

CLIMATE SMART AGRICULTURE, FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

GLOBAL ISSUES & LOCAL PERSPECTIVES volume One

Edited by

Eteyen Nyong

Ijeoma Vincent-Akpu

Bassey Ekpo

Muhammad Hussaini

Udensi Ekea Udensi

Mansur Bindawa

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^{1,2,3} Department of Agricultural Extension, University of Agriculture and Environmental Sciences, Umuagwo

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¹National Cereals Research Institute, P.M.B 8, Bida, Nigeria, ORCID: 0000-0002-9345-1112

²Department of Agronomy, Bayero University Kano, P.M.B 3011, Kano State, Nigeria
ORCID: 0000-0003-0639-009X

³Department of Crop Science, University of Calabar, Cross River State, Nigeria, ORCID: 0000-0002-8513-7457; seabarahm.agr@buk.edu.ng +2348024695219

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¹Mbube, Baridanu Hope, ²Ameh, Daniel Anone & ³Kolo, Philip Ndeji
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Department of Agricultural Extension and Management Technology
Email: hopembube@gmail.com & baridanu.mbube@fecorlart.edu.ng

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¹Department of Geography, Federal College of Education, Odugbo, Benue State
²Department of Geography and Planning, University of Jos, Plateau State
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*^aIgbojionu, D.O., ^bIgbojionu, J.N.

^a*Department of Agricultural & Bio-environmental Engineering Technology,
Federal College of Land Resources Technology, Owerri, Imo State*

^b*Department of Soil Science & Technology,
Federal College of Land Resources Technology, Owerri, Imo State, Nigeria*

**a Corresponding author email: igbojionudonatus@gmail.com*

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*Eric, E.E., ** Ejizu, A.N. and *Akpan, U.F.

*Forestry Research Institutes of Nigeria, Ibadan, Swamp Forest Research Station Onne, Rivers State, Nigeria.

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*¹Department of Horticultural Technology, Federal College of Horticulture Dadin-kowa Gombe State Nigeria, *Corresponding author: jkapsiya.hort@fchdk.edu.ng*

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Victoria Folakemi AKINJOGUNLA^{1*} and Charity Ebelechukwu EJIKEME²

¹Department of Fisheries and Aquaculture, Bayero University Kano, Kano State, Nigeria.

²Department of Biology, Federal College of Education (Technical), Akoka, Lagos, Nigeria.

*vfakinjogunla.faq@buk.edu.ng

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Fakuta, B. A, Ediene, V. F and Etta, O. I.

Faculty of Agriculture, University of Calabar, Calabar, Nigeria

Corresponding author: email balthiya1@gmail.com

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Elisha Ikpe¹, Ugbede D. Omede² and Patrick A. John²

¹Department of Geography, Federal College of Education, Odugbo, Benue State

²Department of Agricultural Science, Federal College of Education, Odugbo, Benue State

Email: elishaikpe@fcedugbo.edu.ng

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Muhammad Usman Mairiga

College of Agriculture and Animal Science

Ahmadu Bello University, Mando Kaduna

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Paul Temegbe Owombo

Department of Agricultural Economics and Extension, Olusegun Agagu University of Science and Technology, Okitipupa, Ondo State, Nigeria; owombopaul@gmail.com

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¹Shittu, E.A*, ²Bassey, M.S, and ¹Buhari, F.Z

¹Department of Agronomy, Bayero University Kano, P.M.B 3011, Kano State, Nigeria
ORCID: 0000-0003-0639-009X

²National Cereals Research Institute, P.M.B 8, Bida, Nigeria ORCID: 0000-0002-9345-1112

*Corresponding Author email: seabarahm.agr@buk.edu.ng

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Eteyen Nyong and G. E. Okon

Department of Agricultural Economics, Akwa Ibom State University, Nigeria

eenyong16@gmail.com

Preface

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It eschews pedantry and lays bare the issues in such clarity that conduces to learning. The book elaborates on contemporaneous **Climate Smart Agriculture, Food Security and Sustainable Development** issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which climate smart agriculture (CSA) food security, Sustainable Development issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue climate smart agriculture, food security, and sustainable development necessary in policy making process that will stimulate increase in food production and environmental sustainability.

Climate Smart Agriculture, Food Security and Sustainable Development: *Global Issues & Local Perspectives* is organized in three parts. Part One deals with The Concept of **Climate Smart Agriculture**, Part Two is concerned with The Concept of **Food Security And** and Part Three deals with the Concept of **Sustainable Development**
Eteyen Nyong; October 2025

Chapter Sixteen

Assessing the Challenges of Implementing Climate Change Adaptation Practices in Agricultural Communities of Benue State, Nigeria

Elisha Ikpe¹, Ugbede D. Omede² and Patrick A. John²

¹Department of Geography, Federal College of Education, Odugbo, Benue State

²Department of Agricultural Science, Federal College of Education, Odugbo, Benue State

Email: elishaikpe@fceodugbo.edu.ng

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1.1 INTRODUCTION

Climate change is widely recognized as one of the most critical global challenges of the 21st century, exerting profound impacts on agriculture and food security. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), its effects on ecosystems, farming systems, and human livelihoods are unprecedented. In Africa, the agricultural sector remains particularly vulnerable to rising temperatures, erratic rainfall, and extreme weather events, all of which disrupt crop cycles, reduce yields, and intensify food insecurity (Ariko et al., 2024). Nigeria is not exempt from these realities. In states like Benue, where farming constitutes the backbone of rural livelihoods, climate-related hazards such as floods, droughts, recurrent crop failures, pest outbreaks, and also insecurity and conflict continually undermine agricultural productivity and household welfare (Adamgbe and Ujoh, 2013; Ikpe et al., 2024; Terdoo, 2025).

To cope with these risks, climate change adaptation has emerged as a critical pathway for sustaining agriculture (Food and Agriculture Organization [FAO], 2016). Adaptation refers to the process of anticipating and adjusting to the effects of climate variability, whether to minimize harm or take advantage of potential benefits (World Bank, 2011). According to Oladipo (2008), adaptation involves taking appropriate measures to reduce the negative effects of climate change (and exploit any upsides) by making necessary adjustments. These adjustments may be anticipatory, reactive, incremental, or transformational (IPCC, 2021). Within agriculture, adaptation entails the adoption of practices that enhance resilience, improve productivity, and secure livelihoods despite changing climatic and socioeconomic conditions (Ikpe, 2021; FAO, 2016).

Strengthening the adaptive capacity of local farmers is therefore essential in building resilience against climate shocks (GreenFacts, 2022). While planned adaptation frameworks provide structured responses, incorporating indigenous coping mechanisms and community-based practices often ensures greater effectiveness. As Adeshina and Odekunle (2011) observe, adaptation strategies may either be novel interventions introduced to a locality or enhancements of traditional practices already in use. In Benue State, farmers have embraced several coping mechanisms, including mixed cropping, crop diversification, small-scale irrigation, and the application of organic manure.

However, the effective implementation of these practices is constrained by multiple challenges. Limited financial resources, inadequate access to extension services, weak institutional support, insufficient climate information services, and also external factors such as insecurity, market instability, and poor infrastructure continue to undermine adaptation outcomes (Boko and Iheanacho, 2021; Okon et al., 2022; Terdoo, 2025). In Benue, changing rainfall patterns and temperature fluctuations have been perceived to reduce crop yield, increase drought incidence, and place stress on water availability, yet many farmers lack timely and reliable weather forecasts or early warning systems (Agbo and Ikpe, 2025). As a result, agricultural production in Benue State has often failed to keep pace with population growth, thereby deepening the challenges of hunger and food insecurity (Ikpe et al., 2024). Considering the critical importance of agriculture to both the economy and rural livelihoods, examining the barriers that hinder effective adaptation becomes crucial. Understanding these challenges will provide insights for strengthening resilience, improving policy interventions, and promoting sustainable food security in Benue State.

1.2 STATEMENT OF THE RESEARCH PROBLEM

Despite the widespread recognition of the devastating impacts of climate change, agricultural communities in Benue State continue to grapple with significant difficulties in effectively implementing adaptation strategies (Iornongo, 2021). Although farmers are aware of the changing climate and its effects on agricultural productivity, their adaptation efforts are constrained by multiple systemic and structural challenges. These include inadequate access to credit facilities, which limits their ability to invest in climate-resilient technologies; insufficient awareness and knowledge of climate-smart agricultural practices; poor infrastructural support such as storage facilities, irrigation systems, and rural roads; as well as weak and inconsistent government intervention in policy implementation and extension services (Ikpe and Ugbede, 2025a).

The cumulative effect of these constraints undermines the effectiveness of local adaptation strategies, resulting in declining crop yields, heightened vulnerability to climatic shocks, and persistent threats to household and community food security (Ikpe, 2021). Moreover, socio-economic factors such as poverty, land tenure insecurity, and gender disparities further exacerbate farmers' inability to cope with climate variability. These challenges not only weaken the resilience of farming households but also hinder the overall sustainability of the agricultural sector in the state.

Understanding these barriers is therefore essential for formulating context-specific policies and designing targeted intervention strategies that can strengthen farmers' adaptive capacity, enhance agricultural productivity, and ensure food security in the face of a changing climate. Against this backdrop, this study seeks to critically assess the challenges of implementing climate change adaptation practices in agricultural communities in Benue State, Nigeria, with a view to providing evidence-based recommendations that will guide policy makers, development practitioners, and local stakeholders in promoting sustainable agricultural resilience.

1.3 AIM AND OBJECTIVES OF THE STUDY

1.3.1 Aim:

The primary aim of this study is to critically assess the challenges hindering the effective implementation of climate change adaptation practices in agricultural communities of Benue State, Nigeria. Specifically, the study seeks to identify the systemic, institutional, socio-economic, and environmental factors that limit farmers' capacity to adopt and sustain climate-resilient strategies.

1.3.2 Objectives:

The aim was achieved via the following set objectives: which were to,

- i. identify the various climate change adaptation practices currently employed by farmers in agricultural communities of Benue State.

- ii. examine the major challenges that constrain the effective implementation of these adaptation practices.
- iii. evaluate the relative effectiveness of the identified adaptation practices in sustaining agricultural productivity despite the challenges encountered.
- iv. recommend practical strategies and policy measures that can enhance the successful implementation and sustainability of climate change adaptation practices in the study area.

1.4 STUDY AREA

Benue State, created on February 3, 1976, is situated in the lower River Benue trough within Nigeria's middle belt region and is renowned as the "Food Basket of Nigeria." The state lies between Latitudes 6°25'59"N and 8°8'06"N and Longitudes 7°30'14"E and 10°00'53"E, covering 34,059 square kilometers kilometres (Terdoo et al., 2016; National Bureau of Statistics, 2018). Benue State shares boundaries with five states (Nassarawa, Kogi, Taraba, Ebonyi and Cross River) and the Republic of Cameroon, with a vegetation characteristic of the southern Guinea Savanna biome (Hula, 2010; Nigerian Investment Promotion Commission [NIPC], 2020).

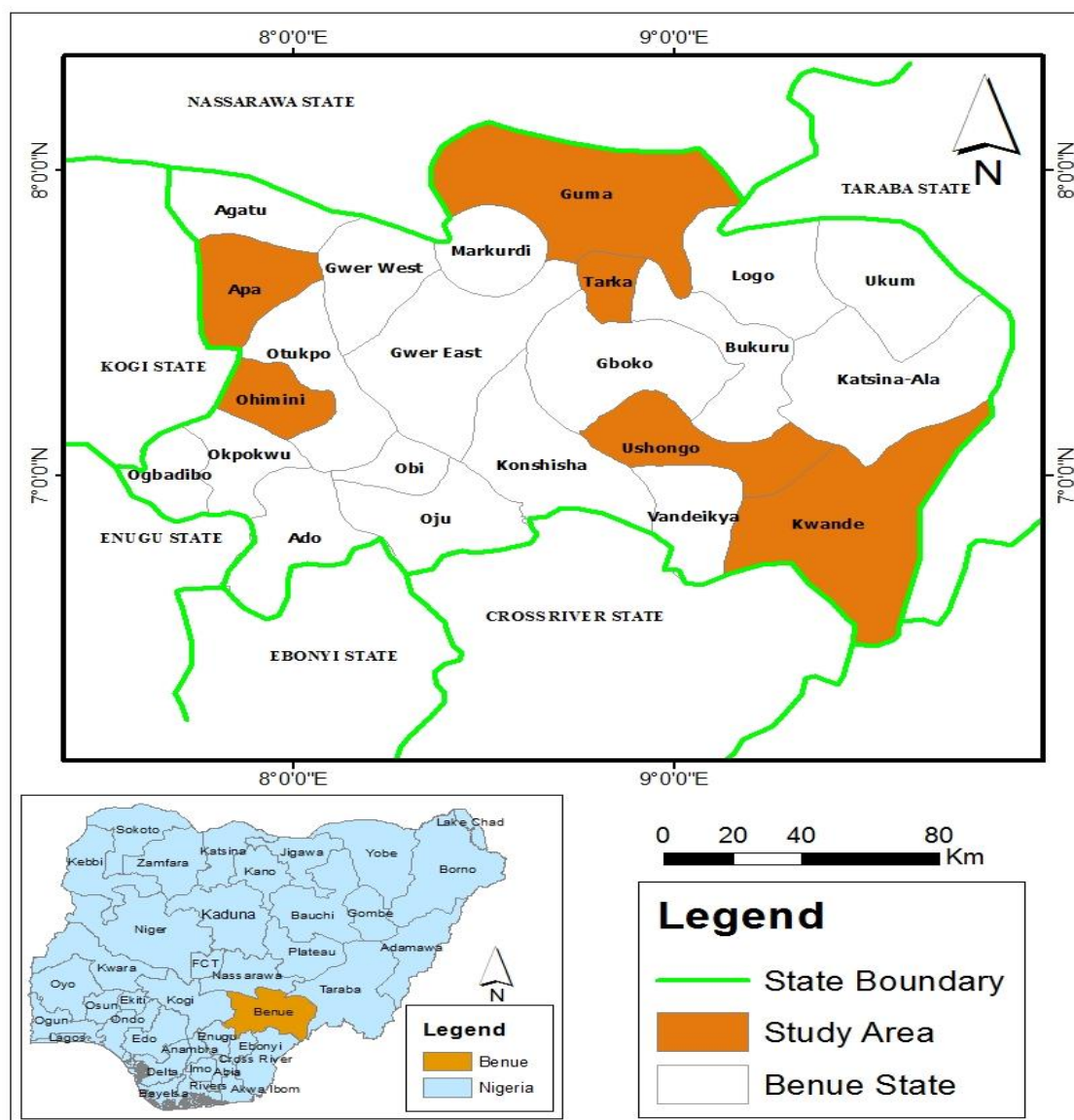


Fig. 1: Benue State (Study Area)

Modified by GIS Lab Department of Geography, A.B.U. Zaria.

According to the Köppen climatic classification, Benue State falls within the AW climate, characterized by two distinct seasons: the wet season and the dry season. The state typically experiences 6-8 months of rainfall (Iornongo, 2021), with the rainy season spanning from April to October and annual rainfall ranging from 1000-2000 mm. The dry season begins in November and ends in March. Temperatures fluctuate between 21°C and 37°C throughout the year. However,

the south-eastern part of the state, adjacent to the Obudu-Cameroun Mountain range, has a cooler climate, similar to that of Plateau State (Ologunorisa and Tersoo, 2006). Notably, temperatures within Makurdi, the state headquarters, are consistently high, averaging between 28°C and 32°C, and sometimes reaching up to 37°C (Hula, 2010).

The state's dominant geographical feature is the River Benue, with numerous tributaries, including the Katsina-Ala River (Hula, 2010). Benue State has a population of approximately 6,096,869 (2006 Population Census) with the Tiv, Idoma, and Iggede peoples being the predominant ethnic groups. Agriculture is the backbone of the state's economy, engaging over 70% of the population, with major cash crops including soybeans, rice, and peanuts, and food crops like yam, cassava, and maize (Terdoo et al. 2016).

1.5 METHODOLOGY

This study employed a quantitative research approach, collecting primary data through structured questionnaires administered in the study area. A multistage sampling technique was utilized. Specifically, the 23 Local Government Areas (LGAs) of the state were alphabetized and systematically sampled, with every third LGA selected for inclusion. The sample size was determined using Krejcie and Morgan's (1970) sample size determination formula, which recommends a sample size of 783 for a population ranging from 500,000 to 10,000,000, at a 95% confidence level and a 3.5% margin of error. A 3.5% margin of error was chosen to minimize errors, as smaller sample sizes typically yield larger margins of error.

Primary and secondary data were used, including structured questionnaires, interviews and Focused Group Discussions (FGDs). The instruments used for data collection were the self-structured Crop Farmers' Perception Questionnaire (CFPQ) and the interview guide titled Crop Farmers' Perception Interview Guide (CFPIG). Six multiple FGDs were designed for the six selected LGAs, each comprising eight experienced crop farmers and two extension workers. These participants were selected by the Heads of farmers from each LGA to explore pertinent

issues affecting crop production in the area. The reliability of the instruments was determined using the Cronbach Alpha reliability coefficient, with values of 0.76 for CFPQ and 0.82 for CFPIG.

The 2006 census figures were projected to 2023 using Newman's (2001) population projection method. The projection of sampled localities' population was based on the Benue State population growth rate of 3%. The formula used was:

$$P_n = P_o + ((1+R)/100 \times P_o) \times n \text{ ----- (1)}$$

Where:

P_n = Population in the recent year;

P_o = Population in the base year;

R = annual growth rate;

n = number of intermediary years.

The sample frame and sample size for each selected LGA is presented in Table 1 (See appendix).

The Relative Importance Index Technique (RII) was used to determine the relative importance of various adaptation strategies to climate change in the study area. The RII formula used was:

$$RII = \sum W / (A \times N) \text{ ----- (2)}$$

Where:

W = Weight given to each factor by the respondents;

A = Highest weight (i.e., 3 in this case);

N = Total number of respondents.

The three-point scale ranged from 1 (Not at all) to 3 (Always). The higher the value of RII, the more important or effective was the adaptation strategy to climate change in the study area.

1.6 RESULTS AND DISCUSSION

1.6.1 Socio-economic characteristics of the respondents

Out of the 783 questionnaires administered, 780 were returned and deemed valid for analysis. The socio-demographic characteristics of farmers in the selected LGAs were examined to provide insights into their backgrounds and potential influences on responses. Findings show that the majority of respondents are male (586, 75%), while females make up only 25% (194). The predominance of male farmers may be attributed to their traditional role as household heads responsible for providing basic needs such as food. In many African societies, including Nigeria, women often face social barriers that limit property rights and access to resources. Consequently, they tend to have fewer opportunities and capabilities in farming compared to men (Gbegeh and Akubuilu, 2013).

The age distribution of respondents is skewed towards the middle-aged group, with 50% (389) falling within the 30–40 years range (Table 2). The 41–50 years age group constitutes 27% (213) of respondents, followed by 15% (114) in the 51–60 years range. The oldest age groups (>61 years) make up a smaller proportion of respondents, with 7% (56) in the 61–70 years range and 1% (8) above 71 years. This age distribution may influence respondents' perspectives, experiences, and attitudes, particularly since age-related factors are relevant to experiences in the choice of adaptation strategies (Ikpe 2021)

The study reveals that Christianity is the dominant religion among respondents, with 93% identifying as Christians, while Islam (4%) and traditional beliefs (3%) account for smaller proportions. This distribution highlights the potential influence of religion on respondents' values, practices, and perspectives regarding climate change (Feder et al., 2013). In terms of marital status, the majority are married (51%), followed by singles (40%), while widowed respondents constitute 8%. Marital status may shape individual experiences and attitudes, particularly when family responsibilities affect adaptation choices. Educational attainment is fairly balanced: 37% possess primary education, 39% secondary, and 23% tertiary education, with

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only 1% lacking formal education. Education plays a vital role in shaping knowledge and adaptive practices. As noted by Enete et al. (2011), farmers with higher education levels are more likely to adopt and invest in indigenous and modern climate change adaptation strategies, given their better access to and understanding of relevant information.

The majority of respondents (72%, 564) have lived in the study area for 20–30 years, indicating a relatively stable and long-term resident population. Smaller proportions of respondents have lived in the area for 31–40 years (24%, 189) or more than 41 years (3%, 27). Length of residency may influence respondents' familiarity with the area, their social networks, and their experiences with local services or issues.

1.6.2 Adaptation Practices

The adaptation strategies adopted by the farmers in the area are presented in Table 3 (See appendix). The result revealed that out of the eight adaptive strategies, five were “highly adopted” by the farmers as reflected in their RII scores of 0.9 and 1.0.

1.6.2.1 Most Frequently Used Strategies

- i. Mixed Cropping: This strategy is used by almost all respondents (744), indicating its widespread adoption and potential effectiveness.
- ii. Use of Organic Manure: A large majority of respondents (672) always use organic manure, highlighting its importance in maintaining soil health and fertility.

1.6.2.2 Highly Adopted Strategies

The following strategies have a high adoption rate (RII = 0.9) and are used by a significant proportion of respondents:

- i. Early Planting (635 respondents)

- ii. Use of Inorganic Manure (575 respondents)
- iii. Planting of Pest and Disease Resistant Crop (555 respondents)

1.6.2.3 Moderately Adopted Strategies

The following strategies have a moderate adoption rate (RII = 0.6-0.7) and are used by a smaller proportion of respondents:

- i. Increase in Number of Weeding (362 respondents)
- ii. Mixed Farming Practices (299 respondents)
- iii. Loans, Grants, and Subsidies (257 respondents)

The ranking of mixed cropping as the top adaptation strategy strongly aligns with recent empirical research. For example, in a study of grain farmers in Sokoto State, mixed cropping was ranked first out of 25 possible adaptation strategies (Ikpe, 2021). Similarly, in a survey of arable crop farmers in Oyo and Ekiti States, mixed cropping was almost universally practiced, with about 97.4% of respondents reporting its use (Ayanlade and Jegede, 2016).

These findings are consistent with earlier work by Ikpe et al. (2018), which showed that in Goronyo LGA, Sokoto State, most farmers adopted mixed cropping as their main means of coping with climate-change impacts. They also resonate with the findings of Nhemachena and Hassan (2007) in Southern Africa, who identified mixed cropping, crop diversification, and adjusting planting dates as key farm-level adaptation strategies.

Focus Group Discussion (FGD) results in more recent studies similarly reinforce farmers' preferences for mixed cropping, especially in terms of its multiple benefits: it allows for multiple harvests, crop security (i.e., reduced risk of total loss because crops respond differently to stress), and diversified income sources. Recent systematic reviews also confirm mixed cropping (or intercropping/crop diversification) as a high-impact adaptation strategy. For instance, a systematic review of climate-smart agricultural practices in Sub-Saharan Africa (2003–2023) found that diversified farming systems significantly increase resilience, reduce the risk of crop

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failure, and improve productivity (Nnadi et al., 2025). Similarly, experimental work by Makumba et al. (2023) demonstrated that cereal–legume mixtures under drought conditions perform better than sole cropping, suggesting that mixed cropping provides ecological and economic stability in variable climates.

However, it is important to acknowledge certain limitations of mixed cropping. Some farmers report that it can complicate farm management due to differences in crop maturity periods, nutrient requirements, and harvesting methods (Abegunde et al., 2019). In addition, the absence of modern mechanization adapted for intercropping systems sometimes reduces efficiency and scalability, particularly in larger farms. These constraints highlight the need for complementary innovations—such as improved extension services, appropriate mechanization, and climate-resilient seed varieties—to maximize the benefits of mixed cropping.

In summary, the high ranking of mixed cropping as an adaptation strategy is well-grounded in both local and regional evidence. It remains one of the most widely adopted, accessible, and sustainable means for smallholder farmers to buffer against climate risks, despite certain management challenges that require institutional and technological support.

1.7 BARRIERS TO CLIMATE CHANGE ADAPTATION PRACTICES IN THE AREA

The barriers to climate change adaptation are presented in Table 4. The analysis of barriers to climate change adaptation strategies in agricultural communities of Benue State shows that several constraints undermine farmers' adaptive capacity. The findings reveal that institutional and financial constraints are the most critical, followed by input availability, market instability, and knowledge-related barriers.

The results reveal several interrelated barriers that hinder the effective implementation of climate change adaptation strategies in the agricultural communities of Benue State. Respondents ranked lack of institutional and financial support as the most critical constraint,

while land tenure issues and extension services emerged as relatively less pressing, though still significant.

1. Lack of support in the form of loans, grants, and subsidies (Ranked 1st):
The study identifies lack of financial support as the most critical barrier to climate change adaptation, with 68% of respondents highlighting it as a severe problem. Farmers' inability to access loans, subsidies, or grants from government and NGOs restricts their investment in improved seeds, irrigation, mechanization, and other climate-smart practices. Financial resources are central to adaptation, as access to credit enhances adoption of new technologies, crop diversification, and resilience to climate shocks (Adebayo et al., 2018; Below et al., 2012). However, financial exclusion persists. For example, Ahmed et al. (2015) reported that 73% of rural households in Borno State lacked access to credit due to low education, lack of collateral, and bureaucratic hurdles. These constraints reduce farm income, limit food supply, and undermine rural food security, supporting earlier findings that emphasize credit access as vital for sustainable agricultural development (Benhin, 2006; Kassahun, 2009).
2. Lack of improved seed varieties (Ranked 2nd):
About 55% of respondents identified limited access to climate-resilient seed varieties as a severe challenge, reflecting farmers' vulnerability to drought, pests, and irregular rainfall. Without improved seeds, adaptation efforts are weakened, as yields remain highly exposed to climate shocks. Early-maturing and drought-resistant varieties are vital to cope with changing rainfall patterns, yet farmers struggle to obtain them. Studies in northern Nigeria confirm that the unavailability of climate-resilient seeds hinders adaptation strategies (Ibrahim et al., 2016; Olayemi et al., 2021). Consequently, many farmers rely on local seed varieties, which are less resistant to climate stresses. This aligns with Enete et al. (2011), who observed that poverty, limited inputs, and weak access to technologies constrain farmers' adaptive capacity in southeastern Nigeria.
3. Unstable/uncertain prices for agricultural produce (Ranked 3rd):
Price instability emerged as a major barrier, with 51% of respondents rating it severe. Unstable produce prices discourage farmers from adopting adaptation measures, as profitability and reinvestment opportunities are reduced. Without stable returns, farmers hesitate to commit to improved practices, undermining long-term resilience. This highlights the critical role of market incentives in promoting adaptation. Price fluctuations have been widely recognized as obstacles to

agricultural sustainability across sub-Saharan Africa, limiting farmers' capacity to cope with climate shocks (FAO, 2016; Ojo and Baiyegunhi, 2020).

4. Lack of current knowledge on adaptation strategies (Ranked 4th): About 43% of respondents rated lack of knowledge as a severe barrier, reflecting gaps in applying climate-smart agricultural practices. While many farmers recognize climate risks, limited training and technical know-how restrict effective adaptation. This knowledge deficit weakens their capacity to implement suitable strategies. The finding supports IPCC (2022), which highlights that access to information and knowledge dissemination are essential for enhancing adaptive capacity and building resilience among smallholder farmers facing climate change challenges.
5. Lack of storage facilities for harvested produce (Ranked 5th): Nearly 40% rated this as severe and 44% as moderate, showing that post-harvest losses remain a serious barrier. The absence of adequate storage discourages investment in larger production, increases waste, and reduces resilience against climate-induced food shortages. Poor storage facilities increase vulnerability during climate-induced shortages, as also noted by Nwalieji and Uzuegbunam (2012).
6. Lack of proper information on weather records (Ranked 6th): About 33% of respondents rated poor access to climate information as severe, while 36% considered it moderate. This highlights farmers' limited access to reliable forecasts needed for planning planting and harvesting. Without timely and accurate data, decisions remain reactive rather than anticipatory. Similar patterns have been reported in Kenya and Ghana, where weak climate information systems constrained resilience (Ariko et al., 2024). Many farmers still depend on indigenous knowledge and past experiences due to inadequate meteorological forecasts. In southern Nigeria, Balarabe et. al (2024) also identified poor access to climate information as a major adaptation barrier. The challenge is compounded by poorly equipped weather stations, which fail to provide location-specific forecasts necessary for effective agricultural planning and climate-smart decision-making.
7. Lack of access to water for irrigation (Ranked 7th): Although irrigation is crucial for coping with rainfall variability, only 26% rated this as severe, while most considered it moderate or minor. This suggests that while water scarcity is a concern, other barriers like finance, seeds, and markets are perceived as more pressing. Lack of irrigation water though ranked lower still affect productivity and resilience (Ukoh and Ikpe, 2025).

8. Lack of/inadequate farm extension worker services (Ranked 8th):
Only 22% of respondents considered inadequate extension services a severe barrier, while 42% rated it moderate. Although not the most critical challenge, it remains significant, as weak extension systems limit farmers' access to knowledge and innovations. Poor extension delivery reduces awareness and adoption of climate-smart practices (Ozor and Nnaji, 2011). Amusa (2010) similarly observed that limited extension programmes hindered cocoa farmers in Ekiti State from embracing improved practices. Extension officers play a vital role in linking research to practice, particularly in disseminating climate-smart strategies and weather information (Adeshina and Odekunle, 2011). Yet, in many rural communities, extension services remain under-resourced, restricting their capacity to support adaptive farming.
9. Lack of access to large pieces of land and the land tenure system (Ranked 9th):
This was rated the least severe, with only 12% identifying it as a severe problem and the majority perceiving it as minor or moderate. This suggests that while land issues exist, farmers consider other constraints like finance and seed access more critical to their adaptive capacity. Land access and tenure insecurity systems were ranked as less severe compared to other barriers but still play an important role in shaping adaptation. In many traditional communities, land rights are communal, and farmers only enjoy temporary user rights. This discourages long-term investments in soil management and climate-resilient farming practices, as previously noted by Benhin (2006) and Tambo and Abdoulaye (2013).

The FGDs confirmed that farmers perceive these barriers as major obstacles to climate resilience. Participants emphasized that without access to financial resources, improved seed varieties, and stable markets, effective adaptation would be nearly impossible. Farmers also stressed the importance of extension support, improved storage facilities, and access to reliable weather forecasts. They recommended interventions such as increased provision of agricultural credit and inputs, establishment of rural weather stations, development of sustainable irrigation projects, and strengthening of extension services to promote awareness and adoption of suitable adaptation measures.

1.8 CONCLUSION

This study assessed the challenges of implementing climate change adaptation practices in agricultural communities of Benue State, Nigeria, and the results reveal that mixed cropping is the most widely adopted strategy, reflecting its accessibility and effectiveness in managing climate risks. However, the findings also show that inadequate financial support, lack of

improved and climate-resilient seed varieties, and market instability remain critical constraints, while weak institutional frameworks, poor extension services, and limited access to timely weather information further undermine the effectiveness of adopted strategies. In addition, socio-economic factors such as poverty, low levels of education, and gender disparities, alongside infrastructural deficits in irrigation, storage, and rural transportation, exacerbate farmers' vulnerability and reduce their adaptive capacity. Thus, although farmers are demonstrating resilience through practices like mixed cropping, meaningful progress in climate change adaptation within Benue State requires stronger institutional and policy support, targeted financial interventions, wider access to climate-smart technologies, improved extension delivery, and the establishment of effective information and market systems to enhance adaptive capacity, ensure food security, and promote sustainable agricultural development in the face of increasing climate variability.

1.9 RECOMMENDATIONS

1. Scale up successful strategies: Expand proven practices such as mixed cropping and organic manure use to reach more farmers.
2. Improve access to finance: Strengthen credit delivery systems, including loans, grants, and subsidies, to enable farmers to invest in adaptation technologies.
3. Promote integrated farming systems: Encourage crop rotation and mixed farming to improve soil health, reduce pest infestations, and enhance resilience.
4. Strengthen extension services: Train and equip extension workers to provide timely technical advice and disseminate climate information.
5. Establish rural weather stations: Develop localized climate information systems to support informed agricultural decision-making.

By implementing these measures, farmers in Benue State can significantly improve their resilience to climate change, sustain maize production, and contribute to broader food security goals.

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APPENDIX

Table 1: Sample Frame and Size for the study

	LGAs	2006 Population	2023 Projected Population	Sample Size
1.	Apa	96,765	154,591	69
2.	Ohimini	71,482	113,819	52
3.	Guma	191,599	299,511	135
4.	Tarka	297,398	477,419	215
5.	Ushongo	188,341	294,191	133
6.	Kwande	248,697	397,311	179
	Total	1,250,149	1,736,842	783

Source: Authors' Compilation

Table 2: Socio-demographic Characteristics of the Farmers

Parameters	Options	Respondents(N=780)	Percentages
Sex	Male	586	75
	Female	194	25
Age	30 – 40 years	389	50
	41 – 50 years	213	27
	51 – 60 years	114	15
	61 – 70 years	56	7
	>71	8	1
Religious Belief	Christianity	724	93
	Islam	30	4
	Traditional	26	3

Marital Status	Single	315	40
	Married	401	52
	Widowed	64	8
Level of Education	Primary	289	37
	Secondary	301	39
	Tertiary	180	23
	Others	10	1
Respondents' years of residency in the study area	20 – 30 years	564	72
	31 – 40 years	189	24
	>41 years	27	3

Source: Field Survey, 2024

Table 3: Adaptation strategies adopted by farmers in the study area.

S/N	Adaptation Strategies	Always Used	Rarely Used	Not at all	RII	Rank
1	Mixed cropping	744	16	2	1.0	1
2	Use of organic manure	672	78	30	0.9	2
3	Early Planting	635	125	20	0.9	2
4	Use of inorganic manure	575	145	60	0.9	2
5	Planting of pest and disease resistant crop	555	172	53	0.9	2
6	Increase in number of weeding	362	262	156	0.7	6
7	Mixed farming practices	299	289	192	0.7	6
8	Loans, grants and subsidies	257	307	216	0.6	7

Source: Field Work 2024

Table 4: Barriers to Climate Change Adaptation Practices in the Area

Problems	Ratings of Problems				Ranking
	1	2	3	4	
Lack of support in the form of loan, grants, subsidies from the government and non-governmental organization	530 (68%)	191 (25%)	34 (4%)	25 (3%)	1 st
Lack of improved seed varieties	430 (55%)	262 (34%)	63 (8%)	25 (3%)	2 nd
Unstable/uncertain prices for agricultural produce	399 (51%)	259 (33%)	107 (14%)	15 (2%)	3 rd
Lack of current knowledge on adaptation strategies	332 (43%)	248 (32%)	145 (18%)	55 (7%)	4 th
Lack of storage facilities for harvested produce	315 (40%)	343 (44%)	91 (12%)	31 (4%)	5 th
Lack of proper information on weather records	256 (33%)	284 (36%)	133 (17%)	107 (14%)	6 th
Lack of access to water for irrigation	203 (26%)	295 (38%)	211 (27%)	71 (9%)	7 th
Lack of/inadequate farm extension workers services	185 (24%)	324 (42%)	171 (22%)	100 (13%)	8 th
Lack of access to large pieces of land and land tenure system	91 (12%)	195 (25%)	311 (40%)	183 (23%)	9 th

Where; 1 – Severe Problem; 2 – Moderate Problem; 3 – Minor Problem; 4 – Not a Problem at all

Source: Field Work 2024

