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Impact of Climate Induced Flooding on Food Security and Women Farmers in Ogbaru Local Government Area, Nigeria

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Abstract
The research undertook a comprehensive analysis of the repercussions of climate-induced flooding on food security and the livelihoods of women farmers in the Ogbaru Local Government Area of Nigeria. Data was procured through a combination of structured questionnaires and in-depth interviews. A total of 394 questionnaires were disseminated, of which 388 were returned and subsequently employed in the analytical process. Analysis were operationalsed using descriptive and inferential statistics. The study's findings indicated that rainfall was the predominant catalyst for flooding, while topography was the least contributory factor. Moreover, it was established that the magnitude of food production among female farmers in the Ogbaru LGA is inextricably linked to the climate-induced flood determinants within the locale, namely maximum temperature, minimum temperature, and precipitation levels. Additionally, the research underscored the profound influence of climatic factors on the overall food security of the region. The obstacles confronted by women farmers in the face of climate-induced flooding, while not insurmountable, demand immediate, coordinated, and sustained intervention. Addressing these challenges is not merely a matter of safeguarding livelihoods but is pivotal to the preservation of food security, public health, and the dignity of entire communities. By positioning women at the epicentre of climate resilience initiatives, tangible progress can be achieved in the pursuit of equitable and sustainable development.

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I. Introduction

The contemporary world grapples with a multitude of environmental challenges, among which are soil erosion, flooding, pollution, and climate change. These persistent issues pose a range of deleterious consequences for human health, economic productivity, food security, natural resource management, and the resilience of physical infrastructure. Given the relentless rise in global population, there are compelling indicators that such environmental concerns will continue to endure and perhaps intensify (Mfon, Oguike, Eteng & Etim, 2022). The term "climate change" refers to long-term alterations in global or regional atmospheric conditions. It encompasses shifts in the statistical parameters of the climate system observed over extended periods. Climate change, which became markedly discernible in the mid-20th century, has been largely driven by elevated carbon dioxide emissions resulting from increased fossil fuel combustion. Additional contributors include deforestation, fluctuations in solar radiation, and volcanic activity. Consequently, climate change has emerged as a defining characteristic of the 21st century (World Health Organization, 2021). Despite the seemingly modest global temperature rise of approximately 1.1°C above pre-industrial levels, the ramifications are profound. The Intergovernmental Panel on Climate Change (IPCC, 2021) projects that global temperatures are likely to surpass the critical 1.5°C threshold within the next two decades. According to Akanwa and Ikechebelu (2020), climate change not only affects global temperature but also disrupts the hydrological cycle, leading to intensified precipitation and heightened flood risks. The IPCC (2018) corroborates this, asserting that climate change influences rainfall distribution and places stress on biophysical, social, and institutional systems integral to agricultural productivity. The resultant adverse effects on agriculture inevitably threaten food security.

Globally, the discourse on food security has gained unprecedented prominence in tandem with concerns over climate change. In Africa, projections suggest that rainfall may increase by 10% to 20%—or potentially up to 50%—by 2050 due to climate change (UN, 2021). This is particularly concerning given concurrent demographic expansion. The World Economic Forum (2022) reports that over one-quarter of Africa's population resides within 100 kilometres of the coast. Alarmingly, the number of individuals at risk of coastal flooding is projected to escalate from 1 million in 1990 to 70 million by 2080. By 2100, approximately 410 million people may be exposed to such risk due to sea-level rise caused by oceanic thermal expansion. This phenomenon will significantly impact the Global South, with Nigeria included due to its geographical and socio-economic characteristics. Limited adaptive capacities render populations particularly susceptible to the adverse effects of climate-induced disasters. In Nigeria, rural farmers primarily rely on rain-fed agriculture, a system profoundly vulnerable to climatic variability. As such, climate change is anticipated to severely diminish agricultural yields, exacerbating food insecurity (Akanwa & Ezeomedo, 2018; FAO, 2018).

Food security, as defined by the World Food Summit (1996), denotes consistent access to adequate, safe, and nutritious food that satisfies dietary needs and food preferences necessary for an active and healthy life. It encompasses the availability, accessibility, and quality of food resources. According to FAO (2018), 925 million people globally endure chronic hunger, and up to 2 billion experience intermittent food insecurity primarily due to poverty. Nigeria, the most populous nation in Africa with over 206 million citizens—representing 47% of West Africa's population—has been particularly affected. Climatic variability and extreme weather events are among the principal drivers of rising global hunger and constitute one of the primary causes of acute food crises (FAO, 2018). Alarmingly, less than 2% of Nigeria's cultivated land benefits from irrigation, making the country heavily dependent on rainfall. Over 80% of agricultural output is generated by smallholder farmers. The increasing intensity of climate change is thus likely to result in crop failures, soaring food prices, asset depletion, impoverishment, hunger, and potentially famine.

UN Women (2022) underscores that "gender inequality coupled with the climate crisis is one of the greatest challenges of our time," posing significant threats to livelihoods, health, and security—especially for women and girls. Women are disproportionately impacted due to their heightened dependence on natural resources for subsistence (Odubo, Obafemi & Emenike, 2019). In West Africa, women play a central role in food production and household nutrition. Therefore, building resilience to climate change within the agricultural sector is inextricably linked to women's participation and empowerment (Janna & James, 2021). According to the National Emergency Management Agency (NEMA, 2022), Nigeria experienced its most devastating floods in a decade in September 2022, affecting 34 out of the 36 states. Approximately 3.2 million individuals were impacted, 60% of whom were children. A total of 612 lives were lost, and 1.4 million people were displaced, with Anambra, Bayelsa, Cross River, and Jigawa States bearing the highest burden. In Anambra State alone, 729,000 individuals were affected, with 526,000 displaced across 13 of its 21 Local Government Areas. These floods, exacerbated by intense rainfall and river overflow, inundated farmlands, obliterated crops, contaminated water supplies, and damaged healthcare and sanitation infrastructure. The resultant income loss and increased exposure to waterborne diseases such as cholera, diarrhoea, and malaria have significantly elevated public health risks (UNICEF, 2022).

Ogbaru Local Government Area, situated adjacent to the River Niger, has historically been prone to flooding. The area's flat topography, impervious soil, and lack of vegetative cover have exacerbated this vulnerability. It is nourished by alluvial deposits from the Niger and Ulasi rivers, rendering it highly fertile and conducive to agriculture. As a result, the region is a critical hub for the cultivation of crops such as yam, cassava, potatoes, okra, rice, vegetables, and maize. Nevertheless, recurrent torrential rainfall and resultant flooding have led to the destruction of extensive hectares of farmland. The cascading impacts of such events include the displacement of populations and infrastructure, destruction of livestock and aquatic biodiversity, and structural failure of reservoirs and dams due to sedimentation overload (Ajah, Igbokwe & Anoke, 2021; Akanwa *et al.,* 2022). Although agriculture is the primary livelihood in Ogbaru, climate-induced flooding significantly undermines its productivity. Notably, women farmers are disproportionately affected; yet, extant literature has inadequately examined the extent of their vulnerability. This research seeks to address that gap in understanding.

II. Literature Review

Food insecurity manifests when the rate of increase in food prices surpasses the growth of average income levels. This phenomenon has provoked considerable global concern, a sentiment aptly reflected in the United Nations Sustainable Development Goals (SDGs), which prioritise the eradication of extreme poverty and hunger by the year 2030. The World Food Summit posits that *food security* exists when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." This definition encompasses four interdependent pillars: availability, accessibility (both physical and economic), utilisation, and the stability of these factors over time (FAO, 2018). Food security may also be defined more precisely as the ability to access nutritionally adequate and safe food required for a healthy, active lifestyle. Nalty, Sharkey, and Dean (2017) elucidated the inextricable linkage between food insecurity, hunger, and poverty. Furthermore, a strong correlation exists between food insecurity and malnutrition. For food security outcomes to adequately satisfy human dietary needs, the quartet of availability, accessibility, stability, and utilisation must be meticulously integrated. These dimensions are inherently susceptible to a range of factors such as environmental, economic, social, and political—which themselves are frequently influenced by the ramifications of climate change and corresponding policy responses.

As delineated by the FAO (2017), food security relies on the availability, access, nutritional utilisation, and stability of food supply. These elements, in turn, are significantly shaped by the productivity of agricultural systems (Maxwell & Slater, 2004). The right to food, as enshrined in the International Covenant on Economic, Social and Cultural Rights adopted by the United Nations, is a fundamental human right irrespective of ethnicity, culture, religion, or gender. At the household level, food security connotes sustained access to food over time. This access is contingent upon two primary factors: the consistent availability of adequate food supplies and the financial means to procure them. The notion of food availability encompasses not only presence but also the right timing and quantity, both of which are dependent on efficient systems of production, distribution, and food exchange (IFAD, 2018). This includes the cultivation of crops, rearing of livestock, fisheries production, and collection of wild foods—especially vital for nomadic and indigenous communities. A robust domestic production capacity, consistent import capability, strategic food reserves, efficient transportation networks, social safety nets, and—where necessary—external food aid collectively underpin food availability (Kuwornu, Suleyman, & Amegashie).

Food accessibility refers to the ability of individuals and households to secure food that satisfies their nutritional needs. It encompasses affordability, distribution mechanisms, and cultural food preferences, thus enabling effective conversion of hunger into demand. Here, poverty and vulnerability assume pivotal roles. The purchasing power of households and the presence (or absence) of enabling infrastructure, such as functional markets and transport systems, significantly impact access to food (FAO, FIDA, OMS, PAM, & UNICEF, 2017). Climate change exacerbates these challenges, particularly through extreme events such as floods and droughts, which disrupt infrastructure and supply chains. Consequently, the destruction of roads and transportation networks impedes food distribution and market access. This issue is magnified in rapidly urbanising regions, where spatial disparities in food allocation further complicate matters. The volatility of food prices, often triggered by climate variability, directly influences affordability and thereby accessibility. For example, droughts not only diminish farm yields but also reduce purchasing power due to loss of income.

Food stability concerns the reliability of both supply and access to food. Instability may arise from acute shocks such as climatic variations, resulting in transitory scarcity (FAO, 2017; World Bank Poverty Net, 2008). Seasonal fluctuations in food supply and income, which are heavily influenced by climatic unpredictability, further compromise food stability (IFPRI, 2016). Additional stressors include social unrest, public health crises, political instability, and economic downturns. A stark illustration is the prevalence of HIV/AIDS, which depletes the agricultural labour force and undermines food production. Moreover, conflict is a formidable driver of food insecurity because it damages croplands, disrupting food systems, and precipitating asset loss and displacement (FAO, 2017). In Nigeria and much of Africa, the rise in communal violence and terrorism has exacerbated food insecurity, as fear dissuades farmers, particularly women from working their land due to threats of violence, sexual assault, and even murder. According to FAO (2019), nearly 690 million individuals were undernourished, representing an increase of approximately 60 million since 2014. Paradoxically, global dietary energy supply—measured in kilocalories per capita per day—has increased, averaging around 2,870 kcal between 2017 and 2019. However, the escalation in food prices continues to aggravate food insecurity. The FAO (2020) further reported a dramatic surge in the monetary value of global food exports, which rose from USD 380 billion in 2000 to just under USD 1.4 trillion in 2018. The FAO food price index, which tracks monthly fluctuations in international prices of five key commodity groups which are cereals, sugar, oils, dairy, and meat—rose significantly, from 43.5 to 96.1 points in 2020. Previous spikes in the food price index were recorded during the crises of 2007–2008 and again in 2010–2011. Such volatility undermines food stability. A poignant example is the 2005 Niger food crisis, in which sudden climatic changes and seasonal scarcities resulted in widespread food shortages. These vulnerabilities are exacerbated by droughts, floods, and other disasters severely constrain livelihoods, particularly during peak agricultural seasons (Sani & Kemaw, 2019).

Food utilisation denotes the biological capacity to absorb and metabolise nutrients, influenced by health status, age, and food quality (World Bank, 2008). Sound nutritional outcomes are contingent upon appropriate dietary practices and access to clean water, healthcare, and sanitation. Additionally, food holds intrinsic cultural and social significance, evidenced by practices such as communal Sunday dinners, Sabbath observances, or the breaking of fasts during Ramadan (Maxwell, 2004). Inadequate health infrastructure in developing nations impairs nutrient absorption due to prevalent diseases such as malaria, cholera, and chronic diarrhoea which is a major contributor to malnutrition among children under five.

Given the heterogeneity of food systems, which mirror the diversity of agricultural practices, it is imperative to harmonise adaptation strategies with mitigation objectives. Such alignment must be grounded in principles of environmental sustainability to ensure enduring food and nutritional security. This necessitates a just transition that respects ecological thresholds and socio-economic needs (FAO, 2018). The role of women in West African food systems is indispensable; enhancing their adaptive capacities and guaranteeing their participation in policy formulation and implementation will not only fortify food security, but also bolster resilience against climate-induced shocks.

The Level of involvement of women in farming

Across the globe, women play an indispensable role in the agricultural and rural economies of every region. In the majority of developing nations, a significant proportion of women, particularly those residing in rural areas, rely on agriculture as their principal source of livelihood. These women make substantial contributions to agricultural productivity and the sustenance of food security (UN, 2019). According to the Food and Agriculture Organization (FAO), women are predominantly engaged in a range of agricultural pursuits, including the cultivation of crops, food processing and preparation, animal husbandry, as well as wage labour within agricultural and ancillary rural enterprises. Additionally, their responsibilities encompass the procurement of water and fuel, involvement in petty trade, caregiving for family members, and the maintenance of household affairs.

In the African context, approximately 80% of agricultural output is attributed to smallholder farmers, the majority of whom are rural women. Notably, in Sub-Saharan Africa, women outnumber men in their participation in agricultural activities (Davison, 2017). ActionAid (2015) further reported that in Nigeria, women constitute between 60% and 80% of the agricultural labour force, and are responsible for the production of nearly two-thirds of all food crops.

Odubo, Obafemi, and Emenike (2019), in their examination of women's engagement in agriculture across selected states within the Niger Delta Region of Nigeria, observed a high level of female participation in fishing endeavours. Their findings revealed that women undertake over half of the labour involved in fishing operations, as well as in broader farming activities.

Similarly, Adepoju et al. (2018) documented that women remain industriously engaged throughout the calendar year in the cultivation of food crops, whilst their male counterparts typically undertake limited replanting activities. On average, female farmers contribute between 14 and 18 hours of arduous physical labour daily in various agricultural enterprises. Despite their invaluable contribution to national food security, women in Nigeria reportedly possess a mere one percent of agricultural assets—a disparity driven by entrenched cultural and traditional marginalisation.

A study by Ogato, Boon, and Subramani (2009), entitled "Improving Access to Productive Resources and Agricultural Services through Gender Empowerment: A Case Study of Three Rural Communities in Ambo District," advocates for the empowerment of rural women via enhanced access to essential productive resources and agricultural services. The study posits that such empowerment constitutes a vital mechanism for alleviating rural poverty. It emphasises that improving rural women's access to finance, land, and water resources would significantly bolster their productivity and contribute to improved food security outcomes.

Ayandade (2018) asserts that women's involvement in climate change adaptation strategies—guided by their perceptions, farming experience, and income levels—is not only instrumental in safeguarding the food security of their households but also pivotal in fortifying communal resilience against climate change.

III. Methodology

Study Area

Ogbaru Local Government Area (LGA) is a distinguished administrative entity within the boundaries of Anambra State, Nigeria. It is geographically delineated to the north by Onitsha South LGA, to the south by the States of Rivers and Imo, to the east by the Local Government Areas of Idemili South, Ekwusigo, and Ihiala, and to the west by Delta State. The western frontier of Ogbaru is defined by the meandering course of the River Niger, while a further boundary stretches from Okpoko town to Ogwu Ikpele, abutting Rivers State. To the east, the Ulasi River forms a natural boundary that courses along Ogwu-Aniocha and Osuakwa, while the LGA's boundary extends westward to Okija, traverses Ihiala, and ultimately reaches the strategic Owerri-Onitsha Road (as depicted in Figure 1).

Situated within a vast and fertile wetland region, Ogbaru occupies the southwestern quadrant of the state, its coordinates falling between latitudes 5°42' and 6°08'N, and longitudes 6°42' and 6°50'E. The LGA encompasses a constellation of 16 constituent communities: Atani, Akili-Ozizor, Akili-Ogidi, Amiyi, Mputu, Ossomalu, Obaogwe, Ochuche Umuodu, Okpoko, Ogwu-Aniocha, Ohita, Odekpe, Ogbakuba, Umuzu, Ogwuikpele, and Umunankwo, as illustrated in Figure 1. According to the 2006 census conducted by the National Population Commission, the LGA boasts a population of 221,879 individuals, with an area coverage of 388 square kilometers and a population density of approximately 762.3 individuals per square kilometer (Media Nigeria, 2018). The administrative headquarters of Ogbaru LGA is situated in Atani.

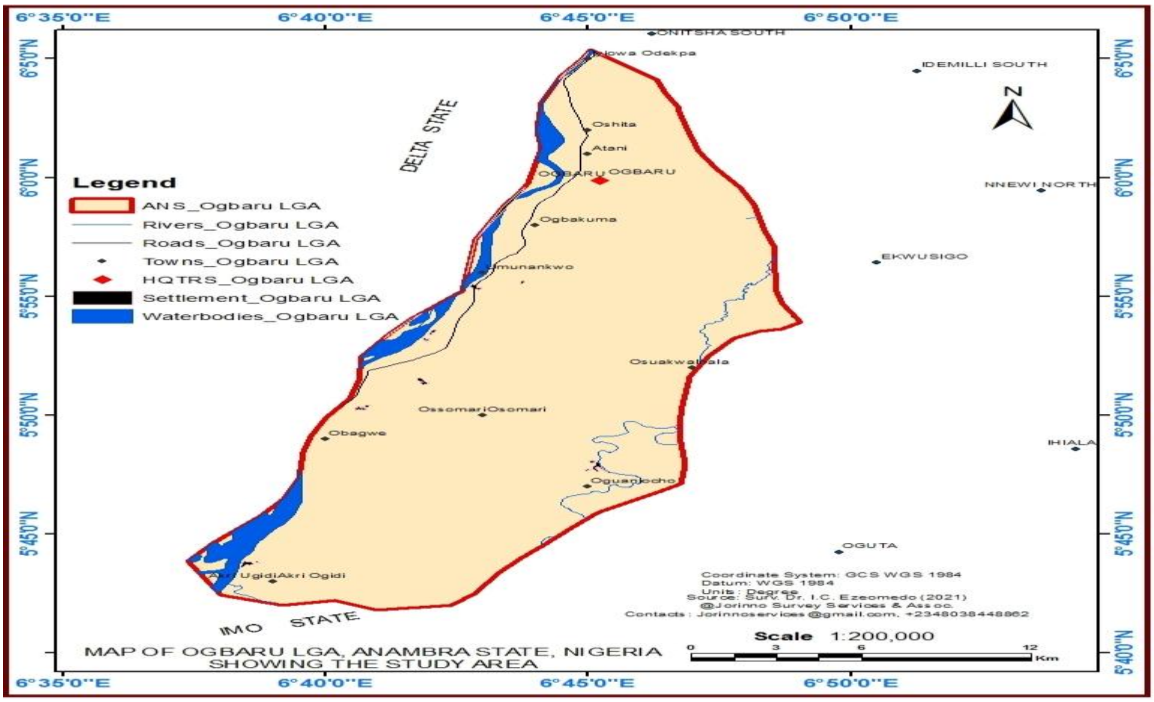

Figure 1: Map of Ogbaru LGA (The Study Area)

Source: Ezeomedo (2019)

IV. Methods

The study adopted a survey design, through which data were meticulously gathered to facilitate the realisation of its objectives. In alignment with the research aims and the inquiries posited to guide the investigation, data were procured concerning the socioeconomic profiles of female farmers in the study locale, the causal factors and repercussions of climate-induced flooding, the extent to which such inundations detrimentally affect crops and, by extension, food security, as well as the degree of floodwater encroachment, among other pertinent variables. Climatic data spanning a period of two decades (2003-2022) were also sourced. Both primary and secondary data repositories were consulted in this regard. Furthermore, demographic information regarding the female farming population was obtained, and geographical representations, including maps of Anambra State and Ogbaru Local Government Area, were likewise made available.

As the study is gender-centric, the sample population was restricted exclusively to females within the selected areas. Thus, the study population is constituted by the entirety of female farmers across the four designated communities in Ogbaru Local Government Area, Anambra State—namely, Atani, Ohita, Ochuche, and Ogbakuba. In the absence of specific data on the number of female farmers, the 1991 population census figures were employed to estimate this cohort. It is of significance to note that agriculture is the predominant occupation within these communities, which collectively house a female population of 10,883. In order to project the current population, calculations were undertaken extending to 2022, employing an annual population growth rate of 2.8 percent. The projections were derived using the formula outlined in Equation 1.

$$Pt = Po\,(1 + r/100)^{n} \text{ ------------------------------ Equation (1)}$$

Where: Po = base population (1991 Population),
n = number of years (31 years)
r = population growth rate (2.8% for Anambra State),
Pt = current population to be determined,
1 = constant

Based on the foregoing calculations, the projected female population in the surveyed communities for the year 2022 was 25,622. This figure constituted the study population. Consequently, a total of 25,622 individuals was utilised as the sample population for the study.

Table 1: Population Projection and Sample Size

S/N	Communities	1991 Population	Projected Population 2022	Sample Sizes	Number of Questionnaire Returned
1	Atani	5,596	13,150	202	199
2	Ohita	760	1,786	28	27
3	Ochuche	2,336	5,490	85	83
4	Ogbakuba	2,191	5,149	79	79
	Total	**10,883**	**25,575**	**394**	**388**

Source: National Population Commission, Awka (NPC, 1991); Projections, 2022

The population under investigation is evidently substantial, as illustrated above. Consequently, to ensure a representative sample, an appropriate sample size was determined. Initially, four communities were selected at random from the entire study area, namely Atani, Ohita, Ochuche, and Ogbakuba. Moreover, the population of women within the sampled communities was utilised to calculate the sample size, as presented in Table 1. Thus, the estimated population of the four sampled communities amounted to 25,575. The target sample for each settlement was then derived by dividing the female population of each community by the total population of the study area, followed by multiplying the result by the study's sample size of 394, thereby determining the specific sample size for each settlement. To arrive at the appropriate sample size, the Taro Yamane formula was applied, as demonstrated mathematically in Equation 2.

$$n = \frac{N}{1 + N(e)^2} \qquad \text{Equation (2)}$$

Where: n = Sample size,
N= Population size,
e = Level of Significance/ limit of error,
1= unit (constant)

The method of proportional sampling was adopted in the selection of communities for the administration of questionnaires. The random sampling technique was employed to ensure that all communities within Ogbaru Local Government Area (LGA) possessed an equal likelihood of being included in the study. To mitigate any potential bias, this random approach was deemed most suitable. Specifically, each community was assigned a unique numerical identifier, and, with the aid of a randomly generated table of numbers, four communities were selected. These communities were Atani, Ohita, Ochuche, and Ogbakuba. Within each of the selected communities, questionnaires were distributed in proportion to the population size of female farmers residing therein. Furthermore, the systematic sampling method was utilised in the distribution of questionnaires across the study area. A precise skipping interval was determined in accordance with the number of households within each community. For instance, in Atani, a skipping interval of 55 households was adhered to, while in Ohita, a skipping interval of 63 households was applied.

A range of statistical techniques was employed in the analysis of the data. Both descriptive and inferential statistics were applied. Descriptive statistics encompassed frequencies, charts, mean scores, and simple percentages, while inferential statistics were calculated using appropriate formulae. The hypothesis postulated—that "flooding has no significant effect on food production among female farmers in Ogbaru LGA"—was tested using Multiple Linear Regression, facilitated by the Statistical Package for the Social Sciences (SPSS). The multiple regression analysis was conducted as follows:

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \cdots + b_nX_n - - - - - - - - \text{Equation (3)}$$

Where $\hat{Y}$ = predicted value of the dependent variable, X_1 through X_n are n distinct independent or predictor variables, b_0 is the value of Y when all of the independent variables (X_1 through X_n) are equal to zero, and b_1 through b_n are the estimated regression coefficients.

V. Findings and Discussions

Determinants of Flooding

The underlying causes of flooding within the study area have been meticulously ascertained. Data was extracted with precision, and mean scores were calculated from diverse inputs, thereby reflecting the relative weight of each variable's contribution to the occurrence of flooding in the region. The results are presented in Table 2. According to the table, climate change stands as the paramount determinant of flooding, commanding a mean score of 4.8, thus establishing it as the preeminent contributor. Excessive precipitation and the inundation of dams also register significant influence, each attaining scores exceeding 4 out of a possible 5, thereby underscoring their considerable impact. Conversely, topography is identified as the least consequential factor in the causation of flooding within the study area.

Table 2: Determinants of Flooding

Variables	5	4	3	2	1	Mean
Excessive rainfall	241	76	39	21	11	4.2
Overflowing of major rivers	216	89	32	11	40	4.0
Insufficient drainages	136	99	68	46	39	3.6
Topography	102	99	88	54	51	3.4
Climate change	301	93		-	-	4.8

Source: Field Survey, 2022

5 – Strongly agree, 4 – agree, 3- Neutral, 2- disagree, 1- Strongly disagree

Effect of Climate Induced Flood on Food Security

The impact of climate change on food security was examined with reference to the data presented in Table 3. To acquire a broad understanding of the situation under scrutiny, minimum and maximum temperatures, along with rainfall data spanning from 2001 to 2021, were sourced from NiMet Awka for the study area. The mean scores for the period 2001-2020 were then calculated. Additionally, data on food production in tonnes were obtained from the Ministry of Agriculture and through field surveys. Averages were similarly computed for the food production statistics, based on the number of years included in the study area. Overall, the table demonstrates that food production and security do not exhibit a consistent trend. For instance, variations in the annual food supply, as depicted in Table 3, are evident. However, the data was subjected to multiple linear regression analysis to more clearly delineate the extent to which climate change predicts food security in Ogbaru LGA.

Table 3: Effect of Climate Induced Floods on Food Production

Year	Mean Max Temp	Mean Minim Temp	Mean Rainfall	Mean food production (Tonnes)
2020	33.092	23.100	228.125	115.000
2019	32.733	23.117	321.950	121.000
2018	32.483	22.375	303.042	112.000
2017	32.758	22.483	301.342	131.000
2016	32.733	22.950	169.575	117.000
2015	32.483	22.908	211.975	121.000
2014	32.925	23.333	139.808	131.000
2013	32.767	21.350	133.617	112.000
2012	32.683	20.842	163.458	158.000
2011	32.767	22.783	151.675	141.000
2010	33.067	23.542	132.158	154.000
2009	32.875	23.333	179.800	123.000
2008	32.658	22.708	171.392	123.000
2007	32.908	22.992	168.900	159.000
2006	32.783	23.500	141.933	167.000
2005	32.425	24.092	158.800	178.000
2004	32.300	24.083	24.083	162.000
2003	32.733	24.250	24.250	198.000
2002	32.658	23.850	23.850	187.000
2001	32.558	24.050	24.050	201.000

Source: Meteorological Agency, 2022; Ministry of Agriculture, 2022;

Climate Induced Flood and Effect on Food Security

The impact of climate change on the forecasting of food security in Ogbaru Local Government Area (LGA) was assessed through the application of multiple linear regression analysis. The dataset utilised for hypothesis testing comprised mean maximum temperature, mean minimum temperature, mean rainfall, and the mean quantity of food produced from 2001 to 2020. Additionally, climate data, specifically maximum temperature, minimum temperature, and rainfall, were also sourced for the period 2001 to 2020. Prior to conducting the primary analysis, preliminary assessments were performed to ensure compliance with the assumptions of normality, linearity, multicollinearity, and homoscedasticity.

In the standard approach to multiple regression, all independent (or predictor) variables are incorporated into the model simultaneously. Each independent variable is then evaluated based on its predictive capacity. The findings of the model are encapsulated in the model summary. The total variance accounted for by the model was 0.788 (78.8 percent), $F(3, 16) = 8.716$, $P = 0.001$.

The results of the test reveal statistical significance, as evidenced by the Sig. F change (P-value) of 0.001, which is less than the threshold of 0.05. The ANOVA table further reflects an F-value of 0.001, underscoring its statistical significance. Consequently, these statistics indicate that the level of food production among female farmers in Ogbaru LGA is significantly influenced by the climate-induced flood predictors within the study area.

Table 4: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.788[a]	.620	.549	19.726556	.620	8.716	3	16	.001

a. Predictors: (Constant), rainfall, Maximum temperature, minimum temperature
b. Dependent Variable: food security
Source: Statistical Computations, 2022

Table 4: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10174.758	3	3391.586	8.716	.001[b]
	Residual	6226.192	16	389.137		
	Total	16400.950	19			

a. Dependent Variable: food security
b. Predictors: (Constant), rainfall, Maximum temperature, minimum temperature

Source: Statistical Computations, 2022

Table 5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	420.302	762.187		.551	.589	-1195.462	2036.065					
	Maximum temperature	-13.819	22.700	-.095	-.609	.551	-61.941	34.303	-.236	-.150	-.094	.966	1.035
	Minimum temperature	9.043	5.882	.270	1.537	.144	-3.427	21.512	.567	.359	.237	.771	1.297
	Rainfall	-.197	.058	-.598	-3.388	.004	-.321	-.074	-.744	-.646	-.522	.761	1.315

a. Dependent Variable: food security

Source: Statistical Analysis 2022

In the Standardised Coefficient Table, the Beta values were scrutinised to determine the extent to which the independent variables contributed to the predictive power of the dependent variable. In this context, the Beta coefficient of 0.270 pertained to the mean minimum temperature, whereas the mean maximum temperature exhibited a Beta coefficient of -0.95, and rainfall demonstrated a value of -0.598. Furthermore, the table encapsulated the correlation coefficients, which, upon squaring, elucidated the contribution of each variable to the total R-squared value. This, in essence, provides a measure of the proportion of the total variance in the dependent variable that can be uniquely attributed to each independent variable. Within the table, the part correlation coefficient for mean maximum temperature was found to be 0.094, while that for mean minimum temperature stood at 0.237, and for rainfall, it was 0.522. Collectively, the findings from the analysis suggest that climate change exerts a profound and statistically significant influence on food security. To rephrase, the volume of food produced by women farmers in the study region is intimately and considerably influenced by the climatic variables prevailing in the area between 2001 and 2020.

VI. Discussions

The adverse repercussions of climate-induced flooding on the crop yields and agricultural productivity of women farmers would, by extension, severely undermine their livelihoods, thereby exacerbating food insecurity within the household. The provision of adequate sustenance for families, in the current era marked by climate perturbations, has become an increasingly formidable challenge, further aggravated by the global economic downturn. The considerable family sizes identified within the study area would invariably augment the strain on food security, particularly within female-headed households, as corroborated by Sheheli (2015). The women farmers surveyed noted a marked diminution in the availability of food for their families. The availability of both sustenance and potable water remains indispensable for the realisation of food security. However, the flooding events lead to the contamination of water resources essential for maintaining health, a finding which aligns with the observations made by Fatile (2013). In circumstances where the food supply is inadequate and nutritionally deficient, there is an elevated risk of malnutrition and the onset of various diseases. The work of Nnodim and

Ezekiel (2020) also highlights that in the Orashi Region, flooding has grave and deleterious consequences for the survival and livelihoods of the local population. Given that women constitute the primary producers of food, their livelihoods are disproportionately vulnerable in the face of severe flooding events in the study area. While such flooding events may appear to be seasonal, their occurrence invariably results in profound and enduring negative consequences.

VII. Conclusion and Recommendations

The impact of climate-driven flooding on women farmers, as revealed in this study, is both profound and multifaceted. It extends beyond the immediate physical destruction of farmlands and harvests, touching the very core of family survival and community well-being. Women, who form the backbone of agricultural production and food provisioning in the study area, are disproportionately affected by the recurring menace of floods. These floods, though seasonal, bring with them a ripple of destruction that lingers long after the waters have receded—disrupting farming cycles, contaminating water sources, and diminishing food availability. The loss of crops translates directly into a loss of income and food, thereby increasing food insecurity within households. This is especially significant considering the prevalence of large family sizes and the socio-economic pressure faced by female-headed households, who must stretch limited resources even further to meet basic needs.

Food security, already under strain due to global economic instability, is further threatened by the reduced productivity of women farmers. The decrease in food quantity reported by the women in this study is a clear indication of the deepening struggle to maintain household nourishment. With contaminated water sources becoming the norm during flood periods, the challenge extends beyond food to include water security, compounding health risks and increasing vulnerability to waterborne diseases and malnutrition. These interconnected issues reflect a broader systemic problem, where environmental degradation, gender inequality, and poverty intersect.

In light of these findings, it is imperative to shift focus towards holistic and gender-responsive strategies that not only address the immediate effects of flooding but also build long-term resilience among women farmers. Governments and development agencies must prioritize the inclusion of women in climate adaptation planning and decision-making processes. There should be deliberate investment in climate-smart agricultural technologies that are accessible and practical for women, including the provision of flood-resistant crop varieties, irrigation systems, and tools designed with gender considerations. Strengthening early warning systems and community-based disaster preparedness can also help mitigate the shock of future flood events.

Moreover, it is essential to create enabling environments that support women's access to land, credit, insurance, and extension services. These resources are critical for empowering women to recover from climate shocks and invest in sustainable practices. Education and training programs should also be intensified to build women's technical capacity in climate adaptation and risk management. Lastly, social protection programs must be expanded to cushion the most vulnerable, especially female-headed households, from the harsh economic impacts of floods.

In conclusion, the challenges faced by women farmers in the context of climate-induced flooding are not insurmountable, but they require urgent, coordinated, and sustained action. Addressing these challenges is not just about protecting livelihoods—it is about safeguarding the food security, health, and dignity of entire communities. By placing women at the center of climate resilience strategies, we can make meaningful progress toward equitable and sustainable development.