

**IMPACT OF CLIMATE CHANGE ON AVAILABILITY OF AGRICULTURAL PRODUCE  
IN BWARI AREA COUNCIL, ABUJA, NIGERIA: A DESCRIPTIVE ANALYSIS**KOCE Diko Henry<sup>1</sup>SIMADI Monday<sup>2</sup><sup>1</sup>Department of Marketing, The Federal Polytechnic Bida, Niger state: okindo66@gmail.com<sup>2</sup>FCT Mass Education Headquarters Karu, Abuja: simamong@gmail.com**Abstract**

Agriculture remains a critical pillar of food security, economic development and livelihood sustenance across the globe. But its vulnerability to climate change has become a growing national and international concern. Thus, this study examined the impact of climate change on agricultural produce availability in Bwari Area Council, Abuja - a critical agrarian hub in Nigeria that is vulnerable to shifting global climate patterns. The study employed a descriptive design and collected data from 500 farmers across ten towns in a cross-sectional survey. A structured questionnaire served as data collection instrument. Data analysis, utilizing frequencies and percentages, revealed farmers' acute awareness of climate change, through observed unreliable rainfall, increased dry spells, rising temperatures, and extreme weather events. These changes profoundly impacted production, with significant yield declines across staple crops like maize and yam and a dramatic reduction in vegetable availability. Livestock production also suffered, marked by decreased pasture and water access. Despite farmers' proactive adaptation efforts (e.g., adjusting planting times, these were severely hindered by lack of financial resources, limited access to improved inputs, and insufficient climate information/extension services. The study concludes that climate change is inflicting tangible negative impacts on Bwari's agricultural output and livelihoods and recommends among others, that there should be enhanced financial inclusion and access to capital for farmers to bolster local adaptive capacity and ensure food security.

**Keywords:** Adaptation strategies, climate change, food security, crop yields

**Introduction**

Agriculture remains a critical pillar of food security, economic development, and sustenance livelihood across the globe. However, its vulnerability to climate change has become a growing national and international concern. Global climate systems are undergoing rapid transformation, with observable increases in average temperatures, shifts in precipitation patterns, heightened frequency and severity of extreme weather events, and rising atmospheric greenhouse gas concentrations. These shifts have profound implications for agricultural productivity, particularly in developing regions (Intergovernmental Panel on Climate Change [IPCC], 2023; World Meteorological Organization [WMO], 2022).

Though global models and assessments have extensively mapped the general impact of climate change on agriculture, the localized and contextual realities especially in rural African communities remain under-explored. At the national level, Nigeria faces escalating threats from climate change due to its geographical diversity, overreliance on climate-sensitive sectors, and the predominance of rain-fed agriculture. The country's rural populations, who primarily depend on smallholder farming, are disproportionately affected by climate variability and extremes such as droughts, floods, and irregular rainfall (United Nations Development Programme [UNDP] Nigeria, 2023; Nigerian Meteorological Agency [NIMET], 2021). These climate stressors exacerbate existing structural challenges such as poor access to inputs, limited irrigation infrastructure, degraded soils and inadequate extension services, all of which constrain agricultural productivity (Food and Agricultural Organization [FAO], 2022; African Development Bank [AfDB], 2020).

Abuja, the Federal Capital Territory (FCT) of Nigeria, is a region perceived as politically and economically privileged. Yet, agricultural activities continue to thrive, especially in peri-urban and

rural councils such as Bwari. Bwari Area Council is strategically located within the Guinea Savannah zone of North-Central Nigeria and is recognized for its agrarian economy. The area's residents engage predominantly in the cultivation of staple crops such as yam, maize, sorghum, upland rice, cassava, and cowpea, along with various fruits, vegetables and legumes. Livestock farming, including goats, sheep, cattle, and poultry, is also practiced at a subsistence level (National Bureau of Statistics [NBS], 2022; Ajayi et al., 2021). These agricultural practices not only support household nutrition and income but also contribute significantly to local food security and economic sustainability.

Despite Bwari's agricultural potential, increasing climate variability poses serious threats to the availability and stability of its agricultural outputs. Changes in the timing and intensity of rainfall, prolonged dry spells, extreme weather events and higher temperatures disrupt planting and harvesting schedules, reduce crop yields, degrade soil fertility, and increase the prevalence of pests and diseases (Umar & Olatunji, 2023; International Institute of Tropical Agriculture [IITA], 2021). Livestock production is equally at risk due to reduced water availability, heat stress and emerging zoonotic diseases influenced by climatic shifts (International Fund for Agricultural Development [IFAD], 2021; World Bank, 2022).

While numerous studies have explored the general impacts of climate change on agriculture in Nigeria and Sub-Saharan Africa, there remains a notable knowledge gap regarding its localized effects in specific rural and semi-urban councils such as Bwari. The diversity in agroecological zones, cropping systems, and socio-economic conditions necessitates disaggregated analyses that reflect the unique vulnerabilities and adaptive capacities of local communities. Current literature largely lacks empirical investigations into how climate change is specifically altering the availability of agricultural produce in Bwari Area Council. This knowledge will make it easy to design targeted adaptation and mitigation strategies that align with local realities (Adebayo & Agboola, 2020).

This study sought to bridge this gap by examining the multifaceted impacts of climate change on agricultural produce availability in Bwari Area Council. It integrates scientific insights with local observations to analyze trends, risks and adaptive challenges faced by farmers in the region. By doing so, the research contributes to the broader discourse on climate-resilient agriculture and supports evidence-based policymaking for sustainable rural development. Ultimately, the interconnection between global climate systems, national vulnerabilities, and local livelihood realities underscores the urgency of localized climate adaptation planning. Understanding how climatic stressors uniquely affect regions like Bwari is essential not only for ensuring food security but also for safeguarding rural livelihoods, promoting environmental sustainability, and achieving Nigeria's national development goals as aligned with the UN Sustainable Development Goals (SDGs) and the National Adaptation Strategy (National Adaptation Strategy and Plan of Action for Climate Change Nigeria [NASPA-CCN], 2022; United Nations [UN] Sustainable Development Goals [SDG] Report, 2023).

### **Materials and Methods**

This study investigated farmers' perceptions of the impact of climate change on agricultural yield in Bwari Area Council of Abuja. The study was conducted in this rural and peri-urban area in the Guinea Savanna ecological zone because of its strong reliance on agriculture. This study utilized a descriptive research design and collected data via cross-sectional survey. To select participants, a multi-stage sampling technique was employed. 10 purposively selected towns within Bwari Area Council - Kawu, Zango, Zuma, Kuduro, Katampe, Kogo, Jigo, Sabongari, Kuchibuyi, and Ushafa - formed the initial stage. Subsequently, 50 farmers were selected from each town using systematic random sampling, resulting in a total sample size of 500 farmers (Johnson & Chen, 2020).

Data were collected primarily using a structured questionnaire designed with both closed-ended (Likert-scale, multiple-choice) and open-ended questions. This instrument covered socio-demographics, types of crops and livestock, observed climate change indicators, perceived impacts on yields and availability, current adaptation strategies, and associated challenges. A pilot study validated the questionnaire's clarity and reliability (Brown et al., 2022). Ethical approval and informed consent were secured before data collection. Trained enumerators, fluent in local languages, conducted face-to-face interviews over a two-week period in March 2024, ensuring accurate recording and maintaining respondent anonymity (Davis & Green, 2023). For data analysis, responses were coded and entered into SPSS version 29.0. Frequencies, and percentages were exclusively used to summarize the socio-demographic profile, perceived climate change indicators, impacts on agricultural products, and adaptation strategies/challenges. Qualitative insights from open-ended responses were extracted via thematic analysis, providing a comprehensive quantitative summary of farmers' experiences (Pallant, 2020).

## Results

This section presents the key findings derived from the descriptive analysis of data collected from 500 farmers across 10 towns in Bwari Area Council. The results summarize the socio-demographic characteristics of the respondents, their perceptions of climate change indicators, the observed impacts on agricultural products, and the adaptation strategies employed.

**Table 1: Socio-Demographic Profile of Farmers Surveyed in Bwari Area Council**

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	340	68%
	Female	160	32%
Age Bracket	30-50 years	275	55%
	Below 30 years / Above 50 years	225	45%
Educational Attainment	Primary Education	200	40%
	Secondary Education	175	35%
	No Formal Education	125	25%
Farming Experience	Average (Years)	18.5	N/A

**Source:** Field Work, 2025

**Note:** The average farming experience of 18.5 years is a mean value and is therefore not included in the frequency and percentage distribution table.

The socio-demographic analysis of farmers in Bwari Area Council reveals a predominantly male (68%) workforce, with the majority (55%) falling within the active farming age bracket of 30-50 years. This group possesses substantial farming experience, averaging 18.5 years, indicating a deep reliance on traditional agricultural methods. Educational attainment varies, with 40% having primary education, 35% secondary, and 25% no formal schooling, suggesting diverse literacy levels. These characteristics carry significant implications for climate change adaptation. The male dominance means that adaptation strategies must effectively target this demographic, while also recognizing and supporting the roles of female farmers who may face unique barriers. The active but experienced workforce offers valuable indigenous knowledge, yet their reliance on traditional practices might limit their inclination or capacity to adopt new, more technologically advanced climate-resilient techniques. The varied educational backgrounds necessitate diverse communication strategies, ensuring that complex climate information and modern farming advice are accessible to all farmers, including those with limited formal schooling. Ultimately, this profile underscores the need for targeted, culturally

sensitive interventions that build upon existing knowledge while introducing new, climate-resilient agricultural practices to enhance their adaptive capacity against evolving climatic threats.

**Table 2: Perceived Climate Change Indicators by Farmers in Bwari Area Council**

Climate Change Indicator	Category	Frequency (n)	Percentage (%)
Decrease in reliability of rainfall patterns (Delayed onset & early cessation of rainy seasons)	Observed	460	92%
	Not Observed	40	8%
Increase in dry spell duration during cropping season	Observed	425	85%
	Not Observed	75	15%
General increase in ambient temperatures	Observed	390	78%
	Not Observed	110	22%
Increased frequency of extreme weather events (e.g., intense, short-duration rainfall/flash floods)	Observed	350	70%
	Not Observed	150	30%

**Source:** Field Work, 2025

**Note:** For this table, "Observed" indicates respondents who perceived or reported the specific climate change indicator, while "Not Observed" includes those who did not report or perceive it. The percentages are calculated based on the total number (500) of respondents.

Farmers in Bwari Area Council are acutely aware of significant and negative shifts in their local climate. A striking 92% observed a decrease in the reliability of rainfall patterns, noting delayed onset and early cessation of rainy seasons. Similarly, 85% reported an increase in dry spell duration during the crucial cropping season, while 78% observed a general increase in ambient temperatures. Furthermore, 70% perceived an increased frequency of extreme weather events, such as intense, short-duration rainfall leading to flash floods. These observations carry profound implications for the region's agriculture.

The overwhelming experience of erratic rainfall and prolonged dry spells poses a direct and severe threat to the predominantly rain-fed agricultural system, rendering traditional farming practices unreliable. Rising temperatures exacerbate this stress by increasing water demand for crops and livestock. This combination of droughts, floods, and heat creates a volatile environment, significantly heightening the risk of crop failure and undermining household food security. The urgent need for robust and effective adaptive strategies is underscored by farmers' firsthand experiences, emphasizing the importance of efficient water management to mitigate losses and stabilize production.

**Table 3: Perceived Impact of Climatic Change on Crop Yield and Availability in Bwari Area Council**

Crop/Availability Impact	Perceived Impact Category	Frequency (n)	Percentage (%)
Yam Yields	Decline in Yield	375	75%
	No/Less Impact	125	25%
Maize Yields	Decline in Yield	400	80%
	No/Less Impact	100	20%
Upland Rice Production	Reduction in Production	325	65%
	No/Less Impact	175	35%
Sorghum Production	Reduction in Production	300	60%
	No/Less Impact	200	40%
Cassava (Tuber Size/Biomass)	Reduction Observed	275	55%
	No/Less Impact	225	45%
Vegetables (Availability/Quality)	Reduced Availability/Quality	440	88%
	No/Less Impact	60	12%
	General Decrease	360	72%

Overall Consistent Availability of Agricultural Products	No/Less Decrease	140	28%
--	------------------	-----	-----

**Source:** Field Work, 2025

**Note:** "No/Less Impact" or "No/Less Decrease" includes respondents who did not report a decline or reduction, or reported no change/increase. Percentages are calculated based on 500 respondents.

Climate change is profoundly impacting crop production and overall agricultural product availability in Bwari Area Council, presenting a clear threat to food security and farmer livelihoods. A significant majority of farmers reported substantial yield declines in key staple crops: 80% for maize and 75% for yam. Other essential cereals, such as upland rice (65%) and sorghum (60%), also experienced noticeable reductions. Even cassava, typically considered resilient, showed a 55% reduction in tuber size/biomass, indicating its vulnerability to severe climatic shifts. The most dramatic impact was on vegetables, with a staggering 88% of farmers reporting reduced availability and quality, likely due to increased temperatures and water scarcity. Cumulatively, 72% of farmers observed a general decrease in consistent availability of agricultural produce from their farms.

These widespread reductions in crop availability carry severe implications. They directly threaten food security at the household and community levels, potentially leading to higher food prices and reduced access for vulnerable populations. Farmers face increased economic vulnerability, as their primary income source is diminishing, risking poverty and hindering future agricultural investment. The sharp decline in vegetables raises particular concerns for nutritional deficiencies. These impacts also exacerbate pre-existing challenges like limited financial resources and access to inputs, trapping farmers in a cycle of low productivity. The pervasive nature of these impacts across diverse crops highlights the urgent need for comprehensive, multi-faceted interventions that address the systemic vulnerabilities of the entire agricultural sector in Bwari Area Council.

**Table 4: Perceived Impact of Climatic Changes on Livestock Production in Bwari Area Council**

Livestock Impact Indicator	Perceived Impact Category	Frequency (n)	Percentage (%)
Pasture Availability (Availability & quality of natural pastures)	Decrease observed	400	80%
	No decrease/Less impact	100	20%
Water Access (Sufficient water for livestock)	Challenges highlighted	325	65%
	No challenges highlighted	175	35%
Disease Prevalence (Climate-sensitive animal diseases)	Increase reported	250	50%
	No increase/Less impact	250	50%

**Source:** Field Work, 2025

**Note:** "No decrease/Less impact" or "No challenges highlighted" includes respondents who did not report specific impact or perceived less impact. Percentages are calculated based on 500 respondents.

Climate change is significantly stressing livestock farming in Bwari Area Council, presenting a multifaceted threat to agrarian livelihoods. An overwhelming 80% of livestock farmers reported a decrease in the availability and quality of natural pastures, a severe impact on the primary feed source, especially during extended dry seasons. Concurrently, 65% highlighted challenges in accessing sufficient water for their animals due to reduced sources. Furthermore, half (50%) of the farmers observed a noticeable increase in climate-sensitive animal diseases, suggesting changing environmental conditions are creating more favorable environments for pathogens or stressing animals. These findings carry critical implications. The widespread scarcity of pasture and water, coupled with rising disease prevalence, constitutes a direct threat to the sustainability of livestock farming, potentially rendering operations unprofitable and forcing farmers to reduce herd sizes, thereby impacting their income and assets. This decline in livestock productivity compounds existing

food security challenges already faced from crop reductions, creating a more comprehensive food crisis potential. Farmers also face increased burden of veterinary costs and economic losses due to animal morbidity and mortality. Moreover, reduced resource availability could intensify competition for pastures and water, potentially exacerbating resource-based conflicts. These impacts underscore the urgent need for integrated agricultural planning that encompasses both crop and livestock components, promoting strategies to enhance the resilience of the entire farming system.

**Table 5: Adaptation Strategies Employed and Challenges Faced by Farmers in Bwari Area Council**

Category / Indicator	Frequency (n)	Percentage (%)
<b>Adaptation Strategies Employed</b>		
Adjusting planting times	300	60%
Using drought-tolerant crop varieties	225	45%
Practicing mixed cropping	275	55%
<b>Major Challenges Hindering Adoption of Strategies</b>		
Lack of financial resources	450	90%
Limited access to improved seeds and modern implements	425	85%
Insufficient access to relevant climate information and extension services	350	70%

**Source:** Field Work, 2025

**Note:** For adaptation strategies, farmers may employ multiple strategies, so the percentages do not sum to 100%. For challenges, these represent the most frequently cited obstacles. Frequencies are calculated based on 500 respondents.

Farmers in Bwari Area Council are actively implementing various adaptation strategies, including adjusting planting times (60%), practicing mixed cropping (55%), and utilizing drought-tolerant crop varieties (45%). These proactive measures demonstrate farmers' awareness and willingness to adapt to changing climatic conditions. However, these efforts are severely hindered by pervasive systemic and resource-based barriers. The most significant challenges identified are an overwhelming lack of financial resources (90%), limited access to improved seeds and modern implements (85%), and insufficient access to relevant climate information and extension services (70%). This critical disjuncture reveals that while farmers are highly engaged in adapting, their capacity is severely constrained by economic limitations, supply chain issues, and inadequate support systems. Therefore, effective climate change adaptation in Bwari requires targeted policy interventions that prioritizes financial inclusion, availability of crucial agricultural inputs, and revitalization of extension services to bridge the knowledge and resource gaps faced by these communities.

### Discussion of Findings

The findings of this study offer a compelling and localized perspective on the profound impact of climate change on agricultural produce availability in Bwari Area Council of Abuja. The integrated analysis of socio-demographics, perceived climate indicators, observed impacts on both crop and livestock production, and the challenges to adaptation provides a robust empirical foundation for understanding the climate vulnerability of this agrarian community.

Farmers' collective experience reveals a pervasive and detrimental shift in local climatic patterns. A vast majority of respondents (92%) perceived a decrease in rainfall reliability, complemented by a substantial 85% observing an increase in dry spell duration. These changes are compounded by a general rise in ambient temperatures (78%) and an increased frequency of extreme weather events,

such as flash floods (70%). These acute perceptions, deeply rooted in their long-standing agricultural experience (average 18.5 years), directly translate into tangible negative effects on the availability of agricultural products.

The observed impacts on crop production are significant and widespread. Staple crops like maize (80% yield decline) and yam (75% yield decline), which are critical for food security, are severely affected by insufficient rainfall and prolonged dry spells. Even cereals like upland rice (65% reduction) and sorghum (60% reduction), and the traditionally resilient cassava (55% reduction in tuber size), are experiencing considerable stress. The most dramatic impact is on vegetables (88% reduction in availability/quality), highlighting their extreme sensitivity to altered climatic conditions. Cumulatively, 72% of farmers reported an overall decrease in the consistent availability of agricultural products, underscoring a pervasive decline in productivity.

Beyond crops, the study illuminates significant stress on livestock production, which is integral to the agrarian livelihood. An overwhelming 80% of livestock farmers observed a decrease in pasture availability and quality, directly impacting their primary feed source. Concurrently, 65% faced challenges in accessing sufficient water for their animals, and half (50%) reported an increase in climate-sensitive animal diseases. These findings underscore a multifaceted threat to the entire farming system in Bwari.

The implications of these findings are profound for food security, rural livelihoods, and the socio-economic stability of Bwari Area Council, echoing broader challenges faced by developing economies. The widespread decline in staple crop yields and overall agricultural product availability points to an imminent threat to household food security. This aligns with global concerns highlighted by bodies like the IPCC (2023) and FAO (2022), which consistently warn of climate change-induced food insecurity, particularly in rain-fed agricultural regions. Reduced availability inevitably leads to higher food prices, decreased access for vulnerable populations, and increased reliance on external food sources, potentially straining local economies.

The observed impacts also signify a severe economic vulnerability for farmers. With declining yields across their primary sources of income, farming households face increased poverty risk, which may hinder their ability to invest in future agricultural cycles or diversify livelihoods. This situation exacerbates pre-existing challenges such as limited financial resources and access to inputs, as reported by 90% and 85% of farmers respectively. This creates a vicious cycle where climate impact reduce income, which in turn limits adaptive capacity, a challenge consistently documented in literature on climate change in Sub-Saharan Africa (AfDB, 2020; UNEP, 2021). The drastic reduction in vegetable availability (88%) raises particular concerns for nutritional deficiencies, especially among vulnerable groups, emphasizing that climate change impacts extend beyond caloric intake to dietary quality.

The socio-demographic profile of the farmers, predominantly male, middle-aged, and experienced, holds crucial implications. While their deep farming experience (average 18.5 years) embodies valuable indigenous knowledge, it also suggests a potential reliance on traditional methods that may be insufficient against unprecedented climatic variability. This reinforces the need for adaptation programmes to bridge traditional wisdom with modern climate-resilient practices. The varied educational backgrounds necessitate diverse communication strategies to ensure effective knowledge transfer and adoption of new techniques. The male dominance (68%) implies that interventions must strategically engage male farmers while ensuring female farmers (32%) are not overlooked, as they often face unique barriers in accessing resources and information.

Furthermore, the study reveals a critical disjuncture: farmers are actively engaged in adaptation efforts, such as adjusting planting times (60%), practicing mixed cropping (55%), and using drought-tolerant varieties (45%). This proactivity demonstrates an inherent willingness to adapt. However, these grassroots efforts are severely hampered by pervasive systemic and resource-based barriers. The overwhelming lack of financial resources (90%), limited access to improved seeds and modern implements (85%), and insufficient access to relevant climate information and extension services (70%) act as significant bottlenecks. This finding resonates with calls in literature for comprehensive policy interventions that move beyond mere awareness campaigns to address fundamental economic and infrastructural constraints to adaptation (Smith & Jones, 2021; Johnson & Chen, 2020). The high percentage of farmers lacking climate information and extension services highlights a critical knowledge-action gap, which can be bridged by revitalizing these support systems.

Finally, the impacts on livestock production, including reduced pasture and water availability, and increased disease prevalence, underscore that climate change is not solely a crop-farming issue but a comprehensive threat to integrated agrarian livelihoods. This aligns with studies on livestock vulnerability in changing climates (IFAD, 2021) and signals a potential for increased resource competition and conflict if not proactively managed.

### **Limitations and Avenues for Future Research**

Despite its significant contributions, this study has inherent limitations. Firstly, as a descriptive study that collected data in a cross-sectional survey, it provides a snapshot of farmers' perceptions and reported impacts at a specific point in time. While invaluable for understanding lived experiences, these perceptions may not always perfectly align with objective long-term meteorological data or scientifically measured yield trends. Future research would greatly benefit from longitudinal studies that integrate actual weather station data for Bwari Area Council, satellite imagery for land use and vegetation health changes, and precise quantitative yield measurements over multiple cropping seasons.

Secondly, the study's focus on Bwari Area Council, while yielding critical localized insights, inherently limits the generalizability of the findings to other agro-ecological zones within Nigeria. Future research could conduct comparative studies across diverse regions within the FCT and broader Nigeria to identify commonalities and variations in climate change impacts and adaptation strategies.

Finally, while the study identified various adaptation strategies employed, it did not quantitatively assess their effectiveness, cost-benefit, or sustainability. An important avenue for future research would be to undertake impact evaluations of specific adaptation practices, including an analysis of their economic viability and long-term environmental sustainability under different climate scenarios.

### **Conclusion**

This study demonstrates that climate change is already inflicting tangible and significant negative impacts on availability of agricultural produce in Bwari Area Council of Abuja. Farmers in the region report widespread and acute perceptions of altered rainfall patterns (reduced reliability, extended dry spells), increased temperatures, and more frequent extreme weather events. These climatic shifts directly correlate with and lead to substantial reductions in yields of critical staple crops such as yam, maize, rice, sorghum, and even the generally resilient cassava, alongside a dramatic decline in the availability and quality of vegetables. Furthermore, livestock production faces severe stress due to decreased pasture and water access, and an alarming increase in climate-sensitive animal diseases.

These multifaceted localized impacts pose immediate and severe threat to household and community food security, significantly exacerbating the economic vulnerabilities of Bwari's agrarian population. While farmers exhibit proactive efforts to adapt, their capacity is severely hampered by profound systemic barriers, including a critical lack of financial resources, limited access to improved seeds and modern implements, and insufficient access to crucial climate information and extension services. This highlights that effective climate change adaptation in this context is not solely an environmental challenge but a complex development imperative requiring integrated, multi-sectoral interventions to bolster resilience and ensure sustainable agricultural output.

### Recommendations

Based on the compelling conclusion reached, regarding the profound impacts of climate change on agriculture in Bwari Area Council, we advance the following recommendations are advanced for the purpose of enhancing agricultural resilience and ensuring food security:

- i. **Enhance Financial Inclusion and Access to Capital for Farmers:** Given the overwhelming barrier of insufficient financial resources (90%), government agencies, microfinance institutions, and agricultural development banks must prioritize the provision of accessible, low-interest loans, grants, and subsidies specifically tailored for smallholder farmers in Bwari. This financial support is crucial for enabling farmers to invest in necessary adaptation measures and mitigate economic losses from climate impacts.
- ii. **Improve Access to Climate-Resilient Agricultural Inputs and Modern Implements:** Addressing the severe limitations in access to improved seeds and modern implements (85%), efforts should focus on strengthening the supply chain and distribution networks for climate-resilient crop varieties (e.g., drought-tolerant maize, early-maturing yam, flood-resistant rice) and appropriate farming technologies. Government programs could facilitate bulk procurement and subsidized distribution, or incentivize private sector involvement in these areas.
- iii. **Revitalize and Modernize Agricultural Extension Services and Climate Information Dissemination:** Recognizing the significant gap in access to climate information and extension services (70%), it is imperative to strengthen and modernize agricultural extension systems in Bwari. This includes training extension workers on climate-smart agriculture practices, equipping them with tools for localized climate forecasting, and ensuring information is disseminated regularly, accurately, and in locally understandable formats (e.g., via community meetings, local radio, mobile platforms).
- iv. **Promote Integrated and Diversified Climate-Smart Agricultural Practices:** To counter the widespread negative impacts on both crop and livestock production, interventions should advocate for and support the adoption of integrated agricultural strategies. This includes diversifying crop types, promoting agroforestry, implementing efficient water management techniques (e.g., small-scale irrigation, rainwater harvesting, improved borehole maintenance for livestock), and encouraging the use of drought-resistant fodder crops.
- v. **Strengthen Animal Health Services and Disease Surveillance:** In response to the reported increase in climate-sensitive animal diseases, there is a clear need to bolster local veterinary services. This involves enhancing disease surveillance, providing timely veterinary care, and educating livestock farmers on climate-resilient animal husbandry practices and disease prevention.
- vi. **Integrate Climate Change Adaptation into Local Governance and Development Plans:** The Bwari Area Council administration should explicitly incorporate climate change adaptation strategies into its local development plans, ensuring policy support, resource allocation, and

coordination across relevant sectors (agriculture, water resources, and environment) to build comprehensive community resilience.

## References

- African Development Bank (AfDB) (2020). *African Economic Outlook 2020: Developing Africa's workforce for the future*. Abidjan, Côte d'Ivoire: African Development Bank Group.
- Adebayo, O. O., & Agboola, B. O. (2020). Localized climate change impacts on smallholder agriculture in Nigeria: A review. *Journal of Agricultural Development*, 12(3), 85-99.
- Ajayi, A., Oyelere, A., & Olanrewaju, S. (2021). An assessment of agricultural practices and food security in Bwari Area Council, Abuja. *Nigerian Journal of Rural Development*, 9(1), 45-60.
- Brown, L., Smith, K., & Jones, A. (2022). *Research methods for the social sciences: A practical guide (2nd edition)*. Routledge.
- Davis, R., & Green, L. (2023). *Ethical research in practice: Navigating complex issues*. Sage Publications.
- Food and Agriculture Organization of the United Nations (FAO). (2022). *The state of food security and nutrition in the World 2022: Repurposing Food and agricultural policies to make healthy diets more affordable*. FAO.
- International Fund for Agricultural Development (IFAD) (2021). *Adapting to climate change in livestock systems: A practitioner's guide*. IFAD.
- International Institute of Tropical Agriculture (IITA) (2021). *Annual report 2021: Building resilience in African agriculture*. IITA.
- Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate change 2023: Synthesis report. Contribution of working groups I, II and III to the sixth assessment report of the Intergovernmental Panel on Climate Change*. IPCC.
- Johnson, L., & Chen, Y. (2020). *Sampling methods for social research (3rd edition)*. Wiley-Blackwell.
- National Adaptation Strategy and Plan of Action for Climate Change Nigeria (NASPA-CCN). (2022). *Progress report on climate change adaptation in Nigeria*. Federal Ministry of Environment.
- National Bureau of Statistics (NBS) (2022). *Agricultural production survey report 2022*. NBS.
- Nigerian Meteorological Agency (NiMET) (2021). *Seasonal rainfall prediction (SRP) 2021*. NiMET.
- Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS (7th edition)*. Routledge.
- Umar, A., & Olatunji, S. (2023). Climate change impacts on agricultural productivity and food security in North-Central Nigeria. *Journal of Environmental Management and Agriculture*, 10(2), 112-125.
- United Nations (UN) Sustainable Development Goals (SDG) Report. (2023). *The Sustainable Development Goals Report 2023*. United Nations.
- United Nations Development Programme (UNDP) Nigeria. (2023). *Human development report for Nigeria 2023: Climate change and sustainable development*. UNDP.
- World Bank. (2022). *Climate change and livestock: A global perspective*. The World Bank.
- World Meteorological Organization (WMO). (2022). *State of the global climate 2022*. WMO.