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Communities' response and adaptation strategies to climate-induced desertification in Yobe State, Nigeria.

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ABSTRACT :

Globally, climate-induced desertification is a critical environmental challenge in the contemporary society, such as in Yobe State. The socio-economic and cultural livelihood of the people has been affected by the induced desertification due to continual rise in temperature, erratic rainfall, prolonged droughts, and unstable land use practices. The environment has experienced water bodies drying up, sand dune erosion, and deforestation, as well as unconducive weather. This research work explores community-based responses and adaptation strategies to the climate-induced desert encroachment in Yobe State, Nigeria. The study employed a descriptive approach on 120 participants from three (3) prone desertification areas (Yusufari, Geidam, and Yunusari) and applied Likert scale measure questions to acquire information on community-based and adaptive strategies on the climatic phenomenon. SPSS software (23.0) for mean and standard deviation to analysed the data statistically. The findings reveal that communities are aware of the desert encroachment, which is induced by climate factors, increases in barren land and vegetation, dust storms, and erosion. Communities responses were the use of resistant traditional seeds, shifting cultivation, and the mulching method of farming to respond to desertification. A multifaceted traditional approach was introduced to sustain climate-induced desert in the environment. The study underscored the need for integrated, participatory, and well-funded approaches to enhance long-term community resilience and environmental sustainability in Yobe State, Nigeria.

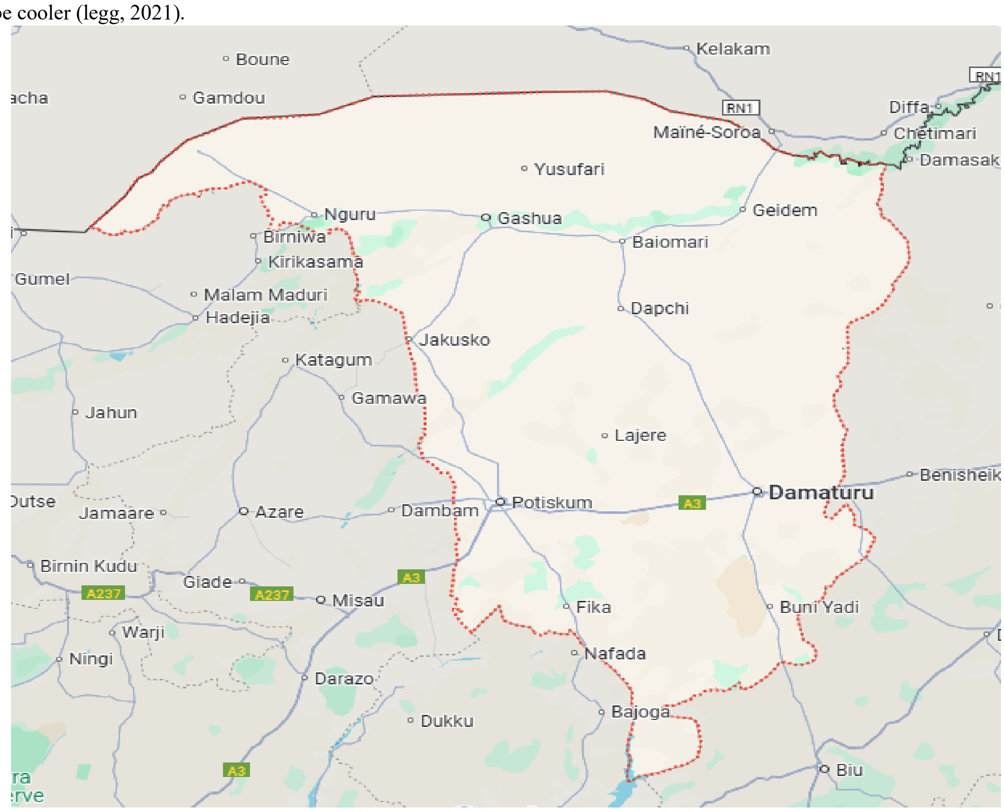
Keywords: Adaptation, climate, community response, desertification, strategy, Yobe

INTRODUCTION

Desertification is one of the environmental challenges causing havoc in arid and semi-arid regions of Nigeria, with severe effects on human livelihoods and food security for both human and animal. With the country losing over 350,000 hectares of land yearly to desertification, it could not afford to watch while arable land is being lost to desert encroachment. The effect of the advancing Sahara Desert is more directly felt in the extreme northern parts of Nigeria. This portion of the country extends from about latitude 12°N to the boundary of the Republic of Niger. The area already exposed to the effects of desertification in Nigeria is estimated at about 326,000 square kilometers. This semi-arid zone cuts across Sokoto, Kebbi, Zamfara, Kano, Jigawa, Borno, Yobe, Katsina, Gombe, Adamawa, and Bauchi states (Azare et al., 2019). The region north of latitude 10^0N is generally regarded as the most desertification-prone area, often described as desertification frontline areas with states such as Adamawa, Bauchi, Borno, Gombe, Jigawa, Kano, Katsina, Kebbi, Sokoto, Yobe, and Zamfara. It is prevalent in the northern part of Nigeria, especially in Yobe, Borno, and Sokoto states. Climate variability, deforestation, and land use practices enhance land degradation (Legg, 2021). With the change in climate over time and frequent increase of weather variables as a result of global warming, climate-induced desertification is more evident in Yobe State compared to Borno and Sokoto States. Being situated within the Sahel Savannah and experiencing frequent droughts, erratic rainfall patterns, and constant rises in temperature increases the magnitude of desert encroachment that causes the loss of large arable land, major roads being buried under sand dunes, and water bodies drying up in the environment (Odjugo, 2010; Bappah et al., 2017; Legg, 2021). Meteorological Agency (NiMet, 2023) has reported an increase of 1.5°C of temperature in the past 30 years and a 20% decrease in annual rainfall, from 28.0°C in 1990 to about 30^0c in 2023. According to Nwokocha (2017), it is estimated that the southward movement of sand is ~0.6 km per year, and Yobe State has lost ~25,000-30,000 hectares annually in the last decade. Drought in the northeast region plays a significant role in increased desertification in the area (Musa & Shaib, 2010; Olagunju, 2015; Terhile, 2017). The climate-induced desertification in Yobe State has compelled residents to migrate or adapt to the changing situation. A large number of people have been relocated to a conducive environment, while others devise strategies of adaptation. This climate greatly affects the daily lives of people, many of whom depend on farming, raising livestock, and fishing. The limited and unpredictable rainfall also impacts water supply, plant cover, and farming output, increasing the region's environmental risks. In Yobe, desertification mainly results from low rainfall, high evaporation rates, overgrazing, deforestation, poor land use, and population growth. The northern part of the state, especially in local government areas like Yusufari, Geidam, and Yunusari, is facing more dune encroachment and desert-like conditions. The loss of plants from logging, collecting firewood, and burning brush has sped up land degradation, making the soil more vulnerable to erosion and reduced fertility (FME, 2019). Local communities have had to adopt various coping strategies to maintain their livelihoods in response to these environmental changes. However, the effectiveness of these strategies is unclear due to a lack of institutional assistance, insufficient funding, and limited understanding of climate change (Mshelia et al., 2025). This research explores communities' response and adaptation to climate-induced desertification in Yobe State, Nigeria.

METHODOLOGY

Yobe State is in the North-East region of Nigeria. It is one of the 36 states that make up the Federal Republic of Nigeria. Established from the former Borno State in 1991, Yobe shares an international border with the Republic of Niger to the north. It has several internal borders: Borno to the east, Bauchi to the west, Gombe to the south-south, and Jigawa to the North-west (National Population Commission [NPC], 2006). Yobe State is situated between latitudes 10°23′N and 13°05′N and longitudes 9°29′E and 12°00′E (Federal Ministry of Environment [FME], 2019). Yobe State has two distinct seasons typical of a semi-arid climate. The wet season lasts from June to September, and there is a long dry season from October to May. Rainfall averages between 300 and 600 mm per year. It is usually low and unpredictable, with the southern regions getting slightly more rain than the northern ones (Nigerian Meteorological Agency [NiMet], 2020). The climate features high temperatures year-round, often ranging from 30°C to 42°C. The Harmattan winds, which are dry and dusty northeasterly trade winds from the Sahara Desert, bring hot weather in March and April. In contrast, December and January tend to be cooler (legg, 2021).



Google Map, 2025

Figure 1 Study Area (Yobe State, Nigeria)

The research design for this article is descriptive and serves as a basic tool for researchers to observe and record detailed information required for the study. This method provides a rich account that helps with understanding, categorizing, and interpreting the subject matter. Descriptive research is an exploratory method that allows a researcher to describe a population, situation, or phenomenon. It helps answer questions about what, where, when, and how, but not why. Its main importance is in giving a broad view of a phenomenon. In this study, a sample of 120 participants was taken from three (3) different locations (Yusufari, Geidam, and Yunusari) in Yobe State. The researchers used a random sampling technique to reduce rejection risk; only participants who agreed to answer the questions and participate in interviews were included. Question 1 covers participants' details. Question 2 focuses on their awareness of climate change and desertification. Question 3 looks at their adaptation strategies for climate change and desertification that include item statements rated using four scales: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), with values of 4, 3, 2, and 1, respectively. A mean criterion of 2.50 determined agreement or disagreement with an item statement. Any item with a mean score of 2.50 or higher was considered 'Agree,' while items below 2.50 were marked 'Disagree.'

Results and Discussion

Table 1 shows the demographic details of the participants in the study on community response to climate change-related desertification. The results reveal that 74.2% of the participants are male. In contrast, 25.8% are female, indicating that more male took part in the study and may outnumber female. The age breakdown shows that 36.7% are between 48 and 57 years old, 23.3% are aged 38 to 47, 17.5% are between 18 and 27, and 15% are aged 28 to 37. Meanwhile, 7.5% are 58 or older. This implies that independent and responsible individuals are common in this group. For marital status, 52.5% are married, 20% are widows or widowers, 17.5% are divorced, and 10% of participants are single. This indicates that most people are married. Regarding education, 40.8% have no formal education, 32.5% have completed secondary school, 20% have a primary school qualification, and 6.7% have achieved tertiary education. Most community members are involved in farming, comprising about 44.2% of the population. This is followed by 30.8% who are traders or business owners. Additionally, 15% are unemployed, while 10% have no jobs. This suggests that farming is the main occupation in the area. As for the awareness of climate change-related desert encroachment in their communities, 65% of participants reported seeing signs of desert spread in their environment.

Table 1: Participants' Demographic Features

Description	Frequency	Percentage %
Gender		
Male	89	74.2
Female	31	25.8
Age		
18-27	21	17.5
28- 37	18	15.0
38- 47	28	23.3
48-57	44	36.7
58 >	9	7.5
Marital Status		
Single	12	10.0
Married	63	52.5
Divorce	21	17.5
Widow/widower	24	20
Education Attainment		
No formal education	49	40.8
Primary	24	20
Secondary	39	32.5
Tertiary	8	6.7
Occupation		
Farmer	53	44.2
Trader/business	37	30.8
Unemployed	18	15.0
Civil servant	12	10
Notice climate change is inducing desert encroachment.		
Yes.	78	65.0
No	23	19.2
Not sure	19	15.8

Source: Field Survey, 2025

Table 2: Participants' awareness of climate change is contributing to desertification (mean = 2.90, SD = 1.1). A mean of 2.90 shows that participants agree climate change contributes to desertification. The standard deviation of 1.1 indicates some variability in responses. This suggests that while most participants acknowledge this link, some remain uncertain or uninformed. Eze and Onokala (2022) support this by finding that factors related to climate change primarily drive desertification in northern Nigeria. Similarly, Sharma et al. (2021) and Robert (2011) have confirmed that changing temperature and rainfall patterns significantly advance desert zones in the Sahel region. There has been an increase in barren land and reduced vegetation (mean = 2.70, SD = 1.13). The mean score shows that respondents agree vegetation cover is declining due to climate change. This degradation affects ecosystem balance and local livelihoods. The standard deviation indicates diverse experiences in how severely people see vegetation loss. According to UNEP (2014), the loss of vegetation cover is a key early sign of desert encroachment. Bappah et al. (2025) also observed these trends in northeastern Nigeria, while Orindi and Eriksen (2005) reported similar community views across East Africa. Increased dust storms and wind erosion harm household health (mean = 3.00, SD = 0.84). A high mean and low standard deviation reflect strong agreement and consistent experiences across communities. Participants often notice dust storms and link them to negative health effects, such as respiratory issues. This aligns with Zemba et al. (2018), who reported more hospital visits due to windborne particles in northern Nigeria. The WHO (2016) and Nasir et al. (2018) also connected dust exposure to bronchitis, asthma, and eye irritation in arid and semi-arid regions. Water scarcity has worsened because of desertification (mean = 2.82, SD = 1.00). Respondents agree that desertification makes water scarcity worse, which is critical for both farming and domestic use. A standard deviation of 1.00 shows relatively varied experiences. This is echoed in Nkomo et al. (2006), who noted lower water tables and river flows in dry areas. Amadi et al. (2013) also linked vegetation loss to declining surface and groundwater resources. Ajayi (2014) found that over 60% of rural residents in desertifying areas spend more time fetching water. Climate change is worsening desertification (mean = 2.86, SD = 1.12). There is a clear consensus that climate change is the main cause of worsening desertification. The standard deviation suggests moderate variation, likely due to differences in geographic exposure. This confirms the IPCC (2021) reports, which attribute desertification to human-induced climate change. Likewise, Yahaya et al. (2024) demonstrated that rising temperatures and decreased rainfall speed up desertification across Africa's drylands. Changes in rainfall patterns affect farming (mean = 3.00, SD = 0.92). A mean of 3.00 indicates strong agreement that irregular rainfall impacts agriculture. Farmers are vulnerable to changes in when rainfall starts, how often it occurs, and how long it lasts. The findings align with those of Azare et al. (2020), who identified rainfall variability as a major concern for farmers in Ethiopia. Ibrahim et al. (2022) and Yunuwa (2011) also linked changes in rainfall to poor harvests in Nigeria. The FAO (2018) stressed that climate-driven changes lower agricultural productivity and food security. There is reduced availability of grazing land for pastoralists (mean = 2.76, SD = 1.10). Respondents report a decline in grazing land, agreeing this is due to desert encroachment. The moderate standard deviation reflects different levels of land loss among areas. This agrees with Gana et al. (2021), who described shrinking grazing corridors in northern Nigeria. Gbahabo (2011) also connected land scarcity to rising conflicts between herders and farmers. The loss of grazing land affects pastoral livelihoods and community stability.

Table 2. Participants' Awareness and Signs of Climate Change-Induced Desert Encroachment

Description	SA	A	D	SD	Mean	SD	Remarks
Aware that climate change is contributing to desertification	44	36	24	16	2.90	1.1	Agreed
Noticed an increase in barren land and reduced vegetation cover in my community.	42	38	16	14	2.70	1.13	Agreed
Increased dust storms and wind erosion are negatively impacting the health of households.	32	66	12	10	3.00	0.84	Agreed
Water scarcity has worsened due to desertification.	32	52	18	18	2.82	1.00	Agreed
Climate change is worsening desertification.	46	36	14	24	2.86	1.12	Agreed
Changes in rainfall patterns are affecting their agricultural activities.	40	58	8	14	3.00	0.92	Agreed
There is a significant reduction in the availability of grazing land for pastoralists.	36	44	16	24	2.76	1.10	Agreed

Key: Number of Respondents = 120, SA, A, U, D, SD = Responses of Students, $\bar{X}$ = Mean, δ = Standard Deviation, Criterion mean = 2.50

Table 3 shows how communities respond to climate change-driven desert encroachment and their use of traditional drought-resistant crops (mean = 3.17, SD = 0.58). The high mean and low SD indicate a strong and consistent reliance on traditional seeds. These crops adapt well, resist water stress, and are rooted in indigenous knowledge. Yahaya et al. (2024) confirm their value in climate resilience. IPCC (2022) also highlights the role of indigenous seeds in improving food security under shifting climate conditions. The use of mulching and organic manure (mean = 2.33, SD = 0.99) is below the benchmark (2.50) but is categorized as "Agreed," likely due to rounding. This suggests a limited but growing use of soil moisture retention techniques. Cheri et al. (2020) stress that mulching is essential for improving soil fertility and reducing erosion. Kassie et al. (2015) found that uptake is limited by factors like awareness and labor. Ahmed et al. (2024) also found low adoption due to a lack of technical support. Pastoralist seasonal migration (mean = 2.92, SD = 1.00) highlights that participants recognize pastoralists move seasonally to find pasture. This adaptive strategy is common in Sahelian regions. Moritz (2010) noted flexible transhumance as a response to climate variability. Akinkuolie et al. (2024) pointed out that mobility is vital for sustaining pastoral livelihoods and limiting this traditional adaptation. Construction of traditional water structures (mean = 3.42, SD = 0.52) indicates wide adoption and effectiveness of local water-saving methods. The low SD suggests uniformity among communities. This aligns with Pretty and Bharucha (2014), who support community-led water management. Amadi et al. (2013) mentioned the sustainability of traditional conservation systems. Indigenous agroforestry practices (mean = 3.33, SD = 0.65) show that agroforestry is widely practiced using native species like Gawo and Dogon Yaro. This practice improves soil quality, reduces erosion, and moderates microclimates. Jose (2009) identified agroforestry as a nature-based method for tackling land degradation. Bauer (2016) demonstrated that such systems are ecologically beneficial and cost-effective for small farmers. Adjusting planting dates based on traditional weather forecasts (mean = 2.83, SD = 1.12) shows that respondents accept this adaptive strategy, though the SD reflects some variability. Traditional calendars are still in use, but changing rainfall patterns often challenge them. Brekle & Veste, (2011) documented farmers combining indigenous and scientific forecasts in West Africa. Cheri, Abdullahi & Dlakwa (2019) affirmed that local predictions remain trusted despite modernization gaps. Use of traditional irrigation (mean = 3.66, SD = not stated) has the highest mean in both tables, indicating near-universal reliance on traditional systems. These methods include flood farming and the shadoof for lifting water. Clark et al. (2020) noted that flood-recession methods have long supported dryland communities. David and Nicholas (1994) confirmed that traditional irrigation remains effective in low-resource settings. Storage of crop residues and fodder (mean = 3.16, SD = not stated) shows proactive drought preparedness through managing fodder. This ensures livestock survival during dry periods. Eze and Onokala (2022) pointed out that this is a key practice of resilience. IFAD (2012) highlighted the need for fodder storage to support food security among pastoral communities. Communal labor (Gayya) for land restoration (mean = 3.33, SD = 0.65) indicates that there is still agreement on the practice of communal labor, reflecting social capital in adaptation. It encourages collective responsibility for conserving and sustainably using natural resources. Elijah et al. (2017) viewed this as vital for participatory rural development. Leach et al. (1999) stressed that communal governance strengthens climate responses. Long-distance travel for water access (mean = 3.45, SD = 0.54) shows high agreement that water stress is a major challenge, leading households to travel far. This implies weak water infrastructure or depleted local sources. UNICEF (2018) and WHO/UN-Water (2021) confirm that desertification puts a heavier burden on women and girls who must fetch water. Legg (2021) also pointed out that this is a sign of poverty and time constraints. Rainwater harvesting (mean = 3.20, SD = 1.09) is widely practiced in communities, reflecting an understanding of water scarcity. This method supports resilience, particularly in arid areas. Musa (2012) advocates for rainwater harvesting in rural climate adaptation efforts.

Table 3. Communities' Response and Adaptation Strategies to Climate Change-Induced Desert Encroachment

Description	SA	A	D	SD	Mean	SD	Remarks
Community adaptation strategies							
The community relies on traditional drought-resistant crop varieties to cope with desertification.	30	80	10	-	3.17	0.58	Agreed
Farmers use mulching and organic manure to retain soil moisture in response to increasing aridity.	20	60	20	20	2.33	0.99	Agreed
Pastoralists practice seasonal migration to find grazing land due to desertification.	40	40	30	10	2.92	1.00	Agreed
Communities in my village construct traditional water conservation structures.	50	70	-	-	3.42	0.52	Agreed
Indigenous agroforestry practices (e.g., planting trees like	50	60	10	-	3.33	0.65	Agreed

"Gawo" or "Dogon Yaro") are commonly used to prevent land degradation.							
Local farmers adjust planting dates based on traditional weather forecasts to adapt to changing rainfall patterns.	40	40	20	20	2.83	1.12	Agreed
Traditional irrigation methods (e.g., flood recession farming, Shadoof) are still used to cope with water scarcity.	80	40	-	-	3.66	0.20	Agreed
Households store crop residues and fodder for livestock as a strategy to prepare for prolonged periods of drought.	65	20	25	10	3,16	1.01	Agreed
Communities rely on communal labour (Gayya) for land restoration efforts	50	60	10	-	3.33	0.65	Agreed
Households travel long distances to access drinking water.	75	35	-	10	3.45	0.54	Agreed
Water conservation techniques (rainwater harvesting) are widely practised.	50	50	15	5	3.2	1.09	Agreed

Conclusion

The findings from the work show climate vulnerability in communities impacted by desertification. Participants understood the effects of climate change, especially related to reduced vegetation, unpredictable rainfall, worsening water scarcity, and health issues caused by dust and wind erosion. Additionally, communities are not just passive victims; they actively adapt using a blend of traditional and new methods like water conservation, fodder storage, traditional irrigation, and agroforestry. However, the prevalence of low educational levels has limited the diversification of mediums to respond to the climate-induced desert encroachment. There is a need to have support from institutions, NGOs, and extension services, which is essential to expand the communities response with modern technological know-how. This confirms that any effective climate adaptation strategy must rely on its own to improve indigenous knowledge systems while tackling underlying socio-economic vulnerabilities. However, the invention must be introduced to assist the communities in responding in the following ways:

i. Intervention from foreign funding, such as the Green Climate Fund, to assist in fighting desertification in the region due to its capital intensity.

ii. Resilient trees for desert environments should be planted as afforestation to discourage desert encroachment.

iii. Climate-smart agriculture through agroforestry, effective water management, and resilient crops can help communities and people to harvest crops for their livelihood support.

iv. There is the need for the tapping of underground water for domestic and irrigational purposes, especially boreholes, for access of water, protect trees to avoid drying up and irrigation use.

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