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Rural Farmers' Awareness of Climate Change Indicators: A Study in FCT, Abuja, Nigeria

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Abstract
The exclusion of rural farmers from climate change discourse by policymakers and development partners, particularly Non-Governmental Organisations (NGOs), is often rooted in a disregard for their awareness of climate change indicators. This oversight undermines the effectiveness of climate change interventions targeting these communities. This study explored rural farmers' awareness of climate change indicators in six farming communities—Kawu, Zuma, Igu, Dobi, Kaida, and Dota, located within the Bwari and Gwagwalada Area Councils of the Federal Capital Territory (FCT), Abuja, Nigeria. A total of 348 rural farmers were randomly selected across the study areas. Data were gathered through a combination of primary and secondary sources, including Focus Group Discussions (FGDs) and structured questionnaires. Both descriptive and inferential statistical methods were employed in the analysis. The findings reveal a high level of awareness of climate change indicators among rural farmers in the FCT. Specifically, the farmers identified altered rainfall patterns, shifts in weather conditions, increased temperature and heat intensity, and declining harvests as key indicators of climate change. The study recommended that policymakers and development partners, including NGOs, acknowledge and leverage the existing awareness among rural farmers by actively involving them in the formulation and implementation of climate change interventions aimed at their communities.

Keywords: Climate Change, Rural Farmers, Awareness, Indicators, FCT-Abuja

Introduction

Climate change has emerged as a critical global challenge, with significant implications for agricultural productivity, food security, and rural livelihoods, particularly in Sub-Saharan Africa and other developing regions [10]. Communities in Sub-Saharan Africa are especially vulnerable due to their reliance on rain-fed agriculture, limited adaptive capacity, and heightened exposure to increasing temperatures [2].

The agricultural sector provides employment to over 70% of Nigeria's rural population, making the country highly vulnerable to the impacts of climate change. Current manifestations—such as altered rainfall patterns, droughts, floods, and extreme temperatures—are already being experienced across the country [8].

Despite the rapid pace of urbanization in the Federal Capital Territory (FCT), Abuja, a substantial rural population remains engaged in subsistence and semi-commercial farming. These rural farmers are increasingly affected by climate change, yet most lack adequate access to timely information, appropriate technologies, or institutional support systems to enable effective response. Nonetheless, their awareness of climate change indicators—such as shifts in rainfall patterns and the occurrence of extreme weather events—is fundamental for successful adaptation [13]. Without such awareness, rural farmers may be unable to recognize environmental changes and adjust their practices accordingly, posing a significant barrier to adaptive capacity [7].

Available studies indicate that farmers' perception and awareness of climate change are influenced by socio-economic status, educational attainment, access to agricultural extension services, and indigenous knowledge systems [3]. However, there is a paucity of empirical studies in FCT-Abuja that assess the extent to which rural farmers recognize and interpret climate change indicators. Addressing this gap is essential, especially in light of the region's diverse agro-ecological zones and the urgent need for localized climate adaptation strategies.

This study evaluates the level of awareness of climate change indicators among rural farmers in FCT-Abuja, Nigeria's capital city. It examines rural farmers'

understanding, perception, knowledge, and interpretation of climate-related changes, with the aim of contributing to the development of context-specific policy interventions that enhance adaptive capacity and resilience within rural farming communities.

Climate Change Awareness

Risk communication is a critical framework in climate change awareness, emphasizing the process of informing and influencing individual and community decisions in ways that enhance resilience and reduce vulnerability. It highlights that awareness is shaped not only by access to knowledge but also by how risks are perceived—perceptions which are influenced by cultural, emotional, and contextual factors. Effective risk communication requires that messages be crafted in local languages and within relevant cultural frameworks. It further argues that scientific information should be conveyed through narratives that are accessible, relatable, and actionable. Additionally, the use of visual tools, indigenous languages, and participatory approaches has been shown to enhance awareness outcomes when effectively deployed [14].

From a behavioral change perspective, awareness is considered a catalyst for climate-protective behavior. However, scholars in this field emphasize that awareness alone does not necessarily lead to action. Behavioral change is influenced by a combination of motivation, perceived self-efficacy, social norms, and enabling structural supports. This view is grounded in the Knowledge-Attitude-Practice (KAP) model, which suggests that for awareness to result in tangible behavioral shifts, interventions must address not only knowledge gaps but also the attitudinal and practical barriers to change. Consequently, these scholars strongly advocate for climate change interventions that bridge the gap between awareness and behavioral responses [19].

The socio-cultural dimension of climate change awareness explores how cultural beliefs, traditions, and social structures shape the ways in which communities understand and respond to climate-related changes. It argues that climate change should not be viewed solely as a scientific or technical issue, but as a phenomenon embedded in lived experiences and local epistemologies. Indigenous knowledge systems often contain rich understandings of environmental change, even if these are not explicitly labeled as "climate change." Awareness campaigns that fail to consider local cultural contexts risk alienating communities and undermining intervention efforts. Instead, co-creating knowledge with local communities enhances the relevance, trustworthiness, and impact of climate change communication [16].

Climate change indicators

Climate change indicators are measurable variables that reflect the state and trends of climatic and environmental systems. They are essential for detecting, monitoring, and communicating the impacts of climate change over time. These indicators may be physical (e.g., temperature and precipitation), biological (e.g., species migration), or socio-economic (e.g., agricultural yields), and serve as vital tools for assessment and early warning. They facilitate the tracking of long-term climate variability and extreme events [15].

Biological and ecological indicators include changes in phenology (such as flowering time), species distribution, and ecosystem dynamics. These indicators are particularly sensitive to even minor climatic shifts and often serve as early warnings of more widespread ecological impacts. Species responses are considered integrative indicators, reflecting both climatic and ecological changes. Shifts in ecological indicators can disrupt food webs and ecosystem services, underscoring the importance of long-term ecological monitoring to validate observed trends and inform adaptive responses [17].

Climate change indicators are also embedded within decision-making and policy frameworks. Policymakers and government institutions play a critical role in translating complex climate data into actionable strategies. Indicators function as a bridge between science and policy, providing empirical evidence to support adaptation and mitigation efforts. Furthermore, they are indispensable for evaluating the effectiveness of climate policies, informing vulnerability assessments, and guiding resilience planning [4].

Empirical Review

[6], in their study titled "Analyzing the Determinants of Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia," reported that farmers in the Central Semi-Arid region of Tanzania exhibit a high level of climate change awareness. The study recommended sustained awareness campaigns and advocacy efforts by researchers and agricultural extension officers to ensure that rural farmers receive timely and accurate information on climate change issues.

[5], in their study "Climate Change Awareness: Environmental Education and Gender Role Burdens Among Rural Farmers of Northern Cross River State," highlighted that the use of communication channels such as radio, newspapers, flyers, and billboards has significantly contributed to increased climate change awareness among rural farmers in Cross River State. The study noted that farmers' knowledge of climate issues has strengthened both their mitigation and adaptation practices. It recommended that policymakers broaden their understanding of climate change—particularly in relation to its causes, effects, and mitigation strategies.

[18], in the study "Farmers' Awareness Level and Their Perceptions of Climate Change: A Case of Khyber Pakhtunkhwa Province, Pakistan," found that rural farming households in the province rely on their strong awareness of climate change to implement adaptation strategies such as crop diversification and irrigation. The study recommended that climate change adaptation policies in

Pakistan should be designed in ways that promote and build on citizens' awareness of climate change.

Similarly, [1], in their study "Farmers' Awareness and Perception of Climate Change Impacts: A Case Study of Aguie District in Niger," reported that climate change awareness among rural farmers in the Aguie community enhances their understanding of the issue and motivates their adaptation responses. The study concluded that farmers' awareness of climate change indicators plays a significant role in expanding their knowledge of climate-related risks and in preparing them for appropriate mitigation strategies.

Theoretical Framework

Indigenous Knowledge Systems (IKS) are adopted in this study as a theoretical framework for analysis. As [9] argues, IKS challenges dominant Western epistemologies and calls for the recognition and validation of Indigenous perspectives as legitimate systems of knowledge. His work has contributed significantly to broadening the understanding of the role that Indigenous knowledge plays in community development and the preservation of cultural and ecological heritage. According to [11], Indigenous peoples have, over generations, developed complex knowledge systems that have supported their growth, resilience, and survival. These systems are embedded in their social and environmental contexts and serve as critical tools for navigating development challenges. Similarly, [12] posits that every society has, over time, cultivated distinct philosophical and epistemological frameworks that guide its interactions with the natural world. These frameworks shape daily life and decision-making, encompassing language, social structure, resource use, spiritual practices, and cultural rituals. Indigenous knowledge is inseparable from the cultural fabric of the society; it is not merely a body of information but a living system that underpins sustainable socio-economic development. Many communities view their Indigenous Knowledge Systems as irreplaceable, asserting their supremacy as a foundation for resilience and continuity.

Historically, rural farming communities in the Federal Capital Territory (FCT), Abuja, possess a rich repository of traditional knowledge and cultural practices that have enabled them to adapt effectively to their local environment. Over generations, these communities have developed and maintained Indigenous Knowledge Systems that include locally recognized indicators of climate change, as well as collective wisdom regarding environmental management and adaptation strategies. In this study, indigenous knowledge is defined as the accumulated and culturally embedded body of knowledge, practices, and beliefs developed through sustained interaction between Indigenous peoples and their environment. As such, this study adopts Indigenous Knowledge Systems (IKS) as its theoretical lens, recognizing it as a valid and essential framework for understanding rural farmers' awareness and interpretation of climate change indicators.

Materials and Methods

This study employed an explanatory sequential mixed-methods design, in which quantitative data were first collected and analyzed, followed by the collection of qualitative data to augment and interpret the findings. Quantitative methods—including structured surveys and statistical analysis—were used to measure and assess rural farmers' awareness of climate change indicators in the selected communities. These findings were complemented by qualitative data gathered through Focus Group Discussions (FGDs), which provided in-depth insights and diverse perspectives from rural farmers regarding the indigenous adaptation measures adopted to mitigate the effects of climate change.

The study population consisted of farmers actively engaged in agricultural activities within the selected communities. The study focused specifically on registered farmers in Bwari and Gwagwalada Area Councils of the Federal Capital Territory (FCT), Abuja, narrowing the scope to six rural communities located within Dobi Ward (Gwagwalada) and Kawu Ward (Bwari). According to 2023 records obtained from the Special Agro-Processing Zones (SAPZ)—a federal government initiative designed to enhance agricultural productivity and value chain development—Gwagwalada Area Council had 15,100 registered farmers, with 1,856 of them located in Dobi Ward. Similarly, Bwari Area Council had 14,317 registered farmers, of whom 1,892 resided in Kawu Ward. The combined population of registered farmers in Dobi and Kawu Wards, therefore, totaled 3,748.

Using [20], a sample size of 351 rural farmers was determined. To ensure a representative sample, the study employed a combination of purposive and stratified random sampling techniques, allowing for both proportional representation and the inclusion of diverse farming communities across Dobi and Kawu Wards. From each community, participants were randomly selected, resulting in a final sample size of 348 rural farmers, proportionally distributed according to each community's share of the total population.

The sample was divided into two groups: The primary group comprised 306 rural farmers—51 from each of the six communities—who were randomly selected and administered structured questionnaires. The secondary group consisted of 42 farmers, with seven purposively selected participants from each community engaged in Focus Group Discussions (FGDs).

Primary data collection served as the main source of information for this study. Questionnaires were physically distributed and contained both closed- and open-ended questions designed to capture data relevant to the study's objectives. These instruments allowed respondents to choose applicable responses and provide contextual insights. In addition to the survey, FGDs were conducted using semi-structured guiding questions aligned with the research objectives. These discussions enabled a deeper

exploration of rural farmers' awareness and interpretation of climate change indicators, as well as their lived experiences and indigenous coping mechanisms.

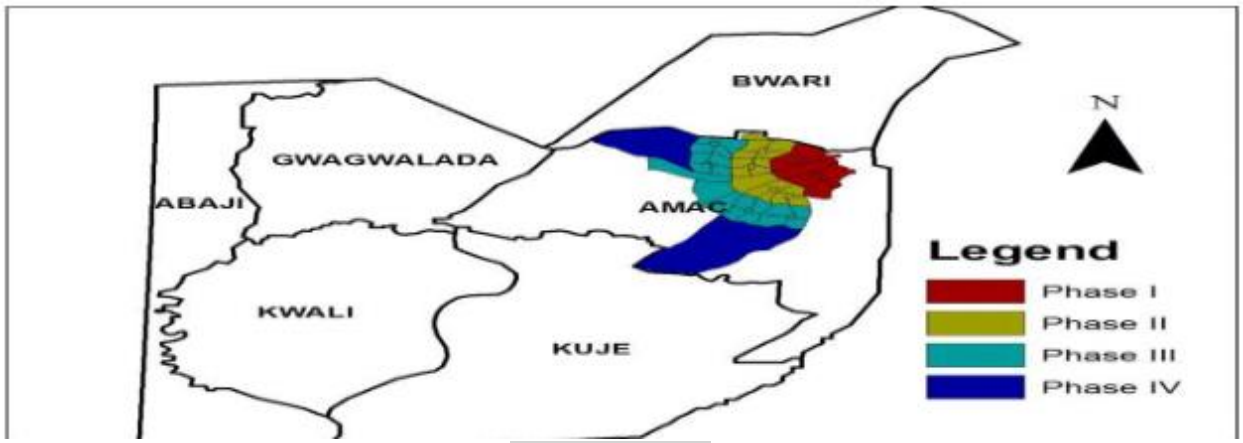

Fig. 1: Study Area

Kawu, Igu, and Zuma communities are located within the Bwari Area Council of the Federal Capital Territory (FCT), Abuja, while Dota, Kaida, and Dobi communities are situated in the Gwagwalada Area Council of the FCT. These six communities are predominantly rural, with agriculture serving as the primary source of livelihood. Farming activities in these areas are largely dependent on rain-fed agriculture, making them highly susceptible to the impacts of climate variability and change.

Data Presentation and Analysis

Table 1: Table 1: Rural Farmers' Awareness of Climate Change Indicators (n = 306)

Question	Response	Frequency	Percentage (%)
Have you heard about climate change?	Yes	306	100.00
What do you understand by climate change?	Change in weather conditions	296	96.77
	Change in temperature and hotness	10	3.27
Do you think climate change affects your farm?	Yes	306	100.00
How is climate change affecting your farm?	Poor harvests	138	45.10
	Poor crop yield & hot weather	167	54.57
	Livestock death	1	0.33
Have you noticed any change in temperature over the last 10 years?	Yes	306	100.00
Have you observed a change in rainfall patterns?	Yes	306	100.00
Have you experienced extreme weather (e.g., droughts, floods, heatwaves)?	Yes	306	100.00

Source: Survey Data, 2025

Table 1 presents the level of awareness of climate change indicators among farmers in the studied communities. The results revealed that 100% of respondents had heard about climate change, indicating universal awareness among the farmers. Furthermore, a majority (96.77%) understood climate change as the primary cause of changes in weather conditions, suggesting a high level of awareness regarding climate change indicators within the communities. This finding aligns with Deressa et al. (2008), who, in their study "Analysing the Determinants of Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia," reported a similarly high level of climate change awareness among farmers in the Central Semi-Arid region of Tanzania.

Conversely, only a small proportion (3.27%) of respondents identified changes in temperature and increased heat as results of climate change. This indicates that while general awareness is high, specific knowledge about certain climate indicators—such as temperature rise-remains limited among a minority of respondents.

All respondents (100%) agreed that climate change is affecting their farming activities, demonstrating a collective recognition of its local impact. Among them, 54.57% reported that climate change has led to poor harvests, while 45.1% attributed poor crop yields to climate change. These responses affirm the tangible impacts of climate variability on agricultural productivity in the communities studied.

In addition, all respondents (100%) confirmed observing changes in temperature over the past 10 years, and likewise, all affirmed witnessing shifts in rainfall patterns. Furthermore, 100% of the farmers reported experiencing extreme weather events such as droughts, floods, and heatwaves. These consistent observations across the communities reinforce the reality of climate change impacts on rural farming systems.

These findings are consistent with [20] who, in their study "Farmers' Awareness and Perception of Climate Change Impacts: A Case Study of Aguie District in Niger," reported that awareness of climate change among rural farmers enhanced their understanding of its impacts and served as a motivation for adopting adaptation measures.

Focused Group Discussions (FDGs)

The results of the Focus Group Discussions (FGDs) revealed a strong awareness of climate change among participants. All participants stated that they were familiar with the concept of climate, indicating widespread awareness of climate change within the studied communities. Moreover, all participants reported having observed changes in rainfall patterns and increased hot weather conditions over the past 10 years, demonstrating their recognition of specific climate change indicators.

Participants consistently attributed inadequate rainfall and excessive heat to changes in climate patterns, which they linked to declining crop yields, increased illnesses, and livestock mortality. This connection highlights the perceived and experienced impacts of climate change on both human and agricultural health in the region.

Additionally, all participants affirmed that excessive heat has negatively affected their living conditions. Some reported relocating from their permanent homes to thatched houses with open ventilation, as a coping mechanism to manage the unbearable night-time temperatures caused by extreme heat.

A particularly notable finding from the FGDs was the widespread observation that shifts in rainfall patterns have disrupted traditional seasonal calendars and planting schedules. According to the participants, prior to these climatic changes, farmers in the communities reliably expected rains to begin in April, which marked the start of the planting season. However, with the increasing variability in weather conditions, the onset of rainfall has become unpredictable, forcing farmers to abandon their traditional planting calendar.

Overall, these responses underscore that farmers in the studied communities possess not only a general awareness of climate change but also a deep, experience-based understanding of its indicators and local impacts.

Results and Discussion

The findings of this study indicate a high level of awareness of climate change indicators among rural farmers in the communities studied. Farmers consistently identified changes in rainfall patterns and rising temperatures as the most prominent indicators of climate change. Over the past decade, they have observed significant shifts in weather conditions, including reduced rainfall and excessive heat. These environmental changes have had direct consequences on agricultural productivity, contributing to declining crop yields and increased livestock mortality. Rural farmers across the communities also reported experiencing extreme weather events such as droughts, floods, and heatwaves, with livestock production identified as the most adversely affected sector.

As one Focus Group Discussion (FGD) participant from Zuma community noted:

"In the last 10 years, we have seen a drastic change in weather that has brought a shortage in rainfall and excess heat, making farmers record poor crop yield and lose livestock to different kinds of illness as a result of excessive heat."

The intensity of the heat has compelled many farmers to relocate from their permanent homes to thatched houses with open ventilation, in a bid to cope with the night-time heat. Furthermore, the disruption of rainfall patterns has severely affected traditional seasonal calendars and planting schedules. Prior to the increasing impacts of climate change, farmers reliably anticipated the onset of rains in April, which marked the beginning of the planting season. However, with the current variability in climate, farmers no longer follow their traditional seasonal calendar, resulting in mistimed planting and poor harvests.

These findings strongly align with the Indigenous Knowledge Systems (IKS) framework adopted in this study. IKS emphasizes that indigenous communities possess deeply rooted, experience-based knowledge developed through generations of interaction with their environment. This knowledge is not only central to their survival and adaptive capacity but also reflects a dynamic understanding of environmental shifts, reinforcing the importance of indigenous perspectives in climate change discourse and adaptation planning.

Conclusion and Recommendations

This study was conducted with the primary objective of evaluating the level of awareness of climate change indicators among rural farmers in the Federal Capital Territory (FCT), Abuja. The findings revealed a high level of awareness among these farmers regarding various indicators of climate change.

Specifically, the study established that rural farmers in the FCT perceive changes in rainfall patterns, fluctuations in weather conditions, rising temperatures, increased heat intensity, and poor agricultural yields as key indicators of climate change. These perceptions reflect the farmers' lived experiences and underscore their capacity to recognize environmental shifts affecting their livelihoods.

Based on the findings, the following recommendations were made:

i. Policymakers and development partners, including Non-Governmental Organisations (NGOs), should acknowledge and leverage rural farmers' awareness of climate change indicators by actively involving them in the design, planning, and implementation of climate change interventions. Such inclusive approaches will enhance the relevance and effectiveness of adaptation strategies.

ii. The media should harness rural farmers' experiential knowledge and awareness of climate change by creating platforms that allow them to share their stories and lived experiences. This participatory approach will not only amplify local voices but also ensure that rural farmers are meaningfully integrated into the broader climate change discourse.

iii. Policymakers and development actors should advocate for the systematic integration of indigenous knowledge into contemporary climate science. Merging traditional and scientific knowledge systems will strengthen community-based adaptation strategies, enhance resilience, and promote context-specific, culturally relevant solutions to climate challenges.

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