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Examining the Nexus between Climate Variability and Food security in Nasarawa State, Nigeria

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Abstract

Climate variability remains a critical challenge to global and national food security, particularly in regions highly dependent on rainfed agriculture, such as Nigeria. This study investigates the nexus between climate variability and food security in Nasarawa State, Nigeria. A total of 450 copies of the structured questionnaire gathered were administered to farmers using stratified random sampling techniques. Data collected were analysed using frequency, percentages, Likert scale, and regression, and the results were presented on tables. Results of the analysis show that the majority (58.3%) of the respondents are male. A significant proportion of respondents (90%) believe that rising temperature and decrease in rainfall are occurring, hence resulting in extreme weather, thereby affecting food security. Regression analysis shows that a temperature increase ($\beta = 0.45$, $p < 0.001$) with a negative coefficient of 0.45 suggests that as temperatures increase, food security decreases. The negative impact of erratic rainfall ($\beta = 0.30$, $p < 0.001$) shows that, as rainfall becomes erratic, food security decreases. It is therefore recommended among others that farmers should integrate climate-smart agricultural practices, like water conservation techniques, to improve yields under changing climatic conditions.

Keywords: Climate Variability, Food Security, Nasarawa state, Nigeria

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1. INTRODUCTION

Globally, climate variability has led to increased occurrences of extreme weather events, such as hurricanes, heat waves, and prolonged droughts, which threaten food security (Intergovernmental Panel on Climate Change, 2021). The rising global temperatures have disrupted food production systems, affecting both crop yields and livestock production, thereby exacerbating food insecurity worldwide (FAO, 2022). According to the United Nations Environment Programme (2023), global food production is expected to decline by up to 30% in some regions by 2050 due to climate-induced disruption. The challenges of climate variability pose significant threats to achieving the United Nations Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 13 (Climate Action), and SDG 15 (Life on Land). The decline in food production directly hinders efforts to eradicate hunger and malnutrition, making it more difficult to ensure access to safe, nutritious, and sufficient food for all (UNDP, 2023).

Food security is a major concern for sub-Saharan countries, where agricultural production is far from much below the demand of the fast-growing population (Ogunlade et al., 2010). Africa is highly vulnerable to climate variability due to its dependence on rainfed agriculture and limited adaptive capacity. Changes in temperature and precipitation patterns have contributed to desertification, soil degradation, and increased frequency of droughts in many parts of the continent (African Union, 2022). In West Africa, including Nigeria, irregular rainfall has caused prolonged dry spells and reduced water availability for irrigation, affecting staple crops such as maize, millet, and rice (World Bank, 2021). A report by the International Food Policy Research Institute (IFPRI, 2023) highlights that food insecurity in sub-Saharan Africa has worsened due to climate variability, with an estimated 30% of the population experiencing food shortages.

The major challenge now is how to adapt food

systems and livelihoods to the expected variability and change in climate (Ziervogel & Eriksen, 2020), especially in Sub-Saharan Africa, where crop production is highly dependent on intraseasonal and interannual variation in rainfall (Schulze et al., 2020). Realising this challenge requires understanding site-specific variability and expected changes in climate to facilitate quantification of expected impacts on crop yields (Sultan et al., 2013). Although knowledge on climate variability has substantially increased over the last 10 years, there is still a dearth of local-specific expected changes and the expected effects on crop yields in general. Food security in Nasarawa State is increasingly under threat due to the adverse effects of climate variability. Farmers experience reduced agricultural productivity due to irregular rainfall, prolonged dry spells, and extreme weather conditions. These climatic changes lead to poor harvests, food shortages, and increased food prices, exacerbating hunger and malnutrition among vulnerable populations. This study seeks to examine the nexus between climate variability and food security, as it affects affordability, availability, and accessibility in Nasarawa State.

1.2 Statement of the Problem

Climate variability poses a significant threat to global food security by disrupting agricultural productivity and access to nutritious food. The Intergovernmental Panel on Climate Variability (IPCC, 2021) states that rising temperatures and extreme weather events such as droughts, floods, and storms have both direct and indirect negative effects on food production systems. These factors lead to reduced crop yields, soil degradation, and increased pest and disease outbreaks, which exacerbate food insecurity worldwide.

In Nigeria, interannual rainfall variability has emerged as a primary source of tension for farming and crop production. Unpredictable weather conditions have led to declining agricultural productivity, negatively impacting the availability and affordability of food. Specifically, climate-induced droughts and floods have reduced yields, leading to increased hunger levels, particularly among rural populations. In Nigeria, studies have also shown that climate variability has severe implications for food security. Nwajiuba (2019) found that unpredictable weather conditions in Nigeria have led to declining agricultural productivity, negatively impacting food availability and affordability. Ebele and Emodi (2016) emphasise that climate variability-induced droughts and floods have reduced crop yields, leading to food shortages and increased hunger, particularly among rural populations.

The situation in Nasarawa State is increasingly critical, as food security is under threat from irregular rainfall and prolonged dry spells. These climatic changes result in poor harvests and inflated food prices, worsening malnutrition among vulnerable groups. Furthermore, there is a significant lack of adaptive strategies and policies to mitigate these climate-induced risks within the state, such as drought-resistant crop varieties and improved irrigation techniques. While existing research has explored these effects in various regions of Nigeria, there remains a notable gap concerning the specific nexus between climate variability and food security in Nasarawa State. This study, therefore, seeks to examine the nexus between climate variability and food security in Nasarawa State, Nigeria.

1.3 Research Questions

The study provided answers to the following questions:

i. What is the impact of climate variability on agricultural productivity in the study areas?
ii. How does climate change affect food security in the study area?

1.4 Objectives of the Study

The study aims to investigate the nexus between climate variability and food security in Nasarawa State, Nigeria.
The specific objectives are to:

i. Assess the impact of climate variability on agricultural productivity in the study areas.
ii. Examine the nexus between climate variability and food security in the study area.

1.5 Research Hypotheses

The hypotheses tested in this study are in line with the research questions and objectives as shown below:

i. There is no significant impact of climate variability in Nasarawa State.
ii. There is no significant relationship between climate variability and food security. Nasarawa State

1.5 Study Area

Nasarawa State is located between latitudes 7o and 9o N and longitudes 7o and 10o E. It shares boundaries with Benue State to the south, Kogi State to the west, the Federal Capital Territory (FCT) to the northwest, Kaduna and Plateau States to the northeast, and Taraba State in the southeast (see Figure 1). Nasarawa State has a total land area of 12,000 square kilometres and is divided into thirteen (13) Local Government Areas (LGAs).

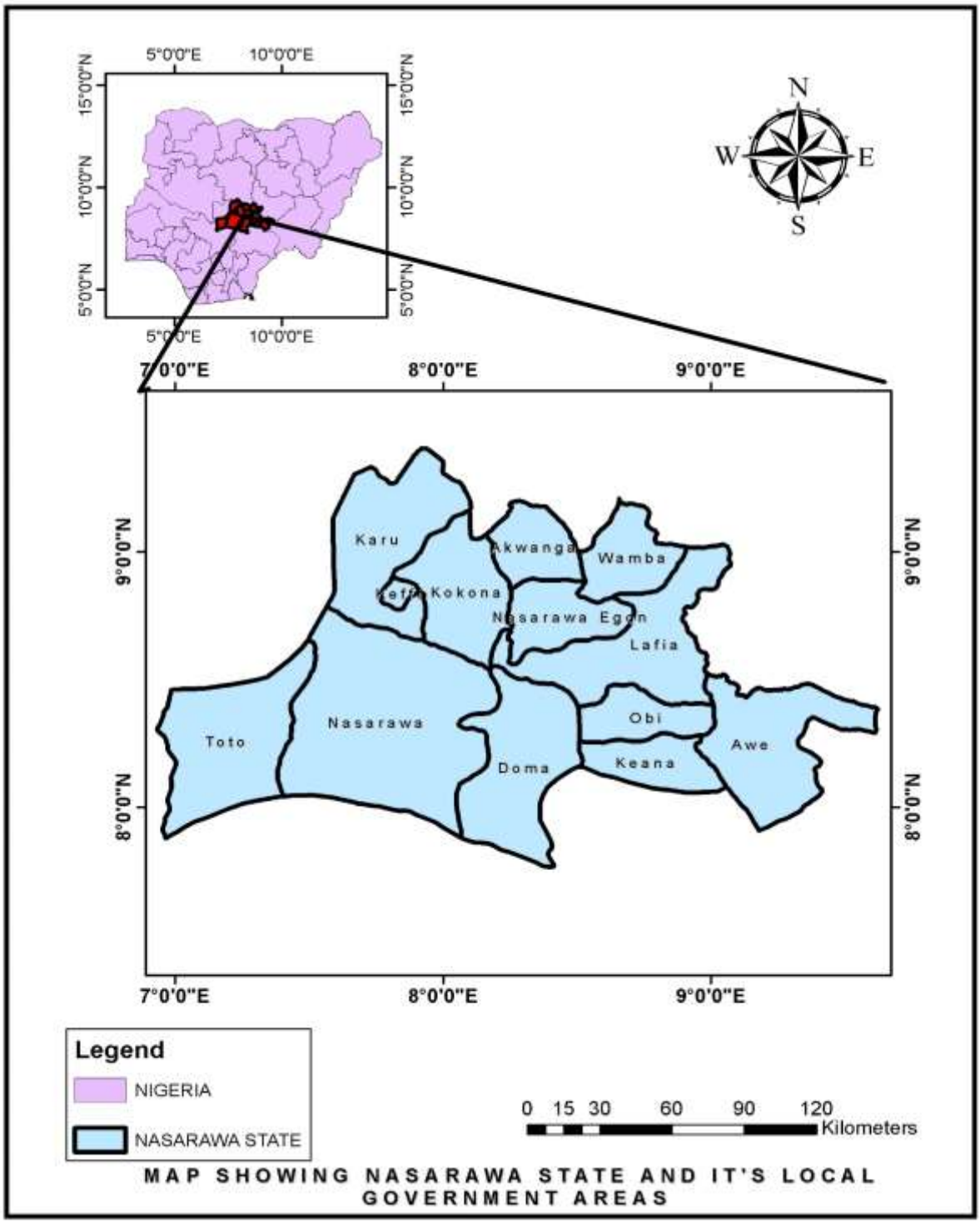

Figure 1: Nigeria Showing Nasarawa State
Source: NASRDA Abuja, 2025

2. LITERATURE REVIEW

Several studies have examined the link between climate variability and food security globally and in Nigeria. Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life (FAO, 1996). The stability of food systems is particularly threatened by climatic changes, economic downturns,

and political instability. The relationship between climate variability and food security is complex and multidimensional.

Climate variability directly affects food production systems through changes in temperature, rainfall, and extreme weather events. It also indirectly affects food security by influencing economic stability, trade patterns, and social structures (Wheeler & von Braun, 2013). A study by Lobell et al. (2011) highlights how global warming reduces crop yields by altering precipitation patterns and increasing heat stress on plants. Similarly, Wheeler and von Braun (2013) argue that climate variability intensifies food price volatility, leading to socioeconomic instability, particularly in low-income countries.

Climate variability has led to a lot of devastating consequences and effects in various parts of Nigeria (Odjugo, 2010). In Nigeria, studies have also shown that climate variability has severe implications for food security. Nwajiuba (2019) found that unpredictable weather conditions in Nigeria have led to declining agricultural productivity, negatively impacting food availability and affordability. Ebele and Emodi (2016) emphasise that climate variability-induced droughts and floods have reduced crop yields, leading to food shortages and increased hunger levels, particularly among rural populations.

Nasarawa State, located in Nigeria's North Central region, experiences a tropical climate characterised by distinct wet and dry seasons. However, recent climate variability has led to irregular rainfall, prolonged droughts, and flooding, which negatively impact agriculture (Ozor et al., 2010). Given that agriculture is the mainstay of Nasarawa's economy, these climatic challenges pose a serious threat to food security. The interplay between climate variability and food security is evident, with rising temperatures, erratic rainfall, and extreme weather events threatening food production and livelihoods. In Nasarawa State, these challenges manifest in reduced crop yields, increased food prices, and economic vulnerabilities.

Yakubu (2015) assessed the impact of rainfall variability on tuber crops (yam and cassava) in Kaduna State of Nigeria. The study used data from the Kaduna State Ministry of Agriculture for a period of 15 years (1996-2010). Descriptive and inferential statistics, particularly the Pearson product moment correlation coefficient, were used to analyse the data. The results indicated that yam yield had a direct relationship with rainfall with a correlation coefficient of 0.195, and cassava yield had an inverse relationship with rainfall with a correlation coefficient of 0.001, implying that an increase in rainfall led to increased and decreased yields of yam and cassava, respectively. The study concluded that variations in the amount of rainfall have a significant effect on the yield of tuber crops (yam and cassava) in the studied area.

Agashua (2016) assessed the effect of rainfall variability on the production of yam in the UKUM local government area of Benue State, Nigeria. Using rainfall data from the Nigerian Meteorological Agency's Ibi station and yam yield from BNARDA, Makurdi, he correlated these rainfall and yam yield data. The Agashua's study showed that the difference in the annual rainfall in the study area within the period of study (1995-2012) was very minimal. This implies that there was a little disparity in the amount of rainfall in the study area within the period of study. However, the author also pointed out that there has been an increasing trend in the annual rainfall in the UKUM. He concluded that there has been an increase in yam yield because of the increase in rainfall in the study area. The study showed a negative relationship between annual rainfall and yam yield in the study area. Collectively, these studies underscore the significant impact of climate variability on food security in Nigeria.

3. METHODOLOGY

Examining the relationship between climate variability and food security: Food security indices were analysed using descriptive statistics such as cumulative and percentages. Also, regression analysis was used to determine the relationship between climate variability variables and food security.

3.1 Method of Data Collection

Data was collected through the following:

a) Primary data, which includes conducting individual interviews for farmers and agricultural extension officers to gain insights on climate variability. Also, numerical data was collected to identify patterns, correlations, and trends in food security in relation to climate variability.

b) Secondary data which includes meteorological records from relevant agencies (Nasarawa State University Weather Stations) and agricultural reports, policy documents, and previous studies were reviewed.

3.2 Sample Size

The sample size was determined using the Yamane formula based on the farmers' record that was obtained from the Nasarawa State Ministry of Agriculture. A minimum of 450 respondents from the thirteen (13) local governments were targeted to ensure statistical significance and avoid bias.

3.3 Analytical Techniques

Descriptive statistics (Likert scale measurement) and regression analysis were carried out to assess the nexus between climate variability and food security.

4. RESULTS AND DISCUSSIONS

Analysing the relationship between climate variability and food security provides a comprehensive approach to understanding the multifaceted ways in which climate variability impacts food systems. The climate variability impact on food security in the study area is presented in Table 5.1.

Table 5.1: Impact of Climate Variability on Food Security

Impact of Climate Variability	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Total (%)
Increase in temperature	40%	35%	15%	10%	100%
Decrease in rainfall	30%	40%	20%	10%	100%
Increase in extreme weather events	50%	30%	15%	5%	100%
Changes in growing seasons	45%	35%	10%	10%	100%

Results on table 5.1 show that a high percentage (90%) of respondents agreed that rising temperatures and decreased rainfall are occurring, aligning with global reports on the effects of climate variability in sub-Saharan Africa (FAO, 2020). The 90% agreement among respondents that rising temperatures and decreased rainfall are occurring suggests that the residents of Nasarawa State are directly experiencing and observing the impacts of climate variability. This aligns with global observations, such as those highlighted in FAO (2020), which emphasises the increased variability in temperature and precipitation patterns in Sub-Saharan Africa. These changes can disrupt agricultural practices, particularly in rainfed farming systems that many rural communities in Nasarawa rely on for their livelihoods. Decreased rainfall can lead to droughts, which will reduce crop yields and negatively affect food availability. With higher temperatures, the growing seasons for various crops may shorten, leading to lower productivity and, ultimately, food insecurity.

It was revealed that half of the respondents strongly agreed that climate variability leads to more extreme weather events, further supporting research by Adger et al. (2014), which links increased climate variability to food security challenges. The finding that climate variability is contributing to more extreme weather events (e.g., floods, droughts, and storms) underscores the increasing unpredictability of weather patterns. According to Adger et al. (2014), the variability in climate often leads to heightened food security challenges because extreme weather events can devastate crops, reduce food supply chains, and disrupt the livelihoods of farmers. Extreme weather events such as flooding or prolonged droughts can directly damage infrastructure, including irrigation systems, roads, and markets, which are critical for food distribution. This would likely result in food shortages, price increases, and reduced access to food for vulnerable populations in Nasarawa State.

Table 5.2: Linear Regression Analysis of the Nexus between Climate Variability and Food security

Variable	Coefficient (β)	Standard Error	Tvalue	pvalue
Intercept (β_0)	3.50	0.20	17.50	<0.001
Temp (β_1)	0.45	0.10	4.50	<0.001
Rainfall (β_2)	0.30	0.08	3.75	<0.001
Transport (β_3)	0.25	0.07	3.57	<0.001
Prices (β_4)	0.50	0.12	4.17	<0.001

The intercept of 3.50 suggests that when all independent variables are at zero, food security is 3.50. This could represent a baseline affordability score. The negative coefficient for temperature ($\beta_1 = 0.45$, $p < 0.001$) suggests that as temperatures rise due to climate variability, food security decreases. A unit increase in perceived temperature changes leads to a decrease in food security by 0.45 units. This is statistically significant (p-value < 0.001), indicating that temperature changes are a major factor in reducing food security. This is aligned with findings from Schlenker and Roberts (2009), who argue that temperature increases can reduce crop yields, leading to higher prices and reduced affordability of food.

A negative coefficient for rainfall variability ($\beta_2 = 0.30$, $p < 0.001$) suggests that as rainfall becomes more erratic or less predictable, food security decreases. The impact of changing rainfall patterns on food production, as shown in various studies (FAO, 2020), supports this result. A unit increase in rainfall variability leads to a decrease in food security by 0.30 units. These findings underscore how disrupted rainfall patterns can reduce crop productivity and drive up food prices. Transport disruptions also have a negative impact on food security. Climate variability (β_3

= 0.25, p < 0.001) can damage transportation infrastructure (e.g., through floods or landslides), which in turn increases the cost of moving food to market. This coefficient suggests that disruptions in transport reduce food security by 0.25 units. This is in line with Challinor et al. (2014), who note that climate-induced damage to infrastructure exacerbates food insecurity by limiting market access.

The most significant factor affecting food security appears to be price increases (β_4 = 0.50, p < 0.001). As food prices rise due to climate-induced disruptions in supply chains and agricultural production, affordability decreases significantly. A 1-unit increase in perceived price increases leads to a 0.50-unit reduction in food security. This result is consistent with the work of Ecker et al. (2012), who argue that rising food prices during climate-related shocks are a key factor affecting food security. The study therefore highlighted the decline in food security because of the impact from erratic weather patterns like increased temperature and reduced rainfall. These factors lead to increased food insecurity, as local communities face challenges in growing enough food to meet their needs. As a result, many households are experiencing rising food prices and greater reliance, putting additional strain on household budgets and nutrition.

REFERENCES

Adeola, A., et al. (2022). "The Impact of Climate Change on Agricultural Production and Food Security in Nigeria." *Environmental Economics and Policy Studies*, 24(3), 505517.

Adesina, K., & Fashola, O. (2022). The impact of Climate Change on food security in Sub-Saharan Africa. African Journal of Climate Studies, 10(2), 112125.

Adewuyi S. A, Okojie L. O, Folorunso B and Bada B. S. (2014). Effect of Climate Change on yam and cassava production in Oyo state, Nigeria: A cointegration model approach. International Journal of Agricultural Economics & Rural Development 6 (1): PP. 5467.

African Union (2022). Climate Change and Food Security in Africa. African Union Report.

Agahiu A. E, Udensi U. E, et al (2011). Assessment of Weed Management Strategies and Intercrop Combinations on Cassava Yield in the middle belt of Nigeria .*African Journal of Agricultural Research Vol. 6(26), pp. 57295735, 12 November, 2011*

Agashua, H. (2016). Effect of Rainfall Change on the production of yam in Ukum Local Government Area of Benue state. *Unpublished undergraduate research project,* Department of Geography, Ahmadu Bello University Zaria Nigeria.

Akinola, A. O., et al. (2019). *Climate Change and its Impact on Food Security in Nigeria: Challenges and Policy Implications*. Agricultural Economics.

Ani, K. J., et al (2022). The impact of Climate Change on food and human security in Nigeria. International Journal of Climate Change Strategies and Management, 14(2), 148167.

Bai, Y., et al (2019). Impacts of Climate Change on food security in developing countries: A systematic review. Climate Policy, 19(6), 745762.

Barrett, C. B. (2010). Measuring food insecurity. Science, 327(5967), 825828.

Challinor, A. J., et al. (2014). A meta-analysis of the impact of Climate Change on food production in sub-Saharan Africa. Environmental Research Letters, 9(3), 034001. https://doi.org/10.1088/17489326/9/3/034001

Ebele, N. E., & Emodi, N. V. (2016). Climate Change and its impact on the Nigerian economy. Journal of Scientific Research and Reports, 10(6), 113.

Ecker, O., et al. (2012). Food Security and Climate Change in the Sahel: Impacts and Policy Responses. The International Food Policy Research Institute (IFPRI). Retrieved from [IFPRI website].

FAO (2016). *The State of Food Security and Nutrition in the World: Safeguarding against economic slowdowns*. FAO.

FAO. (2018). The State of Food Security and Nutrition in the World 2018. *Food and Agriculture Organization of the United Nations*. Retrieved from http://www.fao.org/3/I9553EN/i9553en.pdf

FAO (2020). The Impact of Climate Change on Food Security in Developing Countries. Food and Agriculture Organization of the United Nations. Retrieved from [FAO website].n

FAO (2021). The state of food security and nutrition in the world. Rome: Food and Agriculture Organization.

FAO (2022). Climate Change and food security: Risks and responses. Food and Agriculture Organization of the United Nations.

Federal Ministry of Agriculture and Rural Development (2022). National Food Security Strategy. Government of Nigeria.

Federal Ministry of Environment (2006). Annual Report for 2006.Official Gazatte also available on *www.nigerianstat.gov.ng*.

International Food Policy Research Institute (2023). Food Security in a Changing Climate. IFPRI Research Report.

IPCC (2021). Climate Change 2021: The Physical Science Basis. Intergovernmental Panel on Climate Change.

Lobell, D. B., Schlenker, W., & Costa Roberts, J. (2014). Climate Trends and Global Crop Production Since 1980. *Science, 333*(6042), 616620. https://doi.org/10.1126/science.1204531

Maxwell, S., & Smith, M. (1992). Household food security: A conceptual review. Institute of Development Studies Bulletin, 23(3), 112.

National Bureau of Statistics (2023). Agricultural Sector Performance Report. NBS Publication.

Nigerian Meteorological Agency (2022). Annual Climate Review. NiMet Report.

Nigerian Meteorological Agency (2023). Climate Change in Northern Nigeria. NiMet Report.

Nwafor, J. C. (2020). Food security and Climate Change adaptation in Nigeria. Journal of Development Studies, 56(8), 10211038.

Nwajiuba, C. U. (2019). Climate Change and agricultural productivity in Nigeria. African Journal of Agricultural Research, 14(23), 12341245.

Obinna, U., et al (2023). Rising food prices and food insecurity in Nigeria: The role of Climate Change. African Development Review, 17(3), 203219.

Odjugo P. A. O (2010). General Overview of Climate Change Impacts in Nigeria *Journal Hum. Ecol.,29(1), 4755.*

Ogundipe, A. A., Ogunniyi, A., et al (2020). Impact of Climate Change on food security in Nigeria. Environmental and Socioeconomic Studies, 8(4), 1222.

Okonkwo, L., & Adepoju, T. (2023). The effect of Climate Change on food distribution networks. Journal of Agricultural Economics, 11(1), 89103.

Ozor, N., et al. (2010). Climate Change and adaptation strategies in agriculture. African Journal of Agricultural Research, 5(6), 459466.

Schlenker, W., & Roberts, M. J. (2009). Nonlinear temperature effects indicate severe damages to U.S. crop yields under Climate Change. *Proceedings of the National Academy of Sciences*, 106(37), 1559415598. https://doi.org/10.1073/pnas.0906865106

Schmidhuber, J., & Tubiello, F. N. (2007). Global food security under Climate Change. Proceedings of the National Academy of Sciences, 104(50), 1970319708.

Schulze., Roland, E., et al (2020). Global Climate Change and agricultural productivity in South Africa, Global environment change 3 (4): 330349.

Ume, K., et al. (2022). Climate Change and food security in Nigeria. International Journal of Food Studies, 14(3), 155170.
UNDP (2023). Sustainable Development Goals Report. United Nations Development Programme.

UNEP (2023). Climate Change and Global Food Production. United Nations Environment Programme.

United Nations (2023). SDGs and Climate Change Mitigation. United Nations Report.

Wheeler, T., & von Braun, J. (2013). Climate Change impacts on global food security. Science, 341(6145), 508513.

World Bank (2021). West Africa's Climate Change Challenges. World Bank Publications.

World Bank. (2022). The global food security report. World Bank Group.

Yakubu A. O (2015). Assessing the Impacts of Rainfall Variation on Production of Tuber Crops in Kaduna State. *Unpublished undergraduate research project,* Department of Geography, Ahmadu Bello University Zaria Nigeria.

Ziervogel, G and Eriksen.P.J. (2020). *Adapting to Climate Change to sustain food Security*, Wiley Interdisciplinary Reviews: Climate Change 1(4):525540 July/August 2020