

Food Security: The Impact of Climate Change on Agricultural Production in Rural Areas of Afijio Local Government Area of Oyo State, Nigeria

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Abstract

This study analysed the impact of climate change on agricultural production with reference to farming activities in the rural areas of Afijio Local Government Area (LGA) of Oyo State, Nigeria. The research design adopted for this study was a descriptive survey with data collected through primary and secondary sources. Primary data were collected via interviews and focus groups with local agricultural producers, while secondary data sources include scientific journals and other relevant studies. Two hundred (200) copies of questionnaire were produced and administered on the randomly selected respondents. Statistical tools such as simple frequency counts, percentages, and correlation analysis were used to analyze the data. The results obtained revealed that, the vast majority of people in the area dependent on rainfall for agricultural activities, especially farming. Most of the crops in the area are rain-fed and these include, among others, cassava, maize, yam and vegetables. The results further revealed that, climate change has impacts on farming activities. Also, result further showed that improved yield lowers crop prices and enhances income generation, job creation and poverty reduction. It was concluded that, there are several opportunities for the government, policy makers, and local authorities to make the rural areas benefit more from agro-economic activities if necessary proactive measures are put in place. The study recommends implementation of intensive irrigation projects by the government at all levels in order to address the problems of climate change and boost the agricultural production, reduce prices of agricultural produce, so that, food supply and security can be sustained at moderate prices in Afijio

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Local Government Area of Oyo State, in particular, and Nigeria in general.

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Introduction

Several African countries, Nigeria inclusive, have their economies largely based on weather-sensitive agricultural productions systems; and so vulnerable to climate change. Climate change has emerged as a critical global challenge, significantly affecting various sectors, particularly agriculture, which remains the backbone of rural economies in developing countries like Nigeria (Oladipo and Dada, 2021). In the rural areas of Afijio Local Government Area (LGA) of Oyo State, agriculture is not only the primary source of livelihood but also crucial for ensuring food security (Ajayi and Fadare, 2023). However, the increasing variability in climatic conditions, such as erratic rainfall, rising temperatures, and frequent extreme weather events, poses a severe threat to agricultural productivity and, by extension, food security in this region. The situation in Afijio LGA is exacerbated by socio-economic challenges such as poverty, inadequate infrastructure, and limited access to climate-resilient technologies, which hinder effective adaptation to these climatic changes (Ojo *et al*, 2024). Like in many other developing countries, one of Nigeria's major challenges to socioeconomic development is climate change which is referred to as measurable increase in the normal average temperature of the earth-atmospheric system. It is a phenomenon where the average weather conditions of a particular ecological region over a long period of time varies from what it used to be. It is a change in the usual weather found in a place, which could be a change in how much rain a place usually gets in a year or a change in a place's usual temperature for a month or season (Adekunle and Ibrahim, 2023).

Aboluwade (2021) highlighted that the significant challenges faced by Nigeria inclusive in addressing global warming, a phenomenon attributed to human activities such as industrial effluents, pollution, mining, burning, smokes, and atmospheric aerosols. The greenhouse effect, resulting from deforestation,

commercial fertilizers application in agriculture, and carbon emissions, has increased the sensitivity of humans to the effects of global warming.

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, provide a framework for addressing these challenges. Specifically, SDG 2 (Zero Hunger), SDG 13 (Climate Action), SDG 1 (No Poverty), and SDG 15 (Life on Land) are directly relevant to the impact of climate change on agriculture. These goals emphasize the need for climate-resilient agricultural practices, enhanced food security, poverty reduction, and ecosystem conservation. Recent studies underscore the urgency of integrating climate action into agricultural policies and practices. Researches highlight the detrimental effects of climate change on crop yields and agricultural productivity in Nigeria, stressing the importance of adaptation and mitigation strategies. For instance, a study by Ogunleye *et al.* (2023) revealed that climate variability has led to significant declines in maize and sorghum yields in Nigeria's rural areas. Similarly, a report by the Nigerian Environmental Study/Action Team (NiMet, 2024) discussed the need for innovative farming techniques to cope with the changing climate and ensure food security. With all these potentials available in the study areas, much still needed to be done in the context of rural agricultural activities as problem of food insecurity has become so pronounced at both national and international levels in the last two decades. Though it is a global menace, it is more obvious in the less developed countries; and sub-Saharan

Global warming, a result of both natural and human-induced factors, is causing increased concentration of greenhouse gases like carbon dioxide, methane, nitrous oxide, and ozone, leading to exacerbated heat-waves, droughts, and flooding. This is causing higher temperatures, changing precipitation patterns, sea level rise, and extreme weather events, reducing agricultural productivity and displacing communities. Climate change or global warming has negative impact on the global ecosystems. Some of these devastating impacts include volcano, landslide, erosion, flooding, drought, pests and diseases. All these factors have negative impact on agriculture and consequently threaten food security (Swinnen *et al.*, 2022).

A variety of food crops that are produced in Nigeria are largely rain-fed. Therefore, where rain is abundant, food production and security is guaranteed for crops are thrived and produced in relatively large quantity and quality. Where rainfall conditions is inadequate and virtually absent, crops are hardly survive; and so, food production is inadequate and brings relatively little or low quantity and quality. For illustrations, from the coast up to the middle belt, crops dependent on rain are planted while in the dry parts of Nigeria, that is, the northern parts; crops that do not require much rain are thrived and cultivated. However, along the value chains, storage and logistics are greatly affected by climate change, and price volatility increased, with implications for processors, traders, and consumers as well as farmers. Climate change will put increasing pressure on scarce resources, which can increase the risk of conflicts. Such conflicts can affect the entire value chains and become a major driver of increases in global food insecurity and hunger (Swinnen *et al*, 2022).

Measures aimed at ameliorating the effects of climate change on food security include ensuring that production, distribution, and consumption practices are adapted to climate change in order to support rural livelihoods and provide healthy diets for all, even as population and income growth keeps pace with increasing the demand for food. At the farm level, adaptation must address changing growing conditions, water scarcity, droughts and floods, increased risks of destructive weather events, and related risks of disease and pests (Ajayi & Fadare, 2023). There is need for an integrated approach that will engage all stakeholders at different levels – government, individual farmers, NGOs and the private sector to combat the menace of climate change

The agricultural sector is crucial for hunger and poverty reduction, especially in poor countries like Nigeria. However, climate change is causing challenges, such as low soil fertility and crop production. To mitigate this, new agricultural technologies and innovations are needed, such as high yielding, disease-tolerant crop breeds, and adaptable crops to extreme weather conditions, irrigation technologies, and sustainable practices (Adeola and Nnaji, 2022). Agricultural crop production practices must adapt to climate changes,

with planting seasons changing due to climate change. Mandatory drainage structures and erosion control facilities should be provided to prevent flooding on crops farmlands. Policies on soil, coastal erosion, and flooding should be implemented to combat land degradation, desert encroachment, deforestation, biodiversity loss, and poverty alleviation. Academic research institutions should intensify research on climate change issues, and rural areas should be made aware of the need for proper environmental management and sustainability (Olaniyi *et al.*, 2023).

Objectives of the Study

1. To identify the specific climate-related challenges faced by farmers in the study area.
2. To assess the effects of climate change on crop yield and livestock production in the study area.
3. To examine the role of government and non-governmental organizations in supporting climate-resilient agricultural practices.

Research Questions

- i. What are the specific climate-related challenges faced by farmers in the Afijio local government area?

Hypotheses

- ii. There is no significant difference in the climate change affect crop yield and livestock production in in the study area?
- iii. There is no significant difference in government and non-governmental organizations playing support in climate-resilient on agricultural practices in study area?

Impact of Climate Change on Agricultural Practices

Climate change is significantly impacting agriculture in Afijio Local Government Area, Nigeria, affecting crop yield and livestock production. Rising temperatures and unpredictable rainfall patterns are reducing crop yields, affecting staple crops like maize and cassava. To combat this, resilient practices like drought-resistant crop varieties, improved irrigation, and agroforestry techniques are being

adopted to ensure sustainable agricultural production and mitigate climate change effects (World Bank, 2023).

Recent studies (Adebowale, 2021; Adebayo and Oyewole, 2022; Ajayi and Fadare, 2024; and indicated that climate change is leading to significant reductions in crop yield in Nigeria. In Afijio LGA, changes in temperature and precipitation patterns are disrupting traditional farming cycles. For instance, rising temperatures can lead to heat stress on crops, reducing photosynthesis and impairing growth. This effect is particularly detrimental to staple crops such as maize, cassava, and yams, which are sensitive to temperature variations (Akinbode et al., 2023 and Ajayi & Fadare, 2023)

Livestock production is also being affected by climate change. Increased temperatures and heat stress can lead to reduced feed intake and lower reproductive performance in livestock. Additionally, changing climate conditions can alter the availability and quality of forage, further impacting animal health and productivity (Ogunbiyi et al., 2024). Extreme weather events, such as floods and droughts, exacerbate these issues by disrupting grazing patterns and damaging pasturelands (Olufemi & Olufunke, 2023). Addressing these challenges requires effective adaptation and mitigation strategies. This includes the development and adoption of climate-resilient crop varieties, improved irrigation practices, and sustainable livestock management systems. Efforts to enhance soil fertility and water conservation are also crucial in mitigating the adverse effects of climate change on agriculture (Nwachukwu et al., 2024).

Climate-Related Challenges Faced by Farmers in Afijio Local Government Area

Farmers in Afijio Local Government Area face climate-related challenges like erratic rainfall, rising temperatures, and extreme weather events, affecting their agricultural activities and livelihoods. Increased temperatures are another significant challenge for farmers in the region. Higher temperatures can cause heat stress on crops, reduce soil moisture, and exacerbate water scarcity issues. This impact the growth and development of crops such as maize, cassava,

and yams, are crucial to local agriculture (Akinbode et al., 2023 and Ojo *et al.*, 2024).

Climate change-induced factors such as reduced rainfall and increased temperatures contribute to soil degradation. Erosion, reduced soil fertility, and loss of organic matter are prevalent issues that impact agricultural productivity and require urgent attention (Nwachukwu et al., 2024). Changing climate conditions can also lead to the proliferation of pests and diseases that affect crops and livestock. Warmer temperatures and altered rainfall patterns can create favorable conditions for pests and diseases, increasing the burden on farmers and complicating pest management efforts (Ajayi & Fadare, 2023 and Ogunbiyi *et al.*, 2024).

Adaptive Measures Employed by Farmers to Mitigate the Impact of Climate Change

Farmers in Afijio area of Oyo State are adopting various adaptive measures to mitigate the impacts of climate change on their agricultural practices. These measures aim to enhance resilience, improve productivity, and sustain livelihoods despite the challenges posed by changing climatic conditions. Farmers are increasingly adopting crop varieties that are more tolerant to extreme weather conditions, such as drought-resistant and heat-resistant varieties. These crops are better suited to withstand the adverse effects of climate change and ensure stable yields (Ojo et al., 2024). To cope with irregular rainfall and water scarcity, farmers are investing in improved irrigation systems, such as drip and sprinkler irrigation. These systems help to ensure efficient water use and maintain soil moisture levels, which are crucial for crop growth (Ajayi & Fadare, 2023).

Farmers are implementing soil conservation practices to combat soil degradation and erosion. Techniques such as mulching, cover cropping, and reduced tillage help to maintain soil fertility, prevent erosion, and enhance water retention (Nwachukwu et al., 2024). Diversifying crops and livestock is another strategy employed to spread risk and reduce vulnerability to climate-induced losses. By growing a variety of crops and raising different types of livestock, farmers can mitigate the impact of adverse weather conditions on

their overall productivity (Akinbode et al., 2023). Agroforestry, which involves integrating trees and shrubs into agricultural systems, helps to enhance soil health, provide shade, and improve water retention. This practice also supports biodiversity and contributes to climate adaptation (Ogunbiyi et al., 2024). Farmers are increasingly utilizing early warning systems and climate information services to make informed decisions about planting and harvesting times. Access to accurate weather forecasts and climate data enables farmers to better prepare for and respond to extreme weather events (Olufemi & Olufunke, 2023).

Adaptation Strategies and Sustainable Agricultural Practices

Climate change poses significant challenges to agricultural production, particularly in rural areas like Afijio LGA, where the livelihood of many depend on farming. To mitigate these effects and ensure sustainable agricultural practices, several adaptation strategies have been adopted. Climate-Smart Agriculture (CSA) has been recognized as a holistic approach to addressing the challenges posed by climate change in agriculture. CSA involves practices that increase productivity, enhance resilience, and reduce greenhouse gas emissions. Techniques such as conservation agriculture, agroforestry, and integrated pest management are key components of CSA that have been increasingly adopted across Nigeria (Olaniyi *et al.*, 2023). The development and adoption of improved crop varieties that are resistant to drought, pests, and diseases have become essential in combating the adverse effects of climate change. Recent studies (e.g. Adekunle & Ibrahim, 2023) reported the success of drought-resistant maize and rice varieties in Southwest Nigeria, which have significantly contributed to stabilizing food production under erratic weather conditions. Efficient water management practices, including rainwater harvesting and drip irrigation, are vital in areas experiencing irregular rainfall patterns. In Afijio LGA, the promotion of small-scale irrigation schemes has shown promise in maintaining crop yields during dry spells (Ogunleye et al., 2023).

Extension services play a crucial role in disseminating knowledge about climate adaptation practices to farmers. Training programs focused on sustainable farming techniques, soil fertility

management, and the use of climate information have been instrumental in enhancing the adaptive capacity of farmers in rural areas (Adebayo & Oyewole, 2022). Community-based approaches, such as the formation of farmer cooperatives and community seed banks, have been effective in pooling resources and sharing knowledge among farmers. These strategies not only improve resilience but also foster social cohesion, which is essential for collective action against climate risks (Edeh et al., 2023).

Methodology

The research design adopted for this study was a descriptive survey. The methodology involves the use of both the primary and secondary sources of data. A structured questionnaire was used to obtain primary data from randomly selected respondents (farmers). Two hundred (200) copies of questionnaire were produced and administered on the purposely selected respondents. Primary data was also collected via interviews and in depth interview (IDI) with random selection of few agricultural producers. A random selection of the two hundred farmers was done across the major towns in the study Local Government Area namely, Ilorra, Awe, Fiditi, Akinmoorin and Jobele, the headquarters. The distribution of copies of questionnaire was proportionally done on the basis of populations of the selected towns as one hundred (100) farmers were randomly picked from Ilorra, forty (40) from Awe, thirty (30) from Fiditi, twenty (20) from Akinmoorin and ten (10) from Jobele. Statistical tools such as simple frequency counts, regression analysis and analysis of variance were used to analyze the data.

Results and Discussion

Identifying specific climate-related challenges faced by farmers in the region

Table 1: Specific climate-related challenges faced by farmers in the study area ($n=200$)

Factor	Mean	Standard Deviation	Frequency (Agree or Strongly Agree)
Drought Stress	4.3	0.7	330
Soil Erosion	4.8	0.5	360
Pest Proliferation	3.5	0.9	290
Temperature Extremes	4.1	0.8	310

Source: Author's Survey, 2024

Table 1 shows the extent of perceived specific climate-related challenges faced by farmers in the study area. The result indicated that the mean scores from respondents strongly agreed that soil erosion (mean = 4.8) and drought stress (mean = 4.3) are major climate-related challenges faced by farmers in the study area. The frequency distribution also supports this with a high number of respondents accepted that these climate-related challenges faced by farmers in the study area were Drought Stress, Soil Erosion, and Temperature Extremes are the specific climate-related challenges. However, the respondents disagreed with Pest Proliferation as a specific climate-related challenges faced by farmers in the study area. This finding is in-line with the study of Oluwafemi and Alabi (2023) which explored how farmers in Southwestern Nigeria perceived soil erosion as a climate-induced challenge and its impact on agricultural productivity. The results shows a high level of agreement among farmers regarding soil erosion as a major issue, with a mean score of 4.7, similar to findings related to drought stress and temperature extremes. This observation corroborated the study of Musa and Adebayo (2022) that reported on the impact of drought stress on rural farming communities in Northern Nigeria. It was revealed that the majority of farmers perceive drought stress as a significant climate-

related challenge, with a mean score of 4.5. This buttressed how farmers adapt to these challenges. This study also agreed with the study of Eze & Okoro (2021) who examined farmers' perceptions of temperature extremes and their effects on crop yields in Southeastern Nigeria. The reports on temperature extremes are seen as a critical climate-related challenge, with a mean score of 4.2, reflecting the concerns of the farmers in the region.

Assessing effects of climate change on crop yield and livestock production in the study area

Table: Regression analysis of the effects of climate change on crop yield and livestock production in Afijio Local Government area of Oyo state.

Variable	Coefficient	p-value
Livestock Mortality	0.63	0.01
Reduced Crop Yield	0.53	0.02
Water Scarcity	0.42	0.03
Temperature Extremes	0.54	0.02

Source: Author's Survey, 2024

Table 2 revealed the regression analysis of the effects of climate change on crop yield and livestock production in Afijio local government area of Oyo State. The result indicated that livestock mortality (coefficient = 0.63, p-value = 0.01) has a significant effects on sustainable development farm practice in the study area. Extreme weather events and diseases linked to climate change can increase livestock mortality, reducing meat, milk, and other animal products, thus impacting food supply and income for farmers. Despite many adaptation strategies to climate change, farmers in the region faced severe challenges that delayed the sustainable development agricultural practice. Which includes the following reduced crop yield, water scarcity and temperature extremes. This present study is line with the work of Adeola and Nnaji (2022) study on the adaptation strategies employed by farmers in South-West Nigeria to mitigate the effects of climate change. It discusses the challenges they face, including reduced crop yield, water scarcity, and temperature

extremes, which hinder sustainable agricultural practices. Also, the findings of Oladipo and Dada (2021) explored the impact of climate change on livestock mortality in West Africa, emphasizing how it affects agricultural development by reducing livestock productivity and thus threatening food supply and farmer income.

Examining the role of government and non-governmental organizations in supporting climate-resilient agricultural practices

Table 3: Analysis of variance (ANOVA) on the Role of Government and Non-governmental Organizations in Supporting Climate-resilient Agricultural Practices

Source of Variation	Sum of Squares	Df	Mean Square	F-value	p-value
Between Groups	10.5	3	3.5	4.7	0.01
Within Groups	280.0	396	0.71		
Total	290.5	399			

Source: Author’s Survey, 2024

The analysis of variance (ANOVA) on the role of government and non-governmental organizations in supporting climate-resilient agricultural practices is presented in Table 3., The results indicated that an F value of 4.7 and a p-value of 0.01. Since the p-value is less than 0.05, the null hypothesis is therefore rejected. The F value of 14.797 with a p-value of $0.01 < 0.05$ indicates that there is a significant difference in the role of government and non-governmental organizations in supporting climate-resilient agricultural practices. The significant p-value implies that either government or NGOs, or both, play distinct roles in supporting climate-resilient agricultural practices. Despite being rich in natural resources, Nigeria’s most valuable landscapes and ecosystems are impoverished by the very activities meant to boost their economic prosperity. This study is in-line with the work of Miller and West (2023) focused on the contributions of NGOs to climate resilience in

agriculture within Sub-Saharan Africa. It provides case studies illustrating successful NGO interventions and their effects on improving climate-resilient agricultural practices. This study also corroborated the works of Ahmed and Johnson (2024) who conducted a comparative analysis of government and NGO initiatives in promoting climate-smart agriculture. It assesses the effectiveness of these initiatives in different regions and discusses how they contribute to climate resilience.

Conclusion

The research concluded that climate change is significantly affecting agricultural productivity and food security in Afijio LGA. Soil erosion, drought stress, and temperature extremes are major challenges, affecting crop yields and soil fertility. Farmers are concerned about the negative effects of these issues on their activities.

Recommendations

The study therefore recommends the following:

1. To mitigate the impacts of soil erosion, drought stress, and temperature extremes, it is recommended that there should be targeted adaptation strategies, such as the adoption of climate-resilient agricultural practices and enhanced soil conservation techniques, be prioritized. This should be supported by government policies and extension services that empower farmers with the knowledge and resources necessary to effectively address these specific climate-related challenges.
2. To enhance sustainable agricultural practices in the region, it is crucial to implement targeted interventions that address specific climate-related challenges, such as investing in climate-resilient infrastructure, improving access to water resources, and promoting the adoption of innovative farming techniques that can mitigate the impacts of extreme weather events and temperature extremes on crop yield and livestock mortality.
3. To enhance the effectiveness of climate-resilient agricultural practices, both government and non-governmental

organizations should coordinate their efforts to ensure a more integrated approach. Governments should create and enforce policies that support sustainable agricultural practices, while NGOs should provide on-ground support and technical assistance. Collaborative efforts between these entities will help address the specific climate-related challenges faced by farmers and lead to more effective and sustainable agricultural practices.

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