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THE USE OF TRADITIONAL KNOWLEDGE IN CLIMATE ADAPTATION: INSIGHTS FROM FARMERS IN FIKA LGA, YOBE STATE, NIGERIA

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Abstract

Climate change is a global challenge with profound implications for various aspects of society, including agriculture. Nigerian farmers are particularly vulnerable to the impact of climate change which include erratic weather patterns, temperature changes, droughts, desertification, and altered cropping seasons. This study aimed at investigating the role of traditional knowledge in climate change adaptation among farmers in Fika Local Government Area, Yobe State with a view to providing basis for integrating these practices into broader adaptation policy responses at local and national levels. By assessing awareness, impacts, strategies, and effectiveness of traditional knowledge, the research bridged the gap between farmers' experiential knowledge and expert-driven adaptation strategies and enhancing the resilience of agricultural communities. Data collection involved open-ended and semi-structured questionnaires administered to 351 farmers using the Krejcie and Morgan sampling method. The findings reveal three primary categories of traditional knowledge in Fika, encompassing strategies for soil and water conservation, as well as weather forecasting techniques. Traditional knowledge emerges as a culturally significant and effective resource for bolstering farmers' adaptation strategies. The study recommends the documentation, promotion and integration of traditional knowledge into conventional climate change adaptation strategies.

Keywords: Adaptation strategies, Agriculture, Climate change, Traditional knowledge, Resilience

1.1 Background

Climate change presents one of the most significant challenges to sustainable development globally. Thus, affecting biodiversity, agriculture, human health, water resources, economic activities, natural resources, and environmental stability (Imoro, Adams & Mohammed, 2021). Effective response strategies are essential to enhance society's preparedness and resilience against climate change threats (Kasperson & Kasperson, 2022). The global community acknowledges two primary approaches to addressing climate change: mitigation and adaptation (Abbass et al., 2022). Mitigation focuses on measures for reducing greenhouse gas (GHG) emissions, while adaptation involves socio-ecological adjustments to cope with and minimize climate change's adverse impacts (Owen, 2020).

Developed nations have advanced industrialization and higher per capita incomes and are historically significant contributors to global GHG emissions and thus have greater responsibility and resources for mitigation (Rosenzweig & Parry, 2022; Tenzing, 2020). Conversely, developing countries prioritize adaptation strategies to safeguard their communities and livelihoods (Andreoni, Lall & Rovelli, 2021; Kaplinsky & Kraemer-Mbula, 2022). The Paris Climate Agreement and Sustainable Development Goals (SDG 13) emphasize integrating traditional knowledge into modern climate adaptation strategies (Makondo & Thomas, 2018; Petzold et al., 2020). Traditional knowledge offers valuable insights into local climate patterns, resource management, and sustainable adaptation practices (Andreoni et al., 2021).

Africa, particularly sub-national regions like Yobe State in Nigeria (in the northeastern part of the country), faces significant climate challenges. Communities in Yobe State possessed traditional knowledge encompassing agricultural practices, natural resource management, and ecological preservation, which holds considerable potential for enhancing climate resilience (Oladeji, 2022; Lawangen & Roberts, 2023). Despite the recognized value of traditional knowledge, it remains underutilized in Nigeria's formal climate change adaptation policies (Oladipo, 2016). This study, therefore, assesses the awareness level, perceived impacts, and traditional knowledge strategies for climate change adaptation among farmers in Fika LGA, Yobe State.

2.1 Methodology

2.1.1 Study Area

Fika Local Government Area in Yobe State, Nigeria, covers 2,208 square kilometers with a population of 136,895 (2006 Census). The region experiences annual rainfall of 600 to 1,000 mm and average temperatures of 35°C to 38°C. Farming is the predominant economic activity in the Local Council.

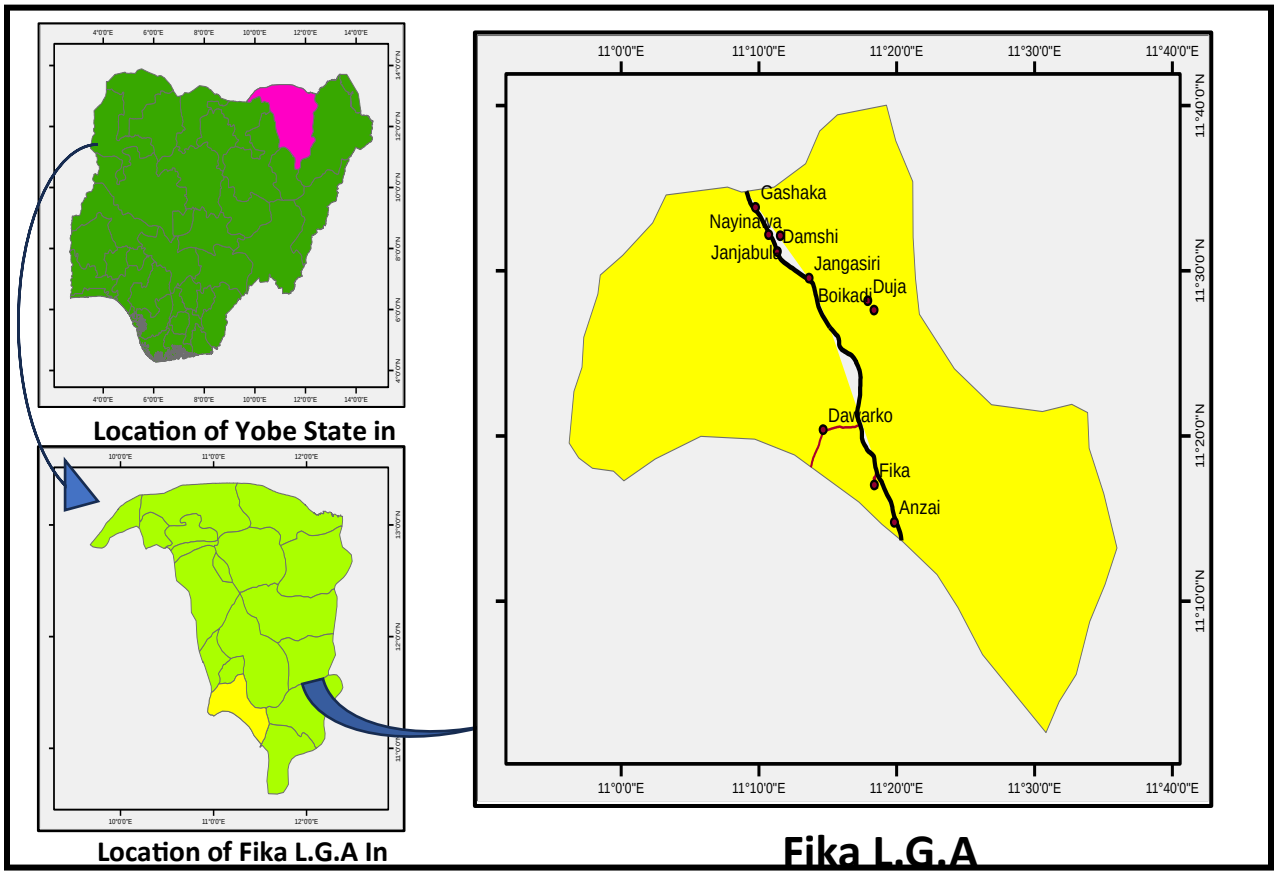

Figure 1 : Study Area
Source: GIS Unit, NAUB (2024).

2.2 Research Design

This study utilized a quantitative research approach to explore traditional knowledge for climate adaptation among farmers in Fika LGA. Survey questionnaires comprising semi-structured and well-structured formats, were developed and administered to farmers in the study area. The first questionnaire employed an open-ended format to gather insights of traditional knowledge for climate change adaptation in the study area. In contrast, the second questionnaire utilized closed-ended questions to delve into farmers' awareness of climate change, their perceived impacts, and the utilization of traditional knowledge in climate change adaptation strategies. The formulation of these questions was guided by relevant literature and expert input, ensuring both the content and construct validity of the questionnaire.

2.3 Sampling Frame and Size

The study focuses on 5,220 registered farmers in Fika LGA (Fika Department of Agriculture, 2023). A sample size of 351 farmers was adopted using the Krejcie and Morgan table for determination of sample size. The farmers were considered as a group of entity within the LGA rather than as individuals within various communities. Thus, a simple random sampling technique was employed to identify farmers that respondent to the survey instrument for ensuring representativeness and statistical reliability.

2.4 Data Collection and Analysis

Trained enumerators were used to administer the survey questionnaire to the selected farmers in Fika LGA. The survey was conducted face-to-face to facilitate clarity and response accuracy. For the first questionnaire, an open-ended question requesting for traditional knowledge in the study area were asked. The responses were deployed in the second questionnaire considering the ethical considerations, informed consent and confidentiality during data collection. The second questionnaire contained four sections detailing demographic characteristics, climate change awareness, perved impacts and traditional knowledge strategies. The survey data for all the section on the analyzed using descriptive statistics techniques to summarize key findings using frequencies and percentages.

3.0 Results and Discussion

3.1 Demographic Characteristics

Table 1 summarizes the demographic characteristics of respondents, including gender, age, farming experience, education, occupation, household size, sources of climate change information, and types of farming engaged.

Table 1: Demographic Information of the respondents

Variables	Frequency	Percentage (%)
Gender		
Male	276	78.6
Female	75	21.4
Age		
20 –29years	39	11
30 --49years	136	38.7
50 and above	176	50.1
Farming years of Experience		
1 –10years	162	46.2
11 –20years	111	31.6
21 –30years	51	14.6
31 and above	27	7.6
Educational Qualification		
Non-formal	89	25.4
Primary	16	4.6
Secondary	134	38.2
Tertiary	112	31.9
Occupation other than farming		
Trading	242	68.9
Civil servant	76	21.7
Student	33	9.4
Household Size		
1 –5 people	57	16.2
6 –10 people	110	31.3
11 –15 people	157	44.7
20 and above	27	7.7

Sources of climate change information		
Electronic media (Radio, Television)	294	83.7
Schools	28	8
NGOs/CBOs	13	3.7
Social media	16	4.6
Types of Farming Engaged		
Crop Farming	164	46.7
Livestock Farming	44	12.5
Both (Crop & Livestock)	143	40.7

Source: Field Survey, 2023

3.2 Farmers' Awareness Level and Perceived Impacts of Climate Change

Table 2 illustrates that most respondents (90.9%) exhibit awareness of the concept of climate change. The high level of awareness among respondents reflects a positive trend, suggesting that educational campaigns or media coverage about climate change may have effectively reached the community. Furthermore, an overwhelming majority of respondents (94.9%) claim to have observed changes in the climate over the past few years. This substantial majority aligns with global trends indicating an increasing awareness of climate change impacts

Table 2: Farmers Awareness Level and Perceived Impacts of Climate Change

Variables	Frequency	Percentage
Are you aware about the concept of Climate Change		
Yes (I know what it means.)	319	90.9
Yes (Yes but I don't know what it means)	19	5.4
Yes (Yes but I didn't believe in it.	5	1.4
No (I have not heard of climate change)	8	2.3
Have you noticed any change in the climate over the past few years?	333	94.9
Yes	3	0.9
No	15	4.3
May be		
Have you noticed any long-term change in rainfall pattern in your farm?	345	98.3
Yes	6	1.7
No		
If yes, specify as under listed		
Drier	322	91.7
Wetter	29	8.3
Observed impacts of climate change (multiple choice)		
Extreme weather event	265	75.5
Change in Temperature	306	87.2
Drought	188	53.6

Source: Field Survey, 2023

Cross-referencing these observations with specific climate data for the region would offer valuable insights into localized effects.

The Table 2 further shows a significant majority (98.3%) of respondents have noticed long-term changes in rainfall patterns on their farms. Among those who noticed changes, 91.7% reported drier conditions, while only 8.3% reported wetter conditions. The high percentage of respondents noting long-term changes in rainfall patterns, particularly the majority reporting drier conditions, could have significant implications for agricultural practices in the region.

Moreover, most respondents (87.2%) reported various observed impacts of climate change. These reported impacts such as extreme weather events, temperature changes, and drought conditions, underscore the vulnerability of the community to climate change effects. Understanding the evolution of these impacts over time, especially when compared to previous studies in the region, would be essential for developing effective adaptation and mitigation strategies.

3.3 Farmers' Traditional Knowledge Strategies for Climate Adaptation in the Study Area

Table 3 presents data on farmers' strategies across three key categories. Soil conservation, water conservation, and weather forecasting were the key strategies. Each category includes multiple strategies with the frequency and percentage of farmers employing each strategy provided.

Table 3: Farmers' traditional Knowledge strategies for Climate Adaptation in the Study Area

Variables	Frequency	Percentage
Farmers' Strategies for Soil Conservation		
Contour Bunding (Zozorma)	211	60.1
Crop Rotation (Shasha Korimara)	155	44.2
Intercropping (Langashiya)	265	75.5
Organic waste composting (Fite Taki)	306	87.2
Animal manure (Kashin Dabbobi)	286	81.5
Mulching (Ngafe)	188	53.6
Farmers' Strategies for Water Conservation		
Contour Bunding (Zozorma)	211	60.1%
Digging of small pit (Bozokori)	155	44.2%
Mulching (Ngafe)	188	53.6%
Conservation Tillage (Mara Dambare)	298	84.4%
Farmers Strategies Weather forecasting		
Sky Observation (Diwa Koryafuzo / Yawwo guda)	155	44.2%
Animal Behaviors: Use of insects and birds (shiyata & karban)	298	87.9%
Wind pattern (Fenfeli Wambai)	238	67.8%
Community knowledge sharing (Elders Experience)	72	20.5%

(Note: All the names in brackets are traditional names)

Source: Field Survey, 2023

3.3.1 Soil Conservation Strategies:

The study revealed that organic waste composting and animal manure are the most widely adopted strategies among farmers, with 87.2% and 81.5% utilizing these practices, respectively. This finding aligns with previous research emphasizing the importance of organic matter in soil fertility and overall agricultural sustainability (Akhtar, Gulab & Ghazanfar, 2023). Organic waste composting and the use of animal manure contribute to soil health by improving nutrient availability, enhancing soil structure, and promoting beneficial microbial activity (Ayamba, Abaidoo, Opoku & Ewusi-Mensah, 2021).

Furthermore, the study found high adoption rates for intercropping and contour bunding, with 75.5% and 60.1% of farmers employing these practices, respectively. Intercropping has been recognized for its benefits in enhancing biodiversity, reducing pest pressure, and maximizing land use efficiency (Stomph et al., 2020). Contour bunding, on the other hand, is an effective soil conservation technique that helps prevent erosion and conserve water resources (Kumawat, Yadav, Samadharmam & Rashmi, 2020).

Interestingly, the adoption rates for mulching and crop rotation were lower, with only 44.2% and 40.5% of farmers employing these practices, respectively. Despite their documented benefits in conserving soil moisture, suppressing weeds, and improving soil fertility, mulching and crop rotation seem to face challenges in terms of adoption (Kumawat et al., 2020). Factors such as lack of awareness, perceived costs, and labor requirements may influence farmers' decisions regarding the adoption of these practices (Gemtou et al., 2024).

3.3.2 Water Conservation Strategies:

Water conservation strategies, which share similarities with soil conservation, include contour bunding and conservation tillage, with adoption rates of 60.1% and 84.4%, respectively. Digging of small pits and mulching have lower adoption rates of 42% and 53.5%, respectively, compared to other strategies. Contour bunding and conservation tillage have been recognized as effective water conservation methods in various agricultural contexts (Kumawat et al., 2020). The higher adoption rates of contour bunding and conservation tillage shows that these methods are more favored among farmers, possibly due to their proven effectiveness in retaining water, reducing erosion, and maintaining soil health. These findings underscore the importance of promoting and supporting such practices for sustainable agriculture and water resource management.

3.3.3 Weather Forecasting Strategies:

The majority of farmers rely on animal behaviors (87.9%) and wind patterns (67.8%) for weather forecasting. Farmers in the study area observe the behavior of animals, particularly insects and birds, as indicators of impending weather changes. Certain insect behaviors, such as changes in feeding patterns or seeking shelter, are believed to signal approaching weather events. Similarly, the flight patterns and calls of birds are interpreted by farmers to anticipate changes in weather conditions, such as the onset of rain or wind. Wind patterns are observed to predict weather changes, such as the arrival of storms or shifts in atmospheric pressure. Farmers pay attention to the direction, speed, and consistency of wind patterns to anticipate weather events and adjust their agricultural

practices accordingly (Datta & Behera, 2022). Wind patterns play a crucial role in influencing microclimates and weather phenomena, making them important indicators for farmers in many regions.

Furthermore, the study found high adoption rates for sky Observation, with 44.2% of farmers employing these practices. This traditional method involves observing the sky for cues such as cloud patterns, color changes, and the movement of celestial bodies to predict weather conditions. Sky observation has been recognized as a valuable indigenous practice for weather forecasting in various agricultural societies (Ebhuoma, & Simatele, 2019). Farmers often rely on these observations to make decisions regarding planting, harvesting, and other agricultural activities, integrating local ecological knowledge with scientific understanding of weather patterns (Gwenzi et al., 2016). These practices reflect the deep connection between farmers and their environment, where animal behavior, wind direction and sky observation serve as valuable environmental indicators.

Finally, the adoption rates for community knowledge sharing were lower, with only 20.5% of farmers employing these practices. Community knowledge sharing, particularly through the wisdom and experience of elders, is a significant aspect of traditional weather forecasting practices. Elders often possess extensive knowledge of local weather patterns, passed down through generations, and play a central role in disseminating this knowledge within their communities (Choudhury, Haque, Nishat & Byrne, 2021). This form of knowledge transmission not only fosters community resilience but also preserves valuable cultural heritage related to agriculture and environmental stewardship.

3.4 Conclusion

The study reveals that traditional knowledge serves as a culturally significant and effective resource for climate change adaptation among farmers in Fika LGA, Yobe State, Nigeria. The high adoption rates of various strategies across different categories underscore farmers' proactive efforts to adapt to environmental challenges and mitigate risks in agriculture. These findings align with previous research, emphasizing the importance of integrating both traditional and modern knowledge systems in sustainable agricultural practices. Therefore, incorporating traditional knowledge into conventional strategies is essential for fostering sustainable climate change solutions in Nigerian communities.

3.5 Recommendations

There is the need to:

i. Document and test traditional knowledge in other communities to broaden understanding and applicability.
ii. Integrate traditional knowledge into conventional strategies to enhance the resilience of agricultural systems.
iii. Involve local communities in adaptation strategy design and implementation to ensure cultural relevance and community ownership.
iv. Support capacity-building initiatives for traditional knowledge holders to preserve and transmit valuable insights across generations.
v. Promote the inclusion of traditional knowledge in educational curricula to

foster appreciation and understanding among future generations.

vi. Establish partnerships between traditional knowledge holders and scientific experts to facilitate knowledge exchange and innovation.

vii. Conduct similar research in other parts of Yobe State to develop centralized adaptation strategies tailored to local contexts and needs.

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