ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

An Assessment of Climate Change Governance and its Implications for Agricultural Sustainability in Benue State

Emmanuel Afeonkhai[1]; Augusta Aondoaver Shahin[2]; Margaret M. Otu[3]

[1,2]Centre for Sustainable Development, University of Abuja, Abuja, Nigeria

[1]Jacob Silver International Limited, Abuja, Nigeria

[2]Lex Initiative for Rights Advocacy and Development (LIRAD)

[3]Institute of Natural Resources, Environment and Sustainable Development, University of Port Harcourt, Rivers State, Nigeria

Publication Date: 2026/01/07

Abstract: Climate change poses significant challenges to agricultural sustainability in Benue State, Nigeria. This study assesses climate change governance and examines its implications for sustainable agricultural practices in the state. Using policy and legal analysis complemented by empirical evidence from agricultural stakeholders, the study reveals that although climate-related policies exist, weak implementation, limited institutional coordination, and inadequate stakeholder engagement constrain effective climate adaptation in agriculture. These governance deficiencies reduce farmers' capacity to adopt climate-resilient and sustainable practices. The study argues that strengthening legal frameworks, enhancing institutional coherence, and promoting inclusive governance are essential for improving agricultural sustainability in Benue State. The findings contribute to ongoing debates on climate change governance and sustainable agriculture in subnational contexts.

Keywords: *Climate Change Governance; Agricultural Sustainability; Climate Adaptation; Environmental Law; Sustainable Agriculture.*

How to Cite: Emmanuel Afeonkhai; Augusta Aondoaver Shahin; Margaret M. Otu (2025) An Assessment of Climate Change Governance and its Implications for Agricultural Sustainability in Benue State. *International Journal of Innovative Science and Research Technology*, 10(12), 2663-2671. https://doi.org/10.38124/ijisrt/25dec1200

I. INTRODUCTION

Climate change poses a critical threat to agricultural sustainability and food security globally, with disproportionate impacts on regions highly dependent on climate-sensitive agricultural systems. Recent assessments confirm that rising temperatures, changing precipitation patterns, and increasing frequency of extreme weather events are already undermining agricultural productivity, particularly in Sub-Saharan Africa (IPCC, 2023; FAO, 2024). The vulnerability of the region is exacerbated by limited adaptive capacity, weak governance structures, and heavy reliance on rain-fed agriculture (World Bank, 2023).

In Nigeria, agriculture remains central to socio-economic development, providing livelihoods for a majority of the rural population. However, climate variability has increasingly disrupted agricultural systems, resulting in declining yields, soil degradation, and heightened food insecurity (Ayanlade et al., 2022; Ojo & Baiyegunhi, 2023). These challenges are especially pronounced in Benue State, widely regarded as Nigeria's "food basket," where agricultural sustainability is closely linked to climatic stability and governance effectiveness (Adebayo et al., 2022).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

Recent studies emphasize that effective climate change governance encompassing legal frameworks, policies, and institutional coordination is essential for enhancing agricultural resilience and sustainability (Jordan et al., 2021; Biermann et al., 2022). In Nigeria, the adoption of national climate policies, including the Climate Change Act, signals growing institutional commitment to climate action. Nonetheless, evidence suggests that governance gaps persist at the subnational level, where weak implementation, limited institutional capacity, and insufficient stakeholder engagement undermine agricultural adaptation efforts (Eleri et al., 2022; Adenle et al., 2023).

Sustainable agricultural practices such as climate-smart agriculture and agroecological approaches have been promoted as viable adaptation pathways. However, their effectiveness depends largely on supportive governance environments that integrate climate considerations into agricultural planning and rural development strategies (FAO, 2023; Scoones et al., 2022). In Benue State, the extent to which existing climate governance arrangements facilitate or constrain agricultural sustainability remains under-examined.

This study addresses this gap by assessing climate change governance in Benue State and examining its implications for agricultural sustainability. Linking governance structures with agricultural outcomes, the study contributes empirical evidence to ongoing debates on climate governance and sustainable agriculture, offering insights relevant to policymakers and scholars concerned with subnational climate adaptation in developing agrarian contexts.

II. LITERATURE REVIEW

➢ *Climate Change and Agricultural Sustainability*

Agricultural sustainability refers to the ability of agricultural systems to maintain productivity over time while preserving environmental integrity, economic viability, and social equity. Climate change has increasingly threatened this balance through rising temperatures, unpredictable rainfall patterns, increased incidence of droughts and floods, and soil degradation (IPCC, 2023). Recent global assessments indicate that climate change has already reduced agricultural productivity growth by approximately 21 percent since 1961, with developing regions experiencing the most severe impacts (FAO, 2024).

In Sub-Saharan Africa, agriculture is predominantly rain-fed, making it particularly vulnerable to climate variability. Studies consistently show that climate-induced stresses have resulted in declining crop yields, increased production risks, and heightened food insecurity across the region (World Bank, 2023; Ayanlade & Adelekan, 2023). These impacts undermine not only food availability but also rural livelihoods and socio-economic stability, emphasizing the need for sustainable and climate-resilient agricultural systems.

➢ *Climate Change Impacts on Agriculture in Nigeria*

Nigeria's agricultural sector is highly sensitive to climatic conditions due to its reliance on rainfall, limited irrigation infrastructure, and widespread smallholder farming systems. Empirical studies indicate that changes in rainfall onset, shortened growing seasons, and temperature increases have negatively affected staple crop production, including maize, rice, and cassava (Ojo & Baiyegunhi, 2023; Umar et al., 2024). Flooding and drought events have become more frequent, leading to crop losses and land degradation, particularly in agrarian states.

Recent research focusing on Nigeria highlights that climate change impacts are not uniformly distributed but vary across ecological zones and states, depending on governance capacity, socio-economic conditions, and adaptive strategies (Adebayo et al., 2022). In Benue State, recurrent flooding and erratic rainfall have disrupted farming activities and reduced agricultural productivity, posing serious challenges to long-term sustainability (Ibrahim et al., 2024).

➢ *Conceptualizing Climate Change Governance*

Climate change governance encompasses the institutions, legal frameworks, policies, and processes through which societies respond to climate risks (Jordan et al., 2021). It operates across multiple levels, international, national, and subnational and involves a wide range of actors, including governments, civil society, and the private sector (Biermann et al., 2022). Effective climate governance is characterized by policy coherence, institutional coordination, accountability, and stakeholder participation.

Recent scholarship emphasizes that governance quality significantly influences adaptation outcomes, particularly in agriculture-dependent regions (Bulkeley et al., 2023). Weak governance structures often lead to fragmented policy implementation, limited resource allocation, and exclusion of vulnerable stakeholders, thereby constraining adaptive capacity and sustainability outcomes.

➢ *Climate Change Governance and Agriculture in Nigeria*

Nigeria has taken notable steps toward institutionalizing climate governance, including the adoption of the National Climate Change Policy and the enactment of the Climate Change Act. These frameworks aim to mainstream climate considerations across sectors, including agriculture. However, studies suggest that the effectiveness of these frameworks is limited by weak enforcement, overlapping institutional mandates, and inadequate coordination between federal and state governments (Eleri et al., 2022; Adenle et al., 2023).

At the subnational level, climate governance remains uneven, with many states lacking dedicated climate institutions or clear implementation strategies. Research indicates that agricultural adaptation initiatives often suffer from poor integration with climate policies, leading to gaps between policy formulation and practical outcomes on farms (Olawuyi,

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

2022). These challenges highlight the importance of examining governance arrangements at the state level, where agricultural decisions and climate impacts are most directly experienced.

- *Climate-Smart and Sustainable Agriculture as Governance Outcomes*

Climate-smart agriculture (CSA) has been widely promoted as a strategy for achieving agricultural sustainability under changing climatic conditions. CSA aims to increase productivity, enhance resilience, and reduce greenhouse gas emissions where possible (FAO, 2023). While CSA practices such as agroforestry, conservation agriculture, and improved crop varieties have shown promise, their adoption remains limited in many developing contexts.

Recent studies argue that the success of CSA depends less on technical feasibility and more on governance factors, including policy support, institutional capacity, access to finance, and stakeholder engagement (Scoones et al., 2022; Umar et al., 2024). In Nigeria, inadequate extension services, weak policy incentives, and limited inclusion of smallholder farmers in decision-making processes have constrained the scaling of sustainable agricultural practices.

- *Empirical Studies on Climate Governance and Agricultural Sustainability*

Empirical evidence from developing countries demonstrates a strong link between climate governance quality and agricultural sustainability outcomes. Studies conducted in Sub-Saharan Africa reveal that regions with coherent climate policies, functional institutions, and inclusive governance structures exhibit higher levels of agricultural adaptation and resilience (Bulkeley et al., 2023; FAO, 2024). Conversely, fragmented governance arrangements tend to exacerbate vulnerability and limit sustainability gains.

In Nigeria, empirical research on climate governance and agriculture remains limited, particularly at the state level. Existing studies often focus on farmer-level adaptation strategies without adequately addressing the institutional and legal contexts shaping these responses (Ayanlade & Adelekan, 2023). This gap is especially evident in Benue State, where agricultural sustainability is critical to regional food security, yet the role of climate change governance remains underexplored.

- *Identified Research Gaps*

The reviewed literature reveals three key gaps. First, while climate change impacts on agriculture in Nigeria are well documented, there is limited empirical analysis linking these impacts directly to governance structures at the subnational level. Second, existing studies often overlook the legal and institutional dimensions of climate governance that shape agricultural sustainability. Third, there is a paucity of location-specific research focusing on Benue State, despite its strategic importance to Nigeria's agricultural sector.

This study seeks to address these gaps by assessing climate change governance in Benue State and examining its implications for agricultural sustainability, thereby contributing to the growing literature on climate governance and sustainable agriculture in developing agrarian contexts.

III. STUDY AREA

The study was conducted in Benue State, located in North-Central Nigeria between latitudes 6°25′-8°08′ N and longitudes 7°47′-10°00′ E. The state shares boundaries with Nasarawa, Taraba, Cross River, Enugu, and Kogi States, as well as the Republic of Cameroon. Agriculture is the primary livelihood for most residents, and the state is widely referred to as Nigeria's "food basket" due to its substantial production of staple crops such as yam, cassava, maize, and rice.

Benue State has a tropical climate characterized by a rainy season (April-October) and a dry season (November–March), with annual rainfall ranging from 1,200 to 1,800 mm. In recent years, the state has experienced increased rainfall variability and recurrent flooding, particularly along the River Benue, posing significant risks to agricultural sustainability. The state's heavy dependence on climate-sensitive agriculture and its growing exposure to climate change impacts make it a suitable location for assessing climate change governance and agricultural sustainability.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

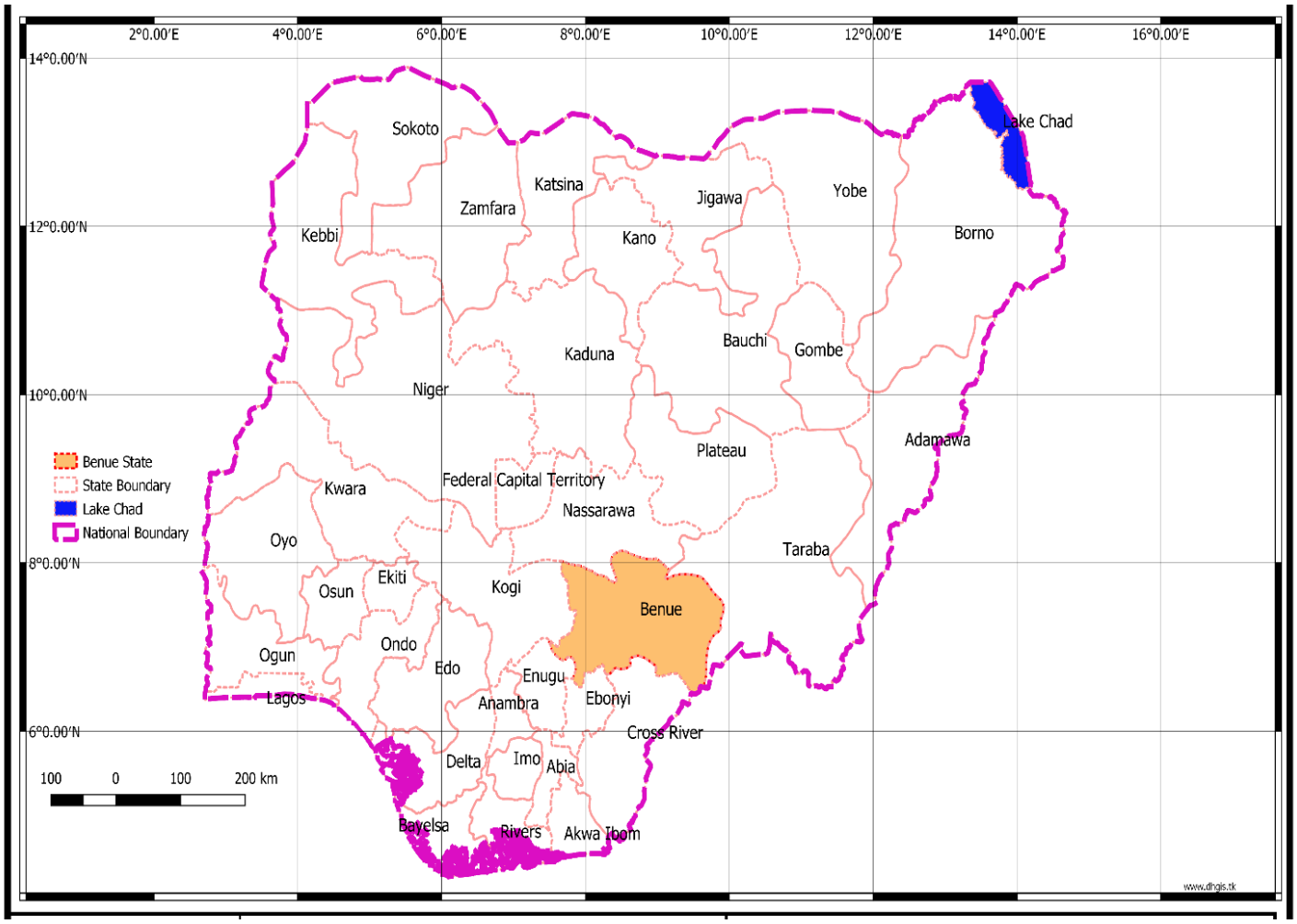

Fig 1: Map of Nigeria Highlighting Benue State
Source: UniAbuja GIS

IV. METHODOLOGY

➢ *Research Design*

This study adopted a mixed-methods research design, combining qualitative and quantitative approaches to assess climate change governance and its implications for agricultural sustainability in Benue State. The mixed-methods approach enabled a comprehensive analysis by integrating policy and legal review with empirical data from agricultural stakeholders, thereby strengthening the validity of the findings.

➢ *Data Sources*

Data were obtained from both primary and secondary sources. Primary data were collected through structured questionnaires administered to smallholder farmers and key informant interviews with relevant stakeholders, including officials from agricultural and environmental agencies, extension officers, and representatives of farmer associations. Secondary data comprised policy documents, legislation, government reports, and relevant academic literature on climate change governance and agriculture.

➢ *Sampling Technique and Sample Size*

A multistage sampling technique was employed. First, selected Local Government Areas were purposively chosen based on their agricultural significance and exposure to climate-related risks. In the second stage, farming communities were randomly selected, and respondents were chosen using simple random sampling. Key informants were selected purposively due to their institutional roles and expertise. The sample size was determined to ensure adequate representation and analytical reliability.

➢ *Data Collection Instruments*

Structured questionnaires were used to elicit information on farmers' awareness of climate policies, perceived climate impacts, adaptation practices, and governance challenges. Key informant interviews followed a semi-structured guide focusing on climate governance frameworks, institutional coordination, and policy implementation at the state and local levels.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

➢ *Data Analysis*

Quantitative data were analyzed using descriptive statistics, including frequencies, percentages, and mean scores, while qualitative data from interviews were analyzed through thematic content analysis. Policy and legal documents were examined using doctrinal and institutional analysis to assess the effectiveness of climate governance frameworks. The triangulation of data sources enhanced the robustness and credibility of the findings.

V. RESULTS AND DISCUSSION

➢ *Socio-Demographic Characteristics of Respondents*

The socio-demographic profile of respondents indicates that agriculture in Benue State is predominantly practiced by smallholder farmers, with the majority of respondents falling within the economically active age group. Most respondents identified farming as their primary occupation, reflecting the agrarian nature of the state and the central role of agriculture in household livelihoods. This demographic structure suggests a high dependence on climate-sensitive agricultural activities for income and food security.

Educational attainment among respondents varied, with a substantial proportion having basic or secondary education. This level of education has important implications for farmers' awareness, access to climate-related information, and understanding of climate change governance and adaptation policies. Limited formal education may constrain the effective uptake of policy-driven adaptation measures and extension services.

Table 1: Socio-Demographic Characteristics of Respondents (N = 200)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	128	64.0
	Female	72	36.0
Age (years)	< 30	34	17.0
	31–40	58	29.0
	41–50	62	31.0
	> 50	46	23.0
Education level	No formal education	48	24.0
	Primary	62	31.0
	Secondary	66	33.0
	Tertiary	24	12.0
Farming experience (years)	< 10	56	28.0
	10–20	84	42.0
	> 20	60	30.0

Source: Authors Research Survey, 2025

As presented in Table 1, the majority of respondents were male, had over ten years of farming experience, and operated at a smallholder scale. These characteristics are consistent with earlier studies that identify smallholder farmers as the most vulnerable group to climate change impacts in Nigeria due to limited access to financial resources, technology, and institutional support (Ayanlade & Adelekan, 2023).

➢ *Awareness of Climate Change and Governance Frameworks*

Quantitative findings indicate that a high proportion of respondents were aware of climate change impacts, particularly changes in rainfall patterns, increased flooding, and rising temperatures, which directly affect agricultural activities in Benue State. This high level of awareness reflects farmers' continuous exposure to climate-related stresses within their farming environments. However, awareness of formal climate change governance frameworks, including policies, laws, and institutional arrangements, was comparatively low.

As presented in Table 2, while the majority of respondents reported awareness of climate change impacts, less than one-third were aware of existing climate change policies, and only a small proportion had participated in climate-related programs. Access to climate information through formal channels such as extension services and government agencies was also limited.

Qualitative evidence from key informant interviews supports these findings, indicating that climate change policies are largely formulated at the national level, with minimal dissemination and localization at the state and community levels. As one respondent noted:

"Farmers see the effects of climate change every season, but they are not aware of any specific government policy meant to support adaptation."

The observed disparity between awareness of climate change impacts and awareness of governance frameworks highlights broader institutional and communication gaps within Nigeria's climate governance system, as similarly documented in recent studies (Eleri et al., 2022; Adenle et al., 2023).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

Table 2: Awareness of Climate Change and Governance Frameworks (N = 200)

Awareness Indicator	Yes (n)	Yes (%)	No (n)	No (%)
Awareness of climate change impacts	182	91.0	18	9.0
Awareness of climate change policies	54	27.0	146	73.0
Access to climate information	96	48.0	104	52.0
Participation in climate-related programs	38	19.0	162	81.0

Source: Authors Research Survey, 2025

➢ *Perceived Climate Change Impacts on Agricultural Sustainability*

As shown in Figure 2, erratic rainfall and flooding constitute the most significant climate change impacts on agricultural activities in Benue State. The dominance of these impacts reflects increasing rainfall variability and recurrent flood events, particularly along the River Benue and its tributaries. Such conditions disrupt planting and harvesting cycles, damage farmlands, and contribute to declining crop yields, thereby threatening long-term agricultural sustainability. The relatively lower reporting of soil erosion and rising temperatures does not diminish their importance but suggests that farmers perceive immediate hydrological extremes as more severe.

These findings align with recent studies documenting climate-induced disruptions to agricultural productivity in North-Central Nigeria (Ibrahim et al., 2024; FAO, 2024). Recurrent flooding along the River Benue was identified as a critical factor undermining long-term agricultural sustainability.

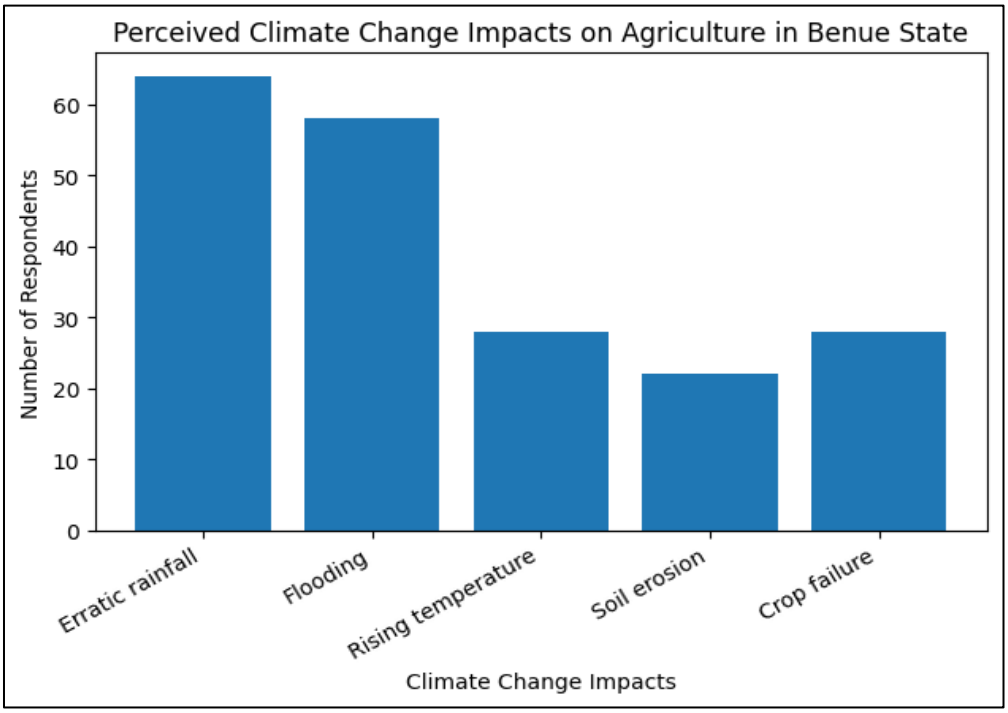

Fig 2: Perceived Climate Change Impacts Affecting Agricultural Sustainability in Benue State.
Source: Authors Research Survey, 2025

➢ *Governance and Institutional Challenges*

As illustrated in Figure 3, respondents reported low levels of satisfaction with government and institutional support for climate change adaptation in agriculture, indicating weak climate change governance in Benue State. The dominance of dissatisfaction responses reflects limited effectiveness of existing governance frameworks in addressing the adaptation needs of farmers. Quantitative evidence suggests that government interventions remain insufficient to support sustainable agricultural practices under changing climatic conditions.

Qualitative evidence from key informant interviews further explains this pattern of dissatisfaction. Respondents highlighted persistent governance challenges, including inadequate funding, weak institutional coordination, limited agricultural extension services, and poor enforcement of environmental regulations. These constraints are exacerbated by institutional fragmentation and the absence of integrated

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

planning between agricultural and environmental agencies. As one key informant observed:

"Climate change issues are not mainstreamed into agricultural planning at the state level, and agencies often work in isolation."

Taken together, the findings presented in Figure 3 underscore the gap between climate policy formulation and implementation at the subnational level, demonstrating how weak governance structures continue to constrain agricultural sustainability in Benue State.

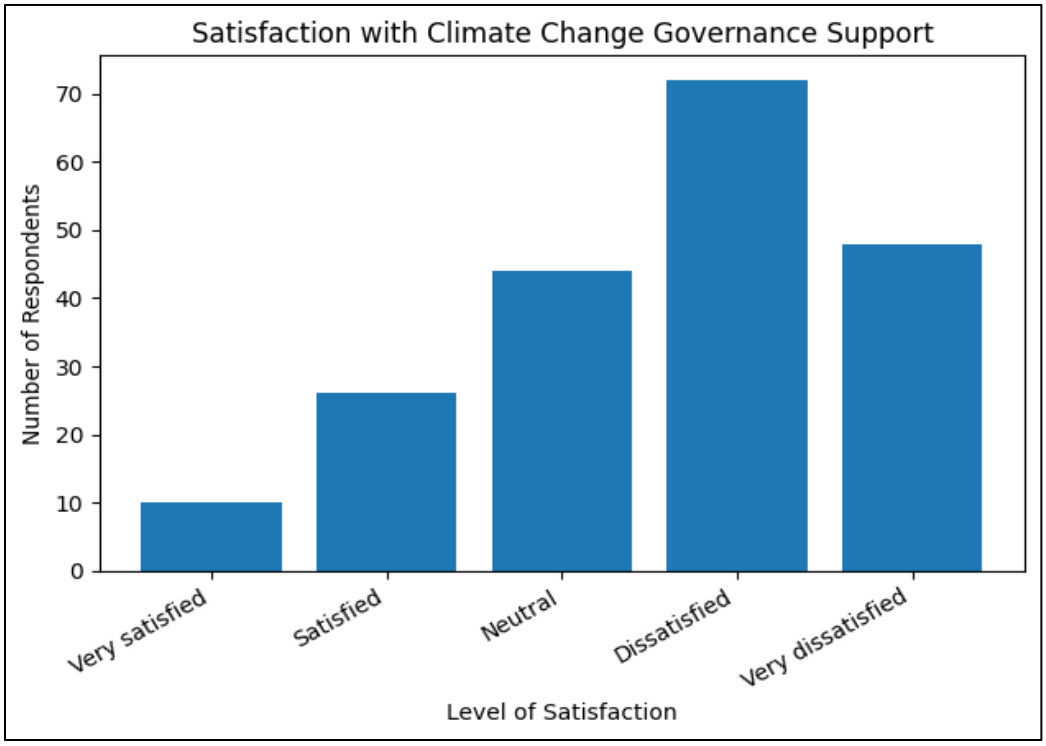

Fig 3: Farmers' Level of Satisfaction with Climate Change Governance Support in Benue State
Source: Authors Research Survey, 2025

This finding supports existing scholarship emphasizing the role of governance coherence and institutional capacity in shaping adaptation outcomes (Jordan et al., 2021; Bulkeley et al., 2023).

➢ *Adaptation Practices and Sustainability Outcomes*

Despite existing governance constraints, farmers in Benue State have adopted a range of autonomous adaptation strategies in response to climate change impacts. These strategies include crop diversification, adjustment of planting dates, use of improved crop varieties, soil conservation practices, and limited irrigation where feasible. Such practices reflect farmers' efforts to cope with increasing climate variability and sustain agricultural production under challenging conditions.

As presented in Table 3, crop diversification and adjustment of planting dates were the most commonly adopted adaptation measures, while irrigation practices were least utilized. Although these strategies demonstrate a degree of adaptive capacity among farmers, they remain largely reactive and short-term, constrained by limited access to finance, modern technology, extension services, and institutional support.

Table 3: Adaptation Strategies Adopted by Farmers (N = 200)

Adaptation Strategy	Frequency (n)	Percentage (%)
Crop diversification	56	28.0
Adjustment of planting dates	48	24.0
Use of improved crop varieties	42	21.0
Soil conservation practices	30	15.0
Irrigation practices	24	12.0

Source: Authors Research Survey, 2025

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

The limited scale and effectiveness of these adaptation practices suggest that, in the absence of supportive and coherent governance structures, agricultural sustainability efforts remain fragile. This finding reinforces existing arguments that sustainable and climate-resilient agriculture depends not only on farmer initiative but also on enabling policy frameworks, effective institutions, and targeted public investment (Scoones et al., 2022; FAO, 2023). Strengthening climate change governance is therefore critical to scaling up adaptation practices and improving long-term agricultural sustainability in Benue State.

- *Discussion of Key Findings*

The findings demonstrate a clear and significant relationship between climate change governance and agricultural sustainability in Benue State. Although farmers exhibit high awareness of climate change impacts, weak governance structures continue to hinder effective adaptation and limit sustainability outcomes. In particular, the absence of localized climate policies, inadequate institutional coordination, and insufficient stakeholder engagement constrain the translation of national climate commitments into practical and targeted agricultural support at the state and community levels.

These results corroborate earlier studies that identify governance capacity as a critical determinant of climate adaptation success in the agricultural sector (Ayanlade & Adelekan, 2023; Adenle et al., 2023). By highlighting how institutional weaknesses shape adaptation outcomes at the subnational level, this study extends existing literature and provides empirical evidence linking climate change governance to agricultural sustainability in Benue State. The findings underscore the importance of strengthening state-level governance mechanisms to enhance climate-resilient agricultural development.

VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed to strengthen climate change governance and enhance agricultural sustainability in Benue State:

- *Strengthen Subnational Climate Governance*

State-level climate change governance structures should be strengthened through the development and implementation of localized climate policies that integrate climate adaptation into agricultural planning and rural development programs.

- *Improve Institutional Coordination*

Effective coordination between agricultural, environmental, and climate-related institutions is essential. Establishing inter-agency collaboration mechanisms would reduce fragmentation and enhance policy coherence and implementation.

- *Enhance Extension and Information Services*

Agricultural extension services should be expanded and equipped to disseminate climate-related information, adaptation strategies, and policy awareness to farmers, particularly smallholder farmers.

- *Increase Funding and Financial Support*

Targeted funding mechanisms, including climate adaptation grants and access to affordable credit, should be provided to support the adoption of climate-resilient and sustainable agricultural practices.

- *Promote Inclusive Stakeholder Engagement*

Farmers, local communities, and traditional institutions should be actively involved in climate policy design and implementation to ensure context-specific and inclusive adaptation strategies.

VII. CONCLUSION

This study assessed climate change governance and its implications for agricultural sustainability in Benue State. The findings reveal that while farmers are highly aware of climate change impacts, weak governance structures, limited institutional coordination, and inadequate policy implementation constrain effective adaptation and sustainability outcomes. Farmers' reliance on largely autonomous and reactive adaptation strategies underscores the absence of sufficient institutional support.

The study contributes to the growing body of literature on climate governance and sustainable agriculture by providing subnational empirical evidence from Benue State. Strengthening climate change governance through localized policies, improved institutional coordination, and inclusive stakeholder participation is critical for enhancing agricultural sustainability and resilience in the face of increasing climate risks. These measures are essential not only for Benue State but also for other agrarian regions facing similar governance and climate challenges.

REFERENCES

[1]. Adebayo, A. A., Olatunji, O. A., & Musa, S. D. (2022). Climate variability and agricultural productivity in North-Central Nigeria. *Journal of Environmental Management*, 317, 115–127. https://doi.org/10.1016/j.jenvman.2022.115127

[2]. Adenle, A. A., Ford, J. D., Morton, J., & Twomlow, S. (2023). Institutional challenges to climate change adaptation in Nigeria's agricultural sector. *Climate Policy*, 23(4), 472–486. https://doi.org/10.1080/14693062.2022.2144891

[3]. Akinro, A. O., Opeyemi, D. A., & Ologunagba, I. B. (2021). Climate change and agricultural sustainability in Nigeria: Challenges and prospects. *Environmental Challenges*, 5, 100320. https://doi.org/10.1016/j.envc.2021.100320

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec1200

[4]. Ayanlade, A., & Adelekan, I. O. (2023). Climate change adaptation and agricultural vulnerability in Nigeria: Evidence from smallholder farmers. *Climate and Development*, 15(3), 219–232. https://doi.org/10.1080/17565529.2022.2079424
[5]. Biermann, F., Hickmann, T., & Sénit, C. A. (2022). The political impact of the sustainable development goals: Transforming governance through global goals? *Global Environmental Change*, 74, 102536. https://doi.org/10.1016/j.gloenvcha.2022.102536
[6]. Bulkeley, H., Andonova, L. B., Betsill, M. M., & Compagnon, D. (2023). Governing climate change through multilevel institutions. *Annual Review of Environment and Resources*, 48, 239–265. https://doi.org/10.1146/annurev-environ-120920-091947
[7]. Eleri, E. O., Ujah, U., & Onuvae, P. (2022). Nigeria's climate change governance architecture: Gaps and opportunities. *Energy, Sustainability and Society*, 12(1), 45. https://doi.org/10.1186/s13705-022-00366-9
[8]. Food and Agriculture Organization of the United Nations (FAO). (2023). *Climate-smart agriculture: A framework for sustainable food systems*. FAO.
[9]. Food and Agriculture Organization of the United Nations (FAO). (2024). *The state of food and agriculture 2024: Climate change, agriculture and resilience*. FAO.
[10]. Intergovernmental Panel on Climate Change (IPCC). (2023). *Sixth Assessment Report: Impacts, adaptation and vulnerability*. Cambridge University Press.
[11]. Ibrahim, H. Y., Sadiq, M. S., & Yusuf, A. A. (2024). Flooding, climate risks, and agricultural livelihoods in Nigeria's Middle Belt. *Natural Hazards*, 121(2), 2159–2178. https://doi.org/10.1007/s11069-023-06125-4
[12]. Jordan, A., Huitema, D., Hildén, M., Van Asselt, H., Rayner, T., & Schoenefeld, J. (2021). Climate change governance: An interdisciplinary perspective. *Environmental Politics*, 30(1–2), 1–19. https://doi.org/10.1080/09644016.2020.1811961
[13]. National Bureau of Statistics (NBS). (2023). *Annual abstract of statistics*. Government of Nigeria.
[14]. Ojo, T. O., & Baiyegunhi, L. J. S. (2023). Climate change, food security and smallholder farmers' adaptation in Nigeria. *Sustainability*, 15(5), 4312. https://doi.org/10.3390/su15054312
[15]. Olawuyi, D. S. (2022). Advancing climate governance in Africa: The role of law and institutions. *Review of European, Comparative & International Environmental Law*, 31(2), 206–218. https://doi.org/10.1111/reel.12431
[16]. Onyeneke, R. U., & Madukwe, D. K. (2022). Adaptation strategies of smallholder farmers to climate change in Nigeria. *Journal of Agriculture and Food Research*, 7, 100256. https://doi.org/10.1016/j.jafr.2021.100256
[17]. Scoones, I., Stirling, A., Abrol, D., Atela, J., Charli-Joseph, L., Eakin, H., Ely, A., Olsson, P., Pereira, L., Priya, R., van Zwanenberg, P., & Yang, L. (2022). Transformations to sustainability: Combining structural, systemic and enabling approaches. *Current Opinion in Environmental Sustainability*, 54, 101–110. https://doi.org/10.1016/j.cosust.2022.101110
[18]. Umar, B. B., Sadiq, M. S., & Ahmed, A. A. (2024). Climate-smart agriculture and adaptation capacity of smallholder farmers in Nigeria. *Agriculture & Food Security*, 13(1), 18. https://doi.org/10.1186/s40066-024-00441-7
[19]. World Bank. (2023). *Climate-smart agriculture and food security in Sub-Saharan Africa*. World Bank Publications.
[20]. World Bank. (2024). *Enhancing climate resilience in African agriculture*. World Bank Publications.