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Research Article

# Smallholder Farmers' Perception on Climate Change and Adaptation Strategies in Kuje Area Council, FCT, Abuja

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**Abstract:**

This study examined farmers' perceptions of climate change and adaptation strategies in Kuje Area Council, Federal Capital Territory (FCT), Abuja. A simple random sampling technique was used to select 75 respondents from a list of 122 registered smallholder farmers across five wards: Kiyi, Shaji, Rubochi, Chukuku, and Jeli. Data were collected using a structured questionnaire and interview schedule, and analyzed using descriptive statistics and a 4-point Likert scale. The findings showed that 66.7% of the farmers were male, and 40% had attained tertiary education, indicating potential for adopting innovative climate practices. However, financial constraints and inadequate extension services were identified as major barriers. Additionally, 73% of the farmers were aware of climate change, with 63% observing climatic changes over time. Soil erosion (53.3%), deforestation (46.7%), and water scarcity for irrigation (46.7%) emerged as significant challenges.The most frequently practiced climate adaptation strategies are conservation tillage (92.3%), crop diversification (80%), and early maturing crops (60%). Conversely, strategies such as irrigation (29.3%) and genetically modified crops (25.3%) are less commonly practiced. Limited access to information (42.67%) and difficulty in changing traditional farming practices (21.33%) further constrained adaptation efforts. The study concluded that farmers in the area face significant climate change challenges, including resource limitations, environmental degradation, and inadequate support for adaptation strategies. These challenges have a profound impact on agricultural productivity in the study area. Therefore, the study recommended strengthening extension services, improving access to credit, promoting conservation agriculture, and establishing reliable climate information systems to enhance farmers' resilience and productivity in the study region.

**Key words:** perception; climate change; farmers; adaptation; strategies

## Introduction

Climate change represents significant global challenges, threatening both human well-being and sustainable development, especially in agriculture, a sector deeply affected by variations in temperature, precipitation patterns, and extreme weather events (Damian et al., 2020). The effects of climate change threaten the sustainability of food production, particularly in regions heavily reliant on rain-fed agriculture, such as Sub-Saharan Africa (Echendu et al., 2022). Rising greenhouse gas emissions are causing shifts in global climatic conditions, including an increase in global mean temperatures, which is expected to surpass a 2°C increase by the end of the century (Ovwigho et al., 2024). While elevated levels of $CO_2$ may initially enhance photosynthesis, higher temperatures and erratic rainfall patterns often result in negative outcomes, including reduced crop yields, pest infestations, and declining soil health. This paper explores the challenges of climate change in agriculture, with a focus on Sub-Saharan Africa, and evaluates strategies for building resilience among smallholder farmers (Sennuga et al., 2024).

The agricultural sector is particularly vulnerable to climate change due to its dependence on natural resources, such as water, soil, and biodiversity. In regions like South Africa, erratic rainfall patterns have led to frequent droughts, reducing crop yields and livestock productivity (Lai-Solarin, et al., 2024). For instance, the 2015 drought in South Africa caused major

economic losses and devastated small-scale farmers who lacked financial resources to recover (Mare et al., 2018). Similarly, Nigeria faces recurring challenges, such as delayed rainfall, flooding, and rising temperatures, which disrupt crop cycles and lower overall productivity (World Bank, 2012). Climate change also influences soil microorganisms and enzymatic activities, which are vital for nutrient recycling and soil health, further compounding the problem (Iliyasu et al., 2023).

Farmers across Sub-Saharan Africa are implementing various adaptation strategies to mitigate the effects of climate change. These include adjusting planting and harvest schedules, adopting drought-resistant crop varieties, employing soil and water conservation techniques, and engaging in mixed farming systems (Atube et al., 2021). In South Africa, strategies such as crop diversification, mixed cropping, and irrigation are prominent among smallholder farmers (Mare et al., 2018). In Nigeria, many farmers have resorted to diversifying into non-farm activities and adjusting their farming practices to accommodate climatic variability (Oloukoi et al., 2014). However, these strategies are often reactive and focus on short-term climate stressors rather than long-term resilience (Oyediji et al., 2024).

The adoption of climate change adaptation strategies is influenced by multiple factors. Socioeconomic characteristics, such as age, education level, gender, farm income, and farm size, play a significant role (Marie et al., 2020). Institutional factors, including access to agricultural extension services, climate information systems, and training, also affect farmers' ability to adapt. In South Africa, access to ICT-based climate information and non-farm income sources has been identified as key drivers of adaptation (Thinda et al., 2020). In Nigeria, farmers' adaptation choices are shaped by the availability of climate-resilient inputs, market access, and the ability to recover from climate-induced shocks (World Bank, 2012).

Climate change is negatively affecting rural livelihoods, agriculture, freshwater supplies, and other natural resources critical to human survival. Understanding how smallholder farmers perceive these changes and what factors drive their adaptation strategies is crucial for effective intervention (Abubakar et al., 2024). For instance, in South Africa, socioeconomic and institutional factors such as gender, age, access to extension services, and climate change information influence both the adoption and intensity of climate adaptation strategies (Thinda et al., 2020). Similarly, in Nigeria, the reliance on rain-fed agriculture makes the country particularly vulnerable to changes in rainfall and temperature patterns. Without targeted adaptation measures, Nigeria could face significant economic losses, with estimates predicting a GDP decline of up to 30% by 2050 (Federal Ministry of Environment (FME), 2011). Therefore, equipping farmers with the knowledge, tools, and resources needed to adapt effectively to the adverse impacts of climate change is essential (Ajah et al., 2023).

Despite growing research on climate change adaptation, significant gaps remain in understanding long-term strategies that enhance smallholder farmers' resilience to future climate risks (Atube et al., 2021; Katharina et al., 2021). Existing studies often focus on generalized or short-term responses, with limited attention to region-specific drivers, resource constraints, and institutional dynamics, such as access to ICTs and extension services (Ebukiba et al., 2023; World Bank, 2012). Furthermore, there is an overemphasis on crop farming, leaving the adaptation needs of livestock and mixed farming systems underexplored (Marie et al., 2020). Technological solutions, particularly ICT-based tools for decision-making and long-term planning, remain inadequately studied (Adangara et al., 2022). Additionally, while policies aimed at enhancing adaptive capacity are frequently proposed, empirical evaluations of their implementation and impact are limited (FME, 2011; Katharina et al., 2021). Addressing these gaps requires localized, comprehensive research that integrates diverse farming systems, socio-economic factors, and the perspectives of farmers on the effectiveness of policy and technological interventions. Therefore, it is critical to understand how individuals interpret and organize sensory information to make sense of their environment (Eleke et al., 2024).

Given these challenges, farmers in developing nations employ coping strategies for short-term shocks and adaptation strategies for long-term sustainability (van der Geest and Warner, 2015; Alemayehu and Bewket, 2017). For example, in Pakistan, women cope by reducing expenses and selling livestock (Batool et al., 2018). In addition, Thinda et al. (2020) suggested that policies focusing on farmer education, non-farm employment, and reinvesting income into farming practices, such as soil conservation and improved crops, can enhance resilience. Government policies should promote capacity-building through agricultural extension services, climate education, and improved market access (Marie et al., 2020). Moreover, Abid et al., (2015) argue for a balance between local solutions and broader policy research to address both local and global factors affecting adaptation. Therefore, understanding the impact of adaptation strategies on farmers, the extent of these interventions, and the potential improvements to support local communities more effectively remains critical (Marie et al., 2020). The goal of this study is to determine how farmers in Kuje Area Council of Abuja, Nigeria, perceive climate change and how adaptation strategies influence their decision-making on their farms (Oyediji.et al., 2024b)

Hence, the following objectives were formulated: to determine the socio-economic characteristics of farmers' adaptation to climate change, to identify the knowledge of farmers on climate change adaptation, to evaluate the problems farmers face due to climate change and to ascertain the constraints of climate change adaptation strategies among farmers in the study area.

## Materials and Methods

### Study Area

The study was conducted in Kuje Area Council, Abuja, Nigeria. Established in November 1987, Kuje is the largest area council in Abuja, covering approximately a quarter of the Federal Capital Territory (FCT). It shares borders with the Abuja Municipal Area Council, Kwali Area Council, and Abaji Area Council. The council's headquarters, Kuje town, is located about a 20-minute drive from Nnamdi Azikiwe International Airport, situated at latitude 8.87953 and longitude 7.22756 in the FCT. Kuje lies just west of Abuja's city center and is known as the "food basket" of Abuja due to its vast agricultural potential. It is part of the six area councils that make up the FCT and is also adjacent to the Centenary City development. While Kuje is a growing suburb, some areas still lack formal development. However, ongoing government investments in infrastructure and new housing projects are contributing to its expansion, with Kuchiyako currently being the most developed area.

The region experiences two distinct seasons: a dry season from October to March, lasting 5 to 6 months, and a rainy season from April to September, with peak rainfall occurring in August. Kuje has an average temperature of 27°C, a land area of 1,644 km², a humidity level of 41%,

and receives a total annual precipitation of 1,250 mm. According to the National Population Commission (NPC), the estimated population of Kuje Area Council is 104,790 people. The area is renowned for both its agricultural and trading activities, encompassing several districts including Chukuku, Damakusa, Shaji, Tauge, Jeli, Lafiya, Chida, Bugako, Rubbochi, and Kiyi.

Sampling Techniques and Sample Sizes

To ensure comprehensive and unbiased coverage, a simple random sampling technique was used to select 75 respondents from a list of 122 registered smallholder farmers in the region, as provided by the Agricultural Development Program (ADP). The sample was drawn from five wards within the area council: Kiyi, Shaji, Rubochi, Chukuku, and Jeli. In each ward, 15 farmers were randomly chosen, ensuring equal representation across the wards. This approach provided a diverse and representative sample of the farming population in the study area.

Data collection and Analysis

Data were gathered from primary sources using a structured questionnaire along with an interview schedule. The primary data collected were analyzed using descriptive statistics, such as frequency counts, percentages and likert scale was used to asssess the extent of constraint face by farmers farmers due climatic constraints. To analyze the challenges faced by the respondents using a 4-point Likert rating system, specific climate constraints were listed, and the farmers were asked to rank them based on their level of agreement regarding the extent of each challenge encountered. The 4-point Likert scale ranged from "Major problem" with a value of 4 to "Not a problem" with a value of 0, with a decision rule set at 2.5.The ratings were as follows:

Not a problem (NP) - 0

Minor problem (MP) - 1

Moderate problem (MoP) - 2

Major problem (MaP) - 3

$Xs = \Sigma fn$

$Nr$

Where Xs = Mean score, F = frequency of each (3, 2, 1,0) option,

∑ = summation, Nr = total number of respondents, n = responses of the respondents.

## Results and Discussion

The Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents described in the study include gender, marital status, age, education attainment, household size, primary occupation farming experience and source of income.

As revealed in Table 1, the majority of respondents (66.7%) are male, with females accounting for 33.3%. This implies that the predominance of male respondents may reflect societal norms regarding agricultural roles or gendered access to resources in the study area. This finding aligns with the study by Olumba and Alimba (2022), which highlights unequal access to agricultural resources such as land, labor, and inputs, with men having greater access to these resources than women farmers.

In terms of age distribution, 40% of the respondents fall within the 36–45 years age group, followed by 24–35 years (20.0%) and 46–55 years (20.0%). Only 6.7% are aged 56 and above. Additionally, the majority of respondents (81.3%) have limited farming experience, ranging from 1–10 years. A smaller group (13.3%) has 11–20 years of experience, while only 5.4% report over 20 years of farming. This suggests that many individuals may have taken up farming relatively recently, likely due to limited job opportunities or a growing interest in agriculture as a viable livelihood.

Maritally, the results show that 53.3% of respondents are married, while 33.3% are single, 12.0% are widowed, and 1.4% are divorced. The predominance of married individuals aligns with family-driven agricultural activities, indicating a reliance on household labor. This is consistent with the findings of Pierotti et al. (2022), which highlight that farmers often rely more on family labor for farming.

Furthermore, the results show that 40.0% of respondents have tertiary education, while 33.4% are secondary school graduates. Non-formal and primary education levels are equally represented at 13.3%. The relatively high level of education among respondents suggests a favorable environment for adopting innovative farming practices and ICT-based extension services.

Moreover, the results in Table 1 revealed that households with 1–5 members constitute 46.7% of respondents, while 33.3% have 6–10 members, and 20.0% have 11–15 members. Smaller household sizes may limit available family labor, suggesting the need for mechanization or hired labor in agricultural operations.

However, the results also revealed that agriculture is the main occupation for 53.3% of respondents, with trading and civil service accounting for 26.7% and 20.0%, respectively. While agriculture remains dominant, the presence of other occupations suggests livelihood diversification, which can help farmers manage economic shocks but may also indicate a shift away from full-time farming. In terms of income sources, 53.3% of respondents rely primarily on family support, followed by income from friends (26.7%), cooperatives (13.3%), and banks (6.7%). This implies that the reliance on informal income sources indicates limited access to formal financial services, highlighting the need for policies that promote financial inclusion and enhance farmers' access to affordable credit. This aligns with Mhlanga et al. (2024), which advocate for policies fostering financial inclusion to ensure farmers have easier access to financial resources.

| **Socio Economic Variables** | **Frequency** | **Percent (%)** |
|---|---|---|
| **Gender** | | |
| Male | 50 | 66.7 |
| Female | 25 | 33.3 |
| **Age range (years)** | | |
| 18-23 | 10 | 13.3 |
| 24-35 | 15 | 20.0 |
| 36-45 | 30 | 40.0 |

| | | |
|---|---|---|
| 46-55 | 15 | 20.0 |
| 56 and above | 5 | 6.7 |
| **Marital status** | | |
| Single | 25 | 33.3 |
| Married | 40 | 53.3 |
| Divorced | 1 | 1.4 |
| Widowed | 9 | 12.0 |
| **Educational attainment** | | |
| Non-formal | 10 | 13.3 |
| Primary school | 10 | 13.3 |
| Secondary school | 25 | 33.4 |
| Tertiary institution | 30 | 40.0 |
| **Household size (members)** | | |
| 1-5 | 35 | 46.7 |
| 6-10 | 25 | 33.3 |
| 11-15 | 15 | 20.0 |
| **Primary Occupation** | | |
| Agriculture (farming) | 40 | 53.3 |
| Civil servant | 15 | 20.0 |
| Trading | 20 | 26.7 |
| **Farm experience (years)** | | |
| 1-10 | 61 | 81.3 |
| 11-20 | 10 | 13.3 |
| 21-30 | 4 | 5.4 |
| **Sources of income** | | |
| Family | 40 | 53.3 |
| Friends | 20 | 26.7 |
| Banks | 5 | 6.7 |
| Cooperatives | 10 | 13.3 |

**Source: Field survey, 2024**

**Table 1:** Summary of socio-economic characteristics of respondents (n = 75 respondents)

### Farmer's Knowledge on Climate Adaptation in the study area

The results in Table 2 reveal that most farmers (73%) in the study area are aware of climate change and adaptation, while 27% are not. Despite differences in literacy level, age, farming experience, or gender, 63% of respondents observed changes in climatic conditions over time, whereas 37% did not notice any changes. This emphasizes the importance of climate knowledge for farmers, as it enables them to adapt to changing conditions, improving their resilience and productivity. However, the 27% who lack awareness represents a gap that can be addressed through targeted extension programs and climate education to promote sustainable farming practices in the study area.

| Variable | Frequency | Percentage |
|---|---|---|
| **Yes** | **55** | **73.0** |
| **No** | **20** | **27.0** |
| **Total** | **75** | **100.0** |

**Source: Field survey, 2024.**

**Table 2:** Information on Farmer's Knowledge on Climate Adaptation

The Most Frequently Practiced Climate Adaptation Strategies by Farmers in the Study Area.

The results presented in Figure1 reveal that majority (92.3%) of respondents engage in conservation tillage while 7.7% do not. This implies that most farmers are likely aware of its benefits for soil fertility and erosion control. The low percentage of non- adopters indicate that conservation tillage is widely accepted and practiced in the study area. Similarly, 80% of respondents practice crop diversification, while 20% do not. This strategy is often used to reduce the risk of crop failure due to climate variability. The few who do not practice it may be limited by factors such as land size or lack of knowledge.

Moreover, 64.7% of farmers use inorganic fertilizers to enhance soil fertility, while 35.3% avoid them, possibly due to cost or a preference for organic farming practices. Similarly, 60% of farmers adopt early maturing crops to mitigate risks from unpredictable weather, while 40% do not, which may due to limited access or other constraints.

Furthermore, the result shows that agroforestry is practiced by 50.7% of farmers, improving soil quality and providing shade, while 49.3% do not, possibly due to land, knowledge, or cost constraints. Only 29.3% use irrigation, with limited adoption likely due to high costs, water scarcity, or inadequate infrastructure. Likewise, 25.3% adopt genetically modified crops, while 74.7% avoid them, which may due to lack of awareness, cost, or preference for traditional methods.

Finally, the most frequently practiced climate adaptation strategies are early maturing crops, conservation tillage, and crop diversification. These strategies appear to be more accessible and easier to implement, even in

resource-constrained environments. Conversely, strategies like irrigation and genetically modified crops have lower adoption rates, which may due to barriers such as cost, infrastructure, and access to necessary resources.

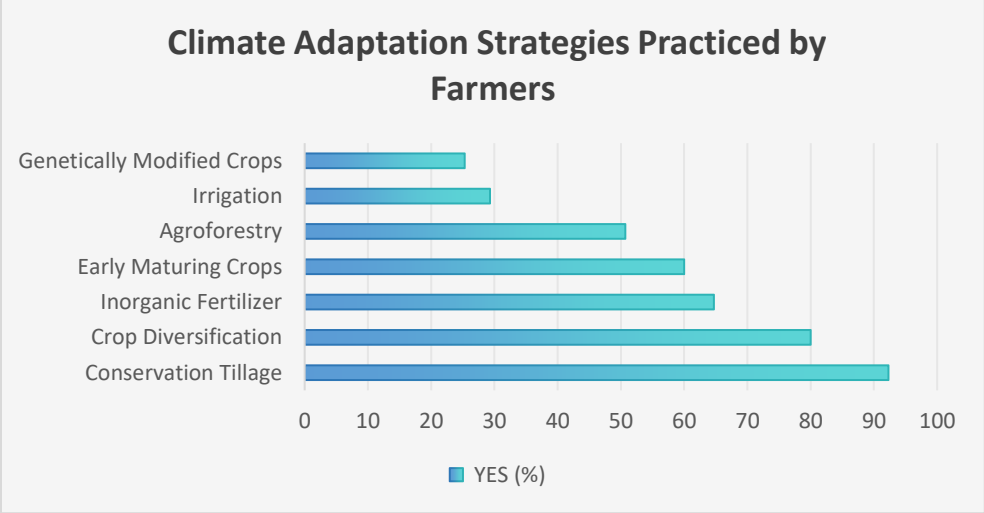


**Figure1:** Distribution of the respondents according to climate adaptation strategies practiced by farmers (n = 75)

Problem faced by farmers due to climate change in the study area

Table 3 revealed that soil erosion is the most significant challenge faced by farmers, with 53.3% of respondents identifying it as a major problem. This highlights the severe impact of soil erosion on agricultural productivity in the area. Deforestation and water scarcity for irrigation were also major concerns for 46.7% of farmers, indicating serious environmental and resource constraints.

Additionally, farmers struggle with excessive pesticide use (44.0%) and bush burning (40.0%), both of which contribute to environmental degradation and unsustainable farming practices. The lack of access to credit facilities, reported by 40.0% of farmers, limits their ability to invest in climate adaptation measures. Furthermore, 33.3% of farmers pointed out the lack of information on climate change and difficulties in planning planting times as significant issues, indicating the need for better education and support to help farmers adapt to changing climatic conditions.

Furthermore, pest and disease outbreaks (33.3%) and reduced crop yields (26.7%) are also significant problems caused by climate change, affecting farmers' productivity and income. These challenges are compounded by the lack of suitable adaptation measures, with only 13.3% of farmers identifying this as a major issue, suggesting that many may not have access to effective solutions or are unaware of available options. Surprisingly, a majority of farmers (60%) did not see the lack of adaptation measures as a problem, which could reflect a reliance on traditional methods or a lack of awareness of the need for more resilient farming practices (Mohammed.et al., 2024).

| Constraint | NP (%) | MP (%) | MoP (%) | MaP (%) | RANK |
|---|---|---|---|---|---|
| Soil erosion | 8.0 | 18.7 | 20.0 | 53.3 | 1st |
| Deforestation | 13.3 | 6.7 | 33.3 | 46.7 | 2nd |
| Water scarcity for irrigation | 5.3 | 14.7 | 33.3 | 46.7 | 3rd |
| Excessive use of pesticide | 12.0 | 13.3 | 30.7 | 44.0 | 4th |
| Bush burning | 5.3 | 18.7 | 36.0 | 40.0 | 5th |
| Lack of credit facility | 13.3 | 13.3 | 33.3 | 40.0 | 6th |
| Lack of information on climate change | 26.7 | 13.3 | 26.7 | 33.3 | 7th |
| Difficulty in planning planting times | 6.7 | 20.0 | 40.0 | 33.3 | 8th |
| Pest and disease outbreak | 0.0 | 26.7 | 40.0 | 33.3 | 9th |
| Reduced crop yields | 0.0 | 26.7 | 46.7 | 26.7 | 10th |
| Lack of suitable adaptation measures | 60.0 | 6.7 | 20.0 | 13.3 | 11th |

**Source:** ***Field survey, 2024***

**Decision rule: $\bar{X} \geq 2.5$= Major problem and $\bar{X} < 2.5$= Not a problem**

**Keys: NP=Not a problem, MP=Minor problem, MoP=moderate problem, MaP=Major problem,**

**Table 3:** Difficulties Faced by Farmers Due to Climatic Constraints

Challenges in Adopting Climate Change Adaptation Strategies Among Farmers in the Study Area

The results presented in Table 4 reveal that 42.67% of respondents face limited access to information, identifying it as a major barrier. This indicates a notable difference in knowledge and awareness about climate change and the adaptation strategies available to farmers. This aligns with the findings of Eneji et al. (2021), which revealed that the majority of rural farmers have some level of climate change awareness, primarily gained through sources such as radio, newspapers, awareness and

campaigns among others. Additionally, Table 4 shows that 21.33% of respondents experience difficulty in changing traditional farming practices. This suggests that many farmers are reluctant or find it challenging to move away from established methods, even when newer practices could improve their ability to cope with climate change. This is consistent with the findings of Nnanna et al., 2024

Furthermore, 20% of respondents cited the limited availability of improved seeds and technologies, highlighting a lack of access to climate-resilient agricultural technologies, which are essential for effective adaptation. Inadequate financial resources were noted by 10.67% of farmers, limiting their ability to invest in the necessary tools and technologies for climate-smart farming. Finally, 5.33% of farmers pointed to the inadequacy of extension services as a challenge, suggesting that the support and guidance provided to farmers is insufficient to help them adapt to climate change.

| Variables | Frequency (n) | Percentages (%) |
|---|---|---|
| Limited access to Information | 32 | 42.67 |
| Difficulty in changing traditional practices | 16 | 21.33 |
| Limited Availability of Improved Seeds/technologies | 15 | 20.00 |
| Inadequate financial resources | 8 | 10.67 |
| Inadequate extension services | 4 | 5.33 |
| **TOTAL** | **75** | **100.00** |

**Table 4:** Constraints to Climate Change Adaptation Strategies of Farmers in study Area

## Conclusion and Recommendations

The study reveals that farmers in the area face significant climate change challenges, including resource limitations, environmental degradation, and inadequate support for adaptation strategies. Male predominance and married respondents reflect societal norms and reliance on family labor. Additionally, while most respondents are aware of climate change and adaptation, gaps remain in knowledge and access to information for a considerable proportion of farmers. Key challenges include soil erosion, deforestation, water scarcity, limited finances, inadequate extension services, and difficulty adopting improved practices, all of which hinder agricultural productivity and highlight the need for targeted interventions. To address the challenges faced by farmers in adapting to climate change, the study recommends strengthen extension services, improve access to credit for climate-resilient investments, and promote conservation agriculture and agroforestry. Encouraging the use of resilient crop varieties and improved soil practices, along with establishing reliable climate information systems, will enhance productivity and resilience in the study area.

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