated with heavy rainfall events. Additionally, Table 3 indicates that a significant proportion (34.3%) of the respondents experienced floods in June-July. This corresponds to the onset of the rainy season in Nigeria. This finding is consistent with the literature, which suggests that early-season floods can occur due to heavy rainfall and poor drainage systems (Olalekan *et al*., 2015).

The duration of flooding is critical as it affects the extent of damage to crops and farmland. Shorter durations, such as less than a week or 1-2 weeks, may lead to temporary waterlogging and minimal damage. However, longer durations, such as 2-3 weeks or a month, can cause more severe damage, including crop destruction and loss of farmland (Oladipo, 2016). The result also highlights the occurrence of floods beyond one year, although this is reported by only a small percentage of respondents (0.6%). This finding may indicate prolonged flooding events or recurring floods over multiple years, which can have devastating effects on agricultural activities and livelihoods (Oladipo, 2016). The result also highlights the occurrence of floods beyond one year, although this is reported by only a small percentage of respondents (0.6%). This finding indicate prolonged flooding events or recurring floods over multiple years, which can have devastating effects on agricultural activities and livelihoods (Oladipo, 2016).

Table 3: Distribution of Respondents according to Duration and Months of Flood Disaster Occurrence (n = 172)

Variables	Frequency	Percentage
Duration of stay of flooding		
Less than a week	66	38.4
1-2 weeks	47	27.3
2-3 weeks	39	22.7
A month	12	7.0
Months	7	4.1
Above one year	1	.6
Months of flood occurrence		
June – July	59	34.3
August – September	104	60.4
October – November	6	3.5
December	3	1.7

4.1.3 Type of Damages Experienced Due to Flood Disaster

Results in Table 4 revealed that destruction of crops is the major (95.9%) common type of damage experienced by respondents. This finding agrees with studies by Olufayo *et al*. (2019) and Olayemi *et al*. (2017) who reported that floods often result in the destruction of crops, leading to significant losses in agricultural productivity. The destruction of harvested produce is also prevalent among respondents, with 80.8% reporting this impact. This is in line with the literature, which suggests that floods can damage stored agricultural produce, further exacerbating the economic losses faced by farmers (Olufayo *et al*., 2019). Loss of farmland is another significant impact of flood as reported by the majority (66.3%) of the respondents. Other types of damages were loss of nutrients (90.7%) and loss of life, though reported by only 4.7% of the respondents, is a severe consequence of flood disaster. Olufayo *et al*. (2019) reported that floods can wash away essential nutrients from the soil, reducing its fertility and affecting crop growth and yields.

Table 4: Distribution of Respondents According to Type of Damages Experienced due to Flood Disaster (n = 172)

Type of damages	Frequency	Percentage *
Destruction of crops	165	95.9
Destruction of harvested produce	139	80.8
Loss of farmland	114	66.3
Loss of n utrients	156	90.7
Loss of life	8	4.7

*Multiple response s

4.1.4 Respondents' Perception on the Severity of Flood Disaster Effects

Table 5 shows the distribution of respondents according to their perception of the severity of flood disaster effects in the study area, which indicated that respondents perceived flooding of farmlands as the most severe effect, with 70.3% considering it very severe. This perception aligns with the significant impact floods can have on agricultural activities, particularly on farmlands, leading to soil erosion, nutrient loss, and crop damage as reported by Olayemi *et al*. (2017). Decrease in yield is also perceived as a severe effect (27.3%) on the respondents. This finding is consistent with Olufayo *et al*., (2019) who reported a negative impact of floods on crop yields, which can result in food insecurity and economic losses for farmers. Similarly, a reasonable proportion (36.6%) of respondents perceived the decrease in income due to floods as severe. This agrees with Olufayo *et al*. (2019) which reported that flooding of farmlands affect yields leading to a reduction in income and livelihood insecurity. Flooding of residential buildings is also perceived as a severe effect by almost half (44.2%) of the respondents. This highlighted the broader impact of floods on communities, including damage to infrastructure and displacement of residents, further exacerbating the socio-economic impacts of floods. Difficulty in harvest is perceived as the least severe effect by few (21.5%) of the respondents while this effect may not directly impact the yield or income of farmers, it can contribute to post-harvest losses and add to the overall challenges faced by farmers in flood-affected areas.

Table 5: Distribution of Respondents According to Severity of Flood Disaster Effect s (n = 172)

Variables	**Very severe**		**Severe**		**Not Severe**		**Mean Score**
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	1.81
Flooding of farmlands	121	70.3	46	26.7	5	2.9	
Decrease in yield	47	27.3	97	56.4	28	16.3	1.88
Decrease in income	63	36.6	83	48.3	26	15.1	1.78
Flooding of residential building	76	44.2	62	36.0	34	19.8	1.75
Difficulty in harvest	37	21.5	78	45.3	57	33.1	1.11

4.2 Effects of Flood Effects **Disaster on Yield and Income of the Respondents**

Table 6 shows that there exists a significant difference (P<0.001) between maize yield before flooding and maize yield after flooding which implies that a mean difference of 5.84 bags exist between maize yields before flooding and maize yields after flooding in the study area. The result further reveals that there exists a significant difference (p<0.001) between income before flooding and income after flooding, which implies that a mean difference of ₦583,308.12 exists between maize income before flooding and maize income after flooding in the study area. The effect of flood disaster on maize yield and income is consistent with Olufayo *et al*. (2019) and Olayemi *et al*. (2017) who reported the significant negative effects of floods on maize production and income in Nigeria. These studies imply that floods can lead to crop damage, reduced yields, and farmers financial losses, which aligns with the findings of the current study. It is also consistent with the literature, which suggests that floods can cause a substantial decrease in maize yield due to waterlogging, soil erosion, and nutrient loss (Olufayo *et al*., 2019; Olayemi *et al*., 2017). Olufayo *et al*. (2019) and Olayemi *et al*. (2017) reiterated that floods result in significant farmers financial losses, leading to poverty and food insecurity.

Table 6: Effects of Flood Disaster on Yield and Income

Factor	Before mean	After Mean	Mean difference	T value
Maize yield (bag)	11.3198	5.4826	5.8372	8.633***
Maize income (₦)	722,965.1163	139,656.9709	583,308.1454	6.278***

***= significant at 1% level

4.3 Constraints faced by respondents in mitigating flood disaster

Table 7 revealed constraints faced by respondents in mitigating flood disaster, which include poor government intervention (85.5%), inadequate diversification opportunities (58.7%) and inadequate insurance services (52.3%), which were ranked 1st, 2nd and 3rd, respectively. Poor government intervention can manifest in various ways, such as inadequate infrastructure, lack of support for adaptation measures and ineffective disaster management policies. Limited diversification opportunities can

restrict farmers' ability to mitigate the impact of floods by relying on alternative income sources or crops. Insurance can provide financial protection against crop losses due to floods, but the low percentage implies that many farmers do not have access to insurance cover tailored to their needs. Findings of the study agree with the report of Adekunle *et al*. (2020; Olayemi *et al*., (2017) who reported that poor government intervention, inadequate diversification opportunities and lack of insurance cover were the major constraints towards mitigating the effect of flood disaster.

Other constraints reported by the respondents were ineffectiveness of flood mitigation strategies (51.7%%), poor urban planning and infrastructure (50.0%), inadequate awareness (48.8%), inadequate access to information (46.5%), inadequate access to credit (45.3%) and inadequate/poor policies/programmes on flood adaptation strategies (45.3%) which were ranked 4th, 5th, 6th, 7th, 8th, 9th, respectively. The findings highlight the complex challenges faced by maize farmers in Gombe State regarding flood disaster adaptation. Addressing these constraints will require a multi-faceted approach involving government intervention, improved infrastructure, enhanced awareness campaigns, and better access to financial and technical resources for farmers.

Table 7: Distribution of the Respondents according to Constraints in Mitigating Flood Disaster

Constraints	Frequency	Percentage	Ranking
Poor government intervention	147	85.5	1st
Inadequate diversification opportunities	101	58.7	2nd
Lack of insurance cover	90	52.3	3rd
In-effectiveness of flood mitigation strategies	89	51.7	4th
Poor urban planning and infrastructure	86	50.0	5th
Inadequate awareness	84	48.8	6th
Inadequate access to information	80	46.5	7th
Inadequate access to credit facilities	78	45.3	8th
Inadequate/poor policies/programme on flood adaptation strategies	78	45.3	9th

*Multiple responses

5.0 Conclusion and Recommendations

5.1 Conclusion

The study concluded that flood disaster had negative effects on yields and income of the respondents. It is also concluded that flooding in the study area is primarily

seasonal, with peak occurrences during August and September. Additionally, most flooding events are of short duration and had significant effects on maize farming, particularly in terms of crop damage and loss of farmland of the maize farmers in the study area. Poor government intervention, inadequate diversification opportunities and inadequate insurance cover were major constraints to mitigating the effects of mood disaster in the study area. Based on the findings of the study, the following recommendations were made;

i. Farmers should be encouraged to adopt agricultural extension services which will educate them on the effects of climate change and adaptation strategies such as insurance cover. This will also assist in raising awareness on early signs of flood disaster.
ii. Government should intervene through construction and maintenance of drainage systems in order to avert the devastating effect of the flood disaster.
iii. Extension agents should assist in creating awareness on early signs of flood disaster.
iv. Multi-sectoral approach to flood mitigation as opposed to single sector should be promoted since there are inter-linkages in terms of flood impact on various aspect the of society.
v. There should be adequate provision of weather forecast records and climate related data in addition to a timely revision and adequate monitoring of adaptation/mitigation strategies across the various agricultural zones of the study

References

Adekunle, A. A., Amos, T. T. and Bala, G. O. (2020). Climate Change Adaptation Strategies Among Farmers in Bauchi State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment,* 16(2): 45-52.

Adelekan, I. O. (2010). Vulnerability of poor urban coastal communities to flooding in Lagos, Nigeria. *Environment and Urbanization*, 22(2): 433-450.

Akpabio, E. S., Udeh, V. C., Uzochukwu, I. E. Ikeh, N. E. and Machebe, N. S. (2021). Climate Change and Agricultural Sustainability in Nigeria: An Assessment of the Crop, Forestry, Fisheries, and Livestock Sub-Sectors. In *Handbook of research on climate change and the sustainable financial sector* (pp. 202-228). IGI Global.

Alam, M.M. (2010). Socioeconomic Impacts of Climatic Change on Paddy Cultivation: An Empirical Investigation in Malaysia. *Journal of Knowledge Globalization*, 3(2): 71– 84.

Etuonovbe, A. K. (2017). The Devastating Effect of Flooding in Nigeria. Hydrography and the Environment. Retrieved from http://www.fig.net/pub/fig2011/papers/ts06j/ts06j_etuonovbe _5002.pdf on 11th March, 2024.

Filani, M. O., Akinbode, O. A. and Olufayo, A. A. (2016). Flood vulnerability assessment in Ondo State, Nigeria. *Journal of Sustainable Development*, 9(1): 109-121.

Giller, K. E., Hijbeek, R., Andersson, J. A. and Sumberg, J. (2021). Regenerative agriculture: an agronomic perspective. *Outlook on agriculture*, 50(1): 13-25.

Gombe State Agricultural Development Programme (GSADP) (2018). Annual Progress Report.

Kamara, A., Conteh, A.R., Rhodes, E.R. and Cooke, R.A., (2020). The relevance of smallholder farming to African agricultural growth and development. *African Journal of Food, Agriculture and Nutritional Development,* 19(1): 14043-14065.

Minocha, A., Sim, S. Y., Than, J. and Vakros, G. (2020). Special saving mobilization for agricultural development. In: 19th Annual conference of farm management association of Nigeria (FAMAN) held at Delta State University Asaba, on 18th-29th (2005), 309-315.

Mmom, P. C. and Ayakpo, A. (2014). Spatial analysis of flood vulnerability levels in Sagbama Local Government Area using geographic information systems (GIS). *International Journal of Research in Environmental Studies*, 1: 1-8.

Muhammad, S., Long, X. and Salman, M. (2020). COVID-19 pandemic and environmental pollution: A blessing in disguise. *Science of the total environment*, 728: 0048-9697

National Bureau of Statistics, (NBS) (2021). Labour Force Statistics Employment by Sector Report. Q3 2021 Vol. 2. The Federal Republic of Nigeria, Garki, Abuja, Nigeria.

Nigerian Meteorological Agency (NIMET) (2018). Seasonal Rainfall Prediction (SRP). *Nigeria Climate Review Bulletin.* 5: 63-64.

Ogunbode, T. O. and Oyebamiji, V. O. (2023). Towards a Sustainable City Environment: Resolving the Challenge of Flooding in a Growing Tropical City in Osun State, Nigeria-A Review. *Aswan University Journal of Environmental Studies*, 3(4): 346-356.

Okeleye, S.O. (2016). Impact Assessment of Flood Disaster on Livelihoods of Farmers in Selected Farming Communities in Oke-Ogun Region of Oyo State, *Nigeria. International Journal of Scientific and Engineering Research,* 7(8): 2067–2083.

Oladipo, E. O. (2016). Flood risk and management strategies in Nigeria: A review. *Journal of Geography, Environment and Earth Science International*, 5(2): 1-17.

Olayemi, A. B., Akintoye, H. A. and Adewale, A. R. (2017). Effect of Climate Change on Maize Production in Oyo State, Nigeria. *International Journal of Sustainable Agricultural Research*, 4(2): 31-41.

Olufayo, A. A., Adeaga, O. A. and Adeoye, G. O. (2019). Impact of Flooding on Maize Production in Nigeria: A Review. *International Journal of Agriculture and Biological Sciences*, 3(1): 1-8.

Ramakrishna, G., Solomon, R.G. and Daisy, I., (2014). Impact of Floods on Food Security and Livelihoods of IDP Tribal. *International Journal of Development and Economics Sustainability*, 2(1): 11–24.

Ren, F., Mahmud, J., Azeez, M. A. and Abdulmaliq, S. Y. (2019). Evidence of Climate Change Impacts on Agriculture and Food Security in Nigeria' *International Journal of Agriculture and Forestry*, 2(2): 49-55.

Serote, B., Mokgehle, S., Du Plooy, C., Mpandeli, S., Nhamo, L, and Senyolo, G. (2021). Factors influencing the adoption of climate-smart irrigation technologies for sustainable crop productivity by smallholder farmers in arid areas of South Africa. *Journal of Tropical Agriculture*, 11(12): 12-22.

Tweneboah, R. S. (2020). Factors Influencing Cassava Farmers' Choices of Climate Adaptation Strategies in Rainforest Agro-Ecological Zone of Southwest, Nigeria. *International Journal of Environmental and Agriculture Research*. 6(3): 114-121.