Journal of Plant Biota

Original Research Article
ISSN: 3048-4863
Journal homepage: https://plant.researchfloor.org/

An Assessment of Rural Households Perception of Climate Change in Taraba State, Nigeria

Oruonye, E. D*[1].; Ojeh Vincent Nduka[1]; Linda Sylvanus Bako[1] and Ezra, A.[2]

[1]*Department of Geography, Taraba State University, Nigeria*
[2]*Post Primary School Management Board Yola, Adamawa State, Nigeria*

Abstract

This study assessed rural households' perceptions of climate change in Taraba State, Nigeria, aiming to understand how residents interpret its causes, the variations across agro-ecological zones, and the influencing socio-cultural and environmental factors. Employing a mixed-methods research design, data were collected through structured household surveys, focus group discussions (FGDs), and key informant interviews (KIIs across four distinct agro-ecological zones: Sudan Savannah, Northern Guinea Savannah, Southern Guinea Savannah, and Montane. Findings revealed that rural households predominantly attribute climate change to "community disobedience to God," particularly in the Montane and Southern Guinea Savannah zones, highlighting the profound influence of religious and cultural beliefs. The "destruction of nature (e.g., deforestation and bush burning)" was the second most perceived cause, especially in the Sudan and Northern Guinea Savannah zones, indicating strong local ecological awareness stemming from direct environmental experiences. Conversely, scientific explanations such as "natural factors" and the "use of chemicals" were less commonly acknowledged, suggesting a gap in understanding broader scientific mechanisms. Crucially, perceptions varied significantly across the agro-ecological zones, underscoring the non-homogenous nature of climate change understanding within the state. This heterogeneity is likely influenced by the specific ecological conditions and climate impacts experienced in each zone. The study concludes that effective climate change adaptation and resilience-building strategies in Taraba State must be culturally sensitive, integrate local knowledge, and be tailored to the specific contexts of each agro-ecological zone to ensure their appropriateness and efficacy.

Keywords: *Adaptation Strategies, Agro-ecological Zones, Climate Change Perception, Rural Households & Taraba State.*

Introduction

Climate change represents one of the most pressing global challenges of the 21st century, affecting the environment, economies, and societies in multifaceted ways. Its impacts are disproportionately felt in developing regions, particularly in sub-Saharan Africa, where livelihoods are largely dependent on climate-sensitive sectors such as agriculture and forestry [1]. Nigeria, as Africa's most populous nation, faces significant climate-related risks including rising temperatures, irregular rainfall patterns, prolonged droughts, and increasing incidences of flooding. These changes threaten food security, water availability, and health, particularly in rural areas where adaptive capacity is generally low [2].

Taraba State, located in the northeastern region of Nigeria, exhibits a diverse agro-ecological landscape comprising the Sudan Savannah, Northern Guinea Savannah, Southern Guinea Savannah, and Montane zones. These zones are home to numerous rural communities whose livelihoods are intricately tied to natural systems. Consequently, any alteration in the climate system has profound implications for their socio-economic well-being. Despite the evident impacts of climate change, understanding how rural populations perceive these changes remains limited. This knowledge gap is critical because perception influences response and adaptation strategies at the community level [3].

Perceptions of climate change among rural populations are shaped by various factors including ecological location, cultural beliefs, religious orientation, and direct environmental experiences. In some rural Nigerian contexts, changes in climate are not solely attributed to scientific or physical causes but are often linked to spiritual or moral explanations such as divine punishment for societal wrongdoing [4]. Understanding these perceptions is essential for designing context-specific climate change communication and adaptation strategies that are both culturally sensitive and scientifically sound.

Although several studies have examined the physical manifestations of climate change in Nigeria, few have focused on local perception, especially in ecologically diverse states such as Taraba. Assessing rural households' perception is not only important for enhancing scientific knowledge but also for informing policy and grassroots action plans aimed at building resilience to climate shocks. Perception studies can help identify knowledge gaps, promote behavior change, and improve the targeting of adaptation interventions [5].

This study, therefore, seeks to assess rural households' perception of climate change in Taraba State, Nigeria. It aims to explore how rural residents interpret the causes of climate change, the extent to which their perceptions differ across agro-ecological zones, and the socio-cultural and environmental factors influencing these perceptions. By doing so, the study

12 April 2025: Received | 13 May 2025: Revised | 15 June 2025: Accepted | 07 July 2025: Available Online

Citation: Oruonye, E. D., Ojeh Vincent Nduka, Linda Sylvanus Bako & Ezra, A. (2025). An Assessment of Rural Households Perception of Climate Change in Taraba State, Nigeria. *Journal of Plant Biota.* **07 to 12.**
DOI: https://doi.org/10.51470/JPB.2025.4.2.01

Oruonye, E. D | eoruonye@gmail.com

contributes to a deeper understanding of local environmental cognition and supports the development of tailored climate adaptation policies.

Statement of the Research Problem

Climate change continues to pose an existential threat to global development, with its impacts disproportionately affecting vulnerable populations, especially in rural and ecologically diverse regions of sub-Saharan Africa. In Nigeria, where over 70% of the population depends on climate-sensitive activities such as agriculture and natural resource extraction, the rural populace remains at the frontline of these environmental challenges [2]. Taraba State, characterized by complex agro-ecological zones and a largely rural demographic, is particularly vulnerable due to its dependence on rain-fed agriculture, extensive deforestation, and low adaptive capacity.

Despite increasing scientific evidence and global awareness of climate change, there remains a significant gap in understanding how rural communities in Nigeria, particularly in Taraba State, perceive the phenomenon. Perception is a key determinant of climate response; it shapes risk appraisal, decision-making, and local adaptation strategies [3, 5]. However, rural perceptions are often influenced not only by direct environmental experiences but also by cultural, religious, and social interpretations. For instance, earlier findings suggest that some rural households in Taraba State attribute climate change to spiritual causes such as divine punishment rather than scientific explanations such as greenhouse gas emissions or land use change [4, 6].

This divergence in perception may result in limited acceptance or misalignment with formal climate change communication and mitigation initiatives. Moreover, variation in perception across ecological zones may further complicate policy formulation and implementation. Without a clear understanding of how rural households interpret climate change and its causes, efforts to promote adaptation and resilience-building at the community level risk being ineffective or culturally inappropriate [1].

While existing studies in Nigeria have predominantly focused on the biophysical impacts of climate change or macro-level vulnerability assessments, little empirical research has been conducted to capture the nuanced, localized perceptions of rural households in Taraba State. There is, therefore, a compelling need to examine these perceptions systematically, identify their socio-cultural and ecological drivers, and assess the extent to which they align with scientific understanding.

This study addresses this critical gap by assessing rural households' perception of climate change across the four agro-ecological zones of Taraba State. It provides evidence-based insights necessary for designing culturally sensitive and geographically targeted climate adaptation policies and education programs.

Description of the Study Area

Taraba State, located in the northeastern region of Nigeria, lies between latitudes 6°30′N and 9°36′N and longitudes 9°10′E and 11°50′E (Fig. 1). It shares international boundaries with the Republic of Cameroon to the east and national boundaries with Bauchi, Gombe, Adamawa, Benue, Nassarawa, and Plateau States. With a land area of approximately 54,473 square kilometers, it ranks among the largest states in Nigeria by landmass [7].

Taraba State exhibits diverse topographical and ecological characteristics shaped by its position on the windward side of the Cameroon Highlands. The state's landscape ranges from low-lying plains in the north to high-altitude mountainous terrains in the southeast, notably in the Mambilla Plateau region which rises to over 1,800 meters above sea level. This ecological variability contributes to its classification into four major agro-ecological zones: the Sudan Savannah, Northern Guinea Savannah, Southern Guinea Savannah, and the Montane zone.

These ecological zones influence not only the state's biodiversity and agricultural productivity but also how communities experience and respond to climate-related changes. For instance, the Montane zone experiences cooler temperatures and higher rainfall, while the Sudan Savannah in the north is drier and more prone to desertification and drought.

The state experiences a tropical climate, with two distinct seasons: the rainy season (April to October) and the dry season (November to March). Annual rainfall varies between 800 mm in the northern Sudan Savannah to over 2,000 mm in the Montane regions. Similarly, temperature patterns vary significantly, with average daily temperatures ranging from 18°C in the Mambilla Plateau to over 38°C in the drier northern parts [8].

This climatic diversity makes the state highly vulnerable to the impacts of climate change and variability, including irregular rainfall, extended dry seasons, flash floods, and soil erosion, particularly in the highland and deforested areas.

Taraba is predominantly agrarian, with over 80% of the population engaged in subsistence agriculture, livestock rearing, and the exploitation of forest resources [2]. Major crops cultivated include maize, millet, yam, cassava, rice, and vegetables, while cash crops such as coffee, tea, and cocoa are grown in the Montane areas. The state is also notable for cattle grazing, especially in its northern and central parts.

The socio-cultural landscape of Taraba is equally diverse, with over 50 ethnic groups including the Jukun, Mumuye, Fulani, Chamba, Kuteb, Tiv, and Mambilla. This ethnic plurality plays a crucial role in shaping local knowledge systems, including perceptions of environmental change and traditional coping mechanisms.

The study covered seven Local Government Areas (LGAs) that were purposively selected to reflect the agro-ecological and cultural diversity of the state. These LGAs include:

- Sudan Savannah Zone: Karim Lamido and Lau
- Northern Guinea Savannah Zone: Gassol and Gashaka
- Southern Guinea Savannah Zone: Bali and Kurmi
- Montane Zone: Sardauna

These areas were chosen based on their population size, vulnerability to climate stressors, and representativeness of ecological conditions. According to projections by the NPC [7], the total population of the selected LGAs was approximately 1.96 million in 2023, with Sardauna, Gassol, and Karim Lamido accounting for the highest shares.

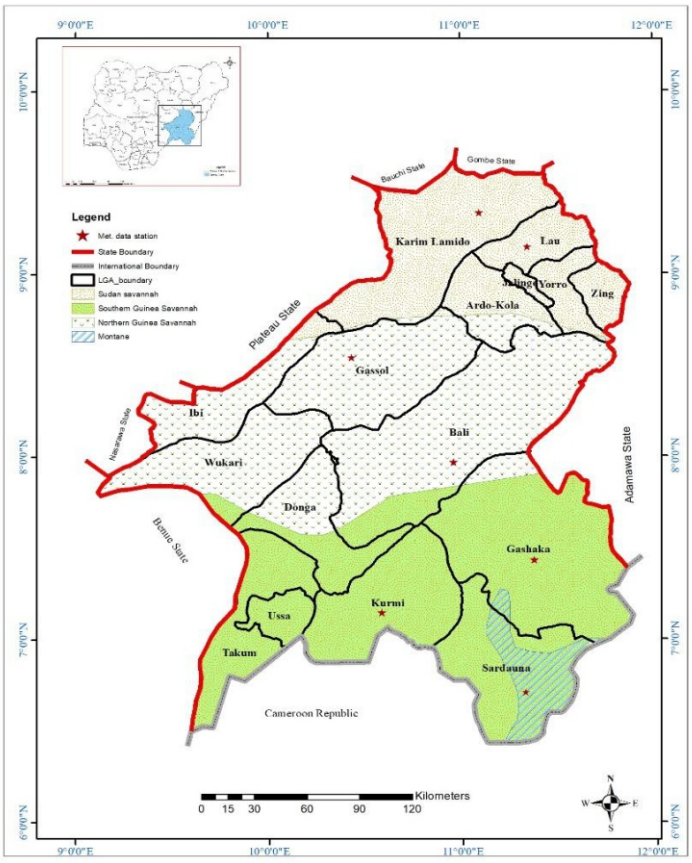

Fig. 1. Map of Agro-ecological Zones in the Study Area

Taraba State faces numerous environmental and climate-related challenges, including but not limited to:

- Deforestation and land degradation due to logging, bush burning, and shifting cultivation.
- Flooding in lowland areas such as Lau and Gassol during peak rainfall seasons.
- Drought and desertification in the northern savannah zones.
- Soil erosion and landslides, particularly in the hilly Montane areas of Sardauna.
- Biodiversity loss and increasing encroachment on forest reserves.

These challenges have exacerbated rural poverty, food insecurity, and migration patterns, increasing the urgency for effective climate adaptation strategies at the grassroots level.

Methodology

This study adopted a mixed-methods research design, integrating both quantitative and qualitative approaches to enhance the validity and depth of findings. The quantitative component involved structured household surveys aimed at capturing measurable data on household demographics, climate change awareness, perceived causes, and observed climatic impacts. The qualitative component included focus group discussions (FGDs), key informant interviews (KIIs), and field observations, which provided context-specific insights and allowed for triangulation of data [9]. This methodological triangulation was critical in addressing complex and culturally embedded perceptions of climate change across diverse agro-ecological zones in Taraba State.

The study was conducted in Taraba State, located in northeastern Nigeria. The state is ecologically diverse, encompassing four major agro-ecological zones: the Sudan Savannah, Northern Guinea Savannah, Southern Guinea Savannah, and Montane region. These zones were selected to reflect ecological variability and differential exposure to climate-related phenomena such as drought, deforestation, flooding, and soil erosion.

Seven Local Government Areas (LGAs) were purposively selected across these ecological zones based on population size, ecological characteristics, and relevance to the study. These included Lau and Karim Lamido (Sudan Savannah), Gassol and Gashaka (Northern Guinea Savannah), Bali and Kurmi (Southern Guinea Savannah), and Sardauna (Montane zone). This stratified selection ensured ecological representation and enhanced the generalizability of the findings across the state.

The projected population for the study area in 2023 was 1,961,136, based on the 2006 population census data, projected using the exponential growth method proposed by Mehta [10]. The formula used is:

$Pn = Po\ (1 + R/100)^n$ (1)

Where:

Pn = Population in the current year
Po = Population in the base year
R = Annual growth rate
n = Number of intermediary years

Using the above method, the population of the study area for the year 2022 was calculated and is summarized below:

Gassol: 418,671
Karim Lamido: 331,273
Gashaka: 148,902
Bali: 360,485
Lau: 162,610
Kurmi: 155,934
Sardauna: 383,261
Total Projected Population for 2023: 1,961,136

A sample size of 1,067 household heads, based on a margin of error of 5%, was adopted for this study, as recommended by Saunders [11], for the total population.

A sample size of 1,067 respondents was derived based on the guidelines by Saunders et al [11], who recommend a minimum sample size of 384 for large populations at a 95% confidence level and ±5% margin of error. To ensure proportional representation, the sample was allocated across the LGAs using a proportionate sampling technique:

$Qi = (Fi / P) \times N$ (2)

Where:

Qi = The number of respondents selected from each LGA
Fi = Population of each LGA (see Table below)
P = Total population of all LGAs
N = Total required sample size (384)

By substituting the values in equation 2, the sample size for each LGA is calculated as follows:

Lau = (162,610/1,961,136) × 1,067 = 88 respondents
Karim Lamido = (331,273/1,961,136) × 1,067 = 180 respondents
Gassol = (418,671/1,961,136) × 1,067 = 228 respondents
Gashaka = (148,902/1,961,136) × 1,067 = 81 respondents
Bali = (360,485/1,961,136) × 1,067 = 196 respondents
Kurmi = (155,934/1,961,136) × 1,067 = 85 respondents
Sardauna = (383,261/ 1,961,136) × 1,067 = 209 respondents
Total Sample Size: 1,067 respondents

The study utilized multiple data collection tools, including structured questionnaires, focus group discussions (FGDs), key informant interviews (KIIs), and systematic field observations, following the principles of multi-method triangulation [12].

Structured questionnaires, composed of both closed- and open-ended questions, were administered to household heads aged 40 and above who had resided in the communities for at least 30 years. This inclusion criterion was essential to ensure respondents possessed long-term experience with local environmental changes. The questionnaire gathered data on socio-demographic characteristics, observed climatic changes, perceptions of climate change causes, and household adaptation strategies. The Likert scale was employed for rating perceived causes and impacts.

FGDs were conducted in each LGA, with at least six participants per session, including community leaders, elders, and farmers. Discussions focused on long-term climatic changes, community vulnerability, and local adaptive practices. FGDs helped contextualize the quantitative findings and provided insights into shared narratives and local epistemologies.

KIIs were conducted with government officials, traditional rulers, environmental officers, and NGO representatives. These interviews provided expert insights on climate trends, local policies, and institutional responses to climate change in rural areas.

Systematic field observations were conducted to visually assess environmental conditions such as land degradation, deforestation, water sources, and settlement patterns. This method offered direct evidence of environmental stress and adaptation strategies in practice, supplementing data obtained through other tools.

Quantitative data from the questionnaire were analyzed using descriptive and inferential statistics. Descriptive statistics, such as frequency distributions, means, and percentages, were used to summarize responses. Inferential techniques including Chi-square tests and Analysis of Variance (ANOVA) were used to assess associations and differences in perception across ecological zones, using SPSS version 21 and Microsoft Excel (2013). Qualitative data from FGDs and KIIs were transcribed, coded thematically, and analyzed using content analysis to identify emerging themes and patterns in perceptions and responses.

This integrative approach provided a nuanced understanding of how rural households in different ecological zones of Taraba State perceive climate change, enabling context-sensitive policy recommendations.

Result of the Findings

Perception of the Causes of Climate Change

Table 1. Rural Households Perception of Climate Change in the Study Area

	Sudan Savannah	Northern Guinea Savannah	Southern Guinea Savannah	Montane	Mean	Rank
Climate Change is Caused by Community disobedience to God	3.2007	4.1294	4.4448	4.6411	4.1040	1st
Climate Change is Caused by Destruction of nature (e.g. deforestation and bush burning)	4.2007	4.3139	3.6512	3.5502	3.9290	2nd
Climate Change is Caused by Use of chemicals (pesticides etc)	3.8030	4.0162	3.3488	3.3158	3.6209	3rd
Climate Change is Caused by Natural factors (e.g. changes in volcanic activity and solar output	3.9963	3.9871	2.4377	2.2201	3.1603	4th
Mean	**3.8002**	**4.1117**	**3.4706**	**3.4318**		
Rank	**2nd**	**1st**	**3rd**	**4th**		

Table 1 presents the perception of rural households across the four agro-ecological zones in Taraba State regarding the causes of climate change. Overall, respondents most strongly attributed climate change to community disobedience to God, with a mean score of 4.1040, ranking 1st across all zones. This reflects a significant influence of religious and cultural beliefs in shaping environmental understanding, particularly in the Montane and Southern Guinea Savannah zones.

The second most perceived cause was the destruction of nature, such as deforestation and bush burning (mean score: 3.9290), indicating a strong awareness of human-induced environmental degradation. This view was especially pronounced in the Sudan and Northern Guinea Savannah zones.

The use of chemicals, including pesticides and fertilizers, was ranked 3rd, with a mean score of 3.6209, suggesting moderate concern about agricultural practices and their environmental impacts.

Lastly, natural factors such as volcanic activity and solar variation were the least perceived cause, with a mean of 3.1603, suggesting that scientific or geophysical explanations for climate change are less commonly acknowledged among rural households.

Across zones, the Northern Guinea Savannah reported the highest overall awareness (mean: 4.1117), while the Montane zone had the lowest (mean: 3.4318). These findings highlight the varying socio-cultural and ecological contexts influencing climate change perceptions in Taraba State. The study went further to test the association between rural households' perception of climate change and the agroecological zones. The result is presented in Table 2.

Table 2. Test of Association between Household Perception of Climate Change and the Agroecological Zones

	Chi-square Value	Df	Asymp. Sig. (2-sided)
Climate Change is Caused by Community disobedience to God	296.358[a]	12	.000
Climate Change is Caused by Destruction of nature (e.g. deforestation and bush burning)	256.252[a]	12	.000
Climate Change is Caused by Use of chemicals (pesticides etc)	123.818[a]	12	.000
Climate Change is Caused by Natural factors (e.g. changes in volcanic activity and solar output	422.326[a]	12	.000

Table 2 presents the results of a Chi-square test examining the association between rural households' perceptions of the causes of climate change and the agro-ecological zones in Taraba State. The findings reveal statistically significant associations across all the listed causes, with p-values less than 0.05 in each case, indicating that perceptions vary significantly by ecological zone. The perception that climate change is caused by community disobedience to God recorded a Chi-square value of 296.358 (df = 12, p = .000), suggesting a strong variation across zones. Similarly, the belief that destruction of nature (e.g., deforestation and bush burning) leads to climate change showed a significant association (Chi-square = 256.252, df = 12, p = .000).

The view that the use of chemicals such as pesticides contributes to climate change also varied significantly (Chi-square = 123.818, df = 12, p = .000), albeit with a lower Chi-square value. Notably, the belief that natural factors such as volcanic activity and solar output are responsible for climate change had the highest Chi-square value of 422.326 (df = 12, p = .000), reflecting the most substantial variation in perception across zones. These results highlight that household understanding of climate change causes is not homogenous across Taraba State but is shaped by ecological and socio-cultural differences, underscoring the need for zone-specific climate education and adaptation strategies.

A Test of variation on perception of climate change among the agroecological zones was also carried out and result is presented in Table 3.

Table 3. Test of Variation on Perception of Climate Change among the Agroecological Zones

	Climate Change is Caused by Community disobedience to God	Climate Change is Caused by Destruction of nature (e.g. deforestation and bush burning)	Climate Change is Caused by Use of chemicals (pesticides etc)	Climate Change is Caused by Natural factors (e.g. changes in volcanic activity and solar output
Sudan Savannah	3.2090a	4.2127a	3.8134a	4.0075a
Northern Guinea Savannah	4.1294b	4.3139a	4.0162b	3.9871a
Southern Guinea Savannah	4.4448c	3.6512b	3.3488c	2.4377b
Montane	4.6411d	3.5502b	3.3158c	2.2201c
F-Value	92.860**	59.997**	31.255**	185.062**

Note: Means with different letters (a, b, c and d) are significantly different while those with the same letters are not significant
**F-Value is significant at 0.05*
***F-Value is significant at 0.01*
Ns=Not Significant Variation

Table 3 shows the results of an analysis of variance (ANOVA) test used to assess whether household perceptions of the causes of climate change significantly vary across the four agro-ecological zones in Taraba State. The results reveal significant variations at the 0.01 level across all perception categories, as indicated by the F-values and the use of superscript letters to denote statistically different group means. For the belief that climate change is caused by community disobedience to God, perceptions varied significantly among the zones, with the Montane zone recording the highest mean score (4.6411^{d}), followed by the Southern Guinea Savannah (4.4448^{c}), Northern Guinea Savannah (4.1294^{b}), and Sudan Savannah (3.2090^{a}). Regarding the destruction of nature, the Northern Guinea and Sudan Savannah zones held significantly higher perceptions (4.3139^{a} and 4.2127^{a}, respectively) compared to the Southern Guinea and Montane zones. A similar pattern of significant variation is observed for the belief that the use of chemicals causes climate change, with Northern Guinea Savannah (4.0162^{b}) scoring higher than the Southern zones. For natural causes such as volcanic activity and solar changes, perceptions also differed significantly, with the Sudan and Northern Guinea Savannahs scoring higher, while the Southern Guinea and Montane zones showed much lower scores. These findings underscore the influence of ecological and possibly cultural differences on how rural households interpret the causes of climate change, suggesting the need for tailored awareness and intervention strategies based on local contexts.

Discussion of the Findings

The findings of this study provide crucial insights into rural households' perceptions of climate change in Taraba State, Nigeria, revealing both consistencies and divergences with existing literature. The most prominent finding is the strong attribution of climate change to "community disobedience to God" (mean score: 4.1040), ranking as the primary perceived cause across all agro-ecological zones. This perception is particularly pronounced in the Montane and Southern Guinea Savannah zones. This finding strongly aligns with previous research in rural Nigerian contexts, where environmental phenomena, including climate change, are often interpreted through spiritual or moral explanations, such as divine punishment for societal wrongdoing [4, 6]. This agreement can be attributed to the deeply ingrained religious and cultural beliefs prevalent in these communities, where a spiritual worldview often mediates the understanding of natural events, overshadowing purely scientific interpretations.

The second most perceived cause, "destruction of nature (e.g., deforestation and bush burning)" (mean score: 3.9290), indicates a significant level of local ecological knowledge and awareness among rural households regarding the direct impact of human activities on their immediate environment. This view was especially pronounced in the Sudan and Northern Guinea Savannah zones. This finding resonates with the understanding that direct environmental experiences significantly shape perceptions of climate change and its impacts [3]. The observed prominence of this perception in zones susceptible to desertification and land degradation suggests that tangible, observable environmental changes, such as extensive deforestation and bush burning, directly influence how communities attribute the causes of climate change. While this reflects an understanding of human-induced environmental degradation, it represents a more localized and direct interpretation compared to the broader scientific understanding of global greenhouse gas emissions.

Conversely, the study found that "natural factors (e.g., changes in volcanic activity and solar output)" were the least perceived cause (mean score: 3.1603), and the "use of chemicals (pesticides etc.)" was moderately perceived. This divergence from a purely scientific understanding of global climate drivers suggests a knowledge gap regarding the broader scientific mechanisms of climate change among rural households. This aligns with observations in other studies where local perceptions may not fully align with complex scientific explanations [6]. The reason for this variation could be attributed to limited access to formal scientific education or communication channels that disseminate such nuanced information in rural areas. Consequently, perceptions are more heavily influenced by readily observable local changes and deeply ingrained cultural or religious frameworks [3].

Furthermore, the study revealed statistically significant variations in perceptions across the four agro-ecological zones for all perceived causes of climate change. This finding strongly supports the existing literature which posits that perceptions

are not homogenous but are significantly shaped by ecological location and direct environmental experiences [3]. The differing ecological characteristics of the zones ranging from the drier Sudan Savannah prone to desertification to the Montane zone with higher rainfall likely influence which climate impacts are most salient to residents, thereby shaping their attributions of causes. For instance, communities experiencing direct impacts of deforestation might attribute climate change more readily to "destruction of nature." This heterogeneity underscores the critical need for context-specific climate education and adaptation strategies, reinforcing the arguments by Below [5] regarding the importance of household-level variables in understanding and promoting climate change adaptation.

Conclusion

This study assessed rural households' perceptions of climate change in Taraba State, Nigeria, revealing a blend of traditional beliefs, direct environmental experiences, and scientific understanding. A primary finding was the strong attribution of climate change to "community disobedience to God," particularly in the Montane and Southern Guinea Savannah zones. This highlights the significant role of religious and cultural worldviews, suggesting that climate communication must be culturally sensitive.

The prominent perception that "destruction of nature (e.g., deforestation and bush burning)" causes climate change, especially in the Sudan and Northern Guinea Savannah zones, indicates a high level of local ecological awareness. Rural households observe and interpret tangible environmental degradation, which directly informs their understanding.

Recommendations

Based on the findings of this study, the following recommendations are put forth to enhance climate change adaptation and resilience-building among rural households in Taraba State:

I. Integrate Cultural and Religious Beliefs: Climate communication should respectfully incorporate local religious and cultural narratives to foster greater community acceptance and engagement.

ii. Leverage Local Ecological Knowledge: Build upon existing local ecological awareness by promoting practical, community-led solutions to address issues like deforestation and unsustainable practices.

iii. Develop Zone-Specific Climate Education: Tailor educational programs to address specific climate impacts and perceived causes relevant to each agro-ecological zone.

iv. Bridge Scientific Understanding Gaps: Gradually introduce scientific explanations through participatory workshops and community dialogues, combining traditional knowledge with scientific insights.

v. Strengthen Collaborative Governance: Foster stronger collaboration among government agencies, NGOs, traditional institutions, and community leaders for effective, culturally appropriate climate action.

References

1. Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the IPCC. Cambridge University Press.
2. Federal Ministry of Environment. (2021). *Nigeria's Updated Nationally Determined Contribution (NDC)*. Abuja: Government of Nigeria.
3. Maddison, D. (2007). *The perception of and adaptation to climate change in Africa*. The World Bank. Policy Research Working Paper 4308.
4. Nwankwo, F. C., Anozie, O. C., & Nwoke, O. O. (2016). Climate change perception and adaptation strategies among rural farmers in Anambra State, Nigeria. *African Journal of Agricultural Research*, 11(32), 3040–3048.
5. Below, T., Mutabazi, K., Kirschke, D., Franke, C., Sieber, S., Siebert, R., & Tscherning, K. (2012). *Can farmers' adaptation to climate change be explained by socio-economic household-level variables?* Global Environmental Change, 22(1), 223–235. https://doi.org/10.1016/j.gloenvcha.2011.11.012
6. Oruonye, E. D. (2015). An assessment of the level of awareness of climate change and variability among rural farmers in Taraba State, Nigeria. *Journal of Geography and Earth Sciences*, *3*(1), 1–9. https://doi.org/10.15640/jges.v3n1a1
7. National Population Commission. (2023). *Population Projection for Taraba State*. Abuja: NPC.
8. Nigerian Meteorological Agency. (2022). *2022 Climate Review and Outlook*. Abuja: NiMet.
9. Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). SAGE Publications.
10. Mehta, S. (2004). *Population projection techniques and applications*. Oxford University Press.
11. Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Pearson Education.
12. Tashakkori, A., & Teddlie, C. (2003). *Handbook of mixed methods in social & behavioral research*. SAGE Publications.